Environmental Impact Statement
for
Converse County Oil and Gas Project

Final

Volume I – Cover through Section 3.14

BLM

Casper Field Office, Wyoming

Estimated Lead Agency Total Costs Associated with Developing and Producing this Final EIS $4,000,000

2020

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DOI-BLM-WY-P060-2014-0135-EIS

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Wyoming State Office
5353 Yellowstone Road
Cheyenne, WY 82009
www.blm.gov/WY

In Reply Refer To:
1610, 1790 (930)

Dear Reader:

The Final Environmental Impact Statement (Final EIS) and Proposed Resource Management Plan Amendment (RMPA) for the Converse County Oil and Gas Project is hereby submitted for your review. The Bureau of Land Management (BLM) prepared the FEIS/Proposed RMPA to analyze the potential impacts of and alternatives to the proposed oil and gas exploration and development by an Operator Group comprised of Occidental Petroleum, Chesapeake Energy Corporation, Devon Energy, EOG Resources, Inc., and Northwoods Energy. The Converse County Project Area (CCPA) encompasses approximately 1.5 million acres of land in Converse County, Wyoming, of which approximately 88,466 surface acres (6 percent of the CCPA) are public lands administered by the BLM Casper Field Office and approximately 63,911 surface acres (4 percent of the CCPA) are administered by the United States Forest Service (USFS) Douglas Ranger District of the Medicine Bow-Routt National Forests and Thunder Basin National Grassland. The remaining surface estate consists of approximately 101,012 surface acres (7 percent) administered by the State of Wyoming and approximately 1,247,477 surface acres (83 percent) that are privately owned. The BLM administers approximately 964,525 acres of mineral estate (64 percent) within the CCPA. Lands with separate surface and mineral ownership (i.e., split estate lands) comprise approximately 812,189 acres (54 percent) of land within the CCPA.

This Final EIS analyzes three alternatives and 6 options for the Proposed RMPA in detail: Alternative A (the No Action Alternative), Alternative B (the Proposed Action) considering each of the 6 options for LUP amendment, and Alternative C (an alternative developed by the agency and cooperators to reduce surface disturbance and related impacts). The Final EIS also contains a discussion of other alternatives that were considered but eliminated from detailed analysis. Under the Proposed Action, up to 5,000 new oil and gas wells would be drilled on 1,500 single and multi-well pads within the CCPA over a period of 10 years. Additionally, approximately 1,970 miles of new access and primary collector roads, 1,500 miles of buried gas gathering pipelines, 500 miles of buried oil and gas main trunk lines, 900 miles of surface water pipelines, 1,500 miles of electrical power lines, 455 other well pads (i.e., production, water source, and disposal well pads), and other infrastructure and facilities as detailed within this Final EIS would be constructed to support this proposed development. Total new surface disturbance under the Proposed Action would be approximately 52,667 acres, or 3.5 percent of the total CCPA.

The Proposed RMPA would modify the Casper RMP to allow relief from timing limitation stipulations for non-eagle raptors within the CCPA. This option was developed to incorporate comments from the Governor of the State of Wyoming and the Operator Group.

The Final EIS was prepared pursuant to the National Environmental Policy Act (NEPA), as well as other regulations and statutes, to address possible environmental and socio-economic impacts that could result from implementation of the project. This Final EIS is not a decision document. Its purpose is to inform the public and the decision maker of the impacts associated with implementing the proponent's drilling proposal while evaluating alternatives to the proposal.

The release of this Final EIS announces a 30-day protest period pursuant to 43 CFR 1610 for the Proposed RMPA. In accordance with 43 CFR 1610.5-2, protests on the Proposed RMPA must be submitted on or before the 30th day following the date the Environmental Protection Agency publishes this notice in the Federal Register. Any person who participated in the planning process and has an interest which is, or may be, adversely affected by the approval or amendment of the RMP may protest such approval or amendment. A protest may raise only those issues which were submitted for the record during the planning process. The BLM will issue a Record of Decision no earlier than 30 days from the date of the Notice of Availability published by the Environmental Protection Agency.

The Proposed RMPA and Final EIS may be examined online at https://go.usa.gov/xdYhv or at the following offices:

- BLM Casper Field Office, 2987 Prospector Drive, Casper, Wyoming 82604;
- BLM Wyoming State Office, 5353 Yellowstone Road, Cheyenne, Wyoming 82009.

All protests on the Proposed RMPA must be submitted in writing by any of the following methods:
Website: https://go.usa.gov/xdYhv
Regular Mail: Director (210)
Attention: Protest Coordinator
P.O. Box 261117, Lakewood, CO 80226
Overnight Delivery: Director (210)
Attention: Protest Coordinator
2850 Youngfield Street, Lakewood, CO 80215

The BLM encourages submission of protests using the ePlanning online tools rather than by mail.

CD copies may be requested by contacting:

Bureau of Land Management
Attn: Mike Robinson
Casper Field Office
2987 Prospector Drive
Casper, Wyoming 82604
Fax: 307-261-7587
WY_CasperMail@blm.gov

Before including your address, phone number, email address, or other personal identifying information in your comment, you should be aware that your entire comment – including your personal identifying information – may be made publicly available at any time. While you may ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we will be able to do so. For further information concerning the project, please contact Mike Robinson at (307) 261-7520.

Sincerely,

Duane Spencer
Acting State Director

Attachments

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Final Environmental Impact Statement
Converse County Oil and Gas Project

Lead Agency: U.S. Department of the Interior, Bureau of Land Management

Project Location: Casper Field Office, Wyoming

Comments and Further Information on the Draft EIS

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BLM Authorized Officer Responsible for Preparing Draft EIS: Stephanie Connolly

Filing Date:

Abstract

An oil and gas Operator Group (OG) consisting of Anadarko Petroleum Company ***(now Occidental Petroleum Corporation)***, Chesapeake Energy Corporation, Devon Energy, EOG Resources, Inc., and ***Northwoods*** Energy proposes to develop oil and gas resources in a portion of Converse County, Wyoming encompassing approximately 1.5 million acres of private, state, and federally-managed lands (Bureau of Land Management and U.S. Forest Service). Existing oil and gas development in the Converse County Project Area (CCPA) consists of a combined total of 1,449 well and production pads and associated access roads, construction facilities, and production facilities, with an estimated disturbance of 13,819 acres. New development as approved under NEPA consists of 1,663 new wells on 361 new well pads with an estimated disturbance of 10,253 acres. The Proposed Action (Alternative B) would include 5,000 new oil and gas wells on an additional 1,955 well and production pads and associated facilities (e.g., access roads, construction facilities, and production facilities), with an estimated disturbance of 52,667 acres. Development is proposed at a rate of 500 wells per year for a 10 year period. Construction would begin after the issuance of the Record of Decision, approved Applications for Permit to Drill, and site-specific NEPA analysis.

Three alternatives are analyzed in this Draft EIS: Alternative A – No Action Alternative, Alternative B – Proposed Action, and Alternative C. Alternative A assumes that approval of the OG's proposed Project would be denied and new drilling would continue by the appropriate permitting agency as disclosed under NEPA. Alternative B would consist of the OG's proposal for development in the CCPA. Alternative C would alter development by allowing the same amount of wells to be drilled but on approximately 38 percent fewer pads. Total surface disturbance from development would be reduced by approximately 30 percent. Under all alternatives, some level of development would continue to occur on private, state, and federally-managed lands. In addition to the OG committed design features listed in Section 6.4 of this document, additional mitigation has been recommended and analyzed that would reduce the environmental impacts of the Project.

The ***Final*** EIS will be available ***to the public*** for a ***30***-day ***protest*** period beginning on the date the U.S. Environmental Protection Agency publishes a Notice of Availability for this Draft EIS.

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Executive Summary

The Converse County Oil and Gas Project (Project) is an oil and natural gas development project proposed by an Operator Group (OG) comprised of Anadarko Petroleum Company ***(now Occidental Petroleum Corporation)***, Chesapeake Energy Corporation, Devon Energy, EOG Resources, Inc., and ***Northwoods*** Energy. The OG notified the Bureau of Land Management (BLM) Casper Field Office (CFO) and the United States Forest Service (USFS) Douglas Ranger District of the Medicine Bow-Routt National Forests and Thunder Basin National Grassland (TBNG) that they propose to conduct drilling to develop the hydrocarbon resources from oil and gas leases owned, at least in part, by members of the OG within the Converse County Project Area (CCPA) in Converse County, Wyoming (**Figure ES-1**).

The CCPA encompasses approximately 1.5 million acres of land, of which 10 percent is federally administered surface estate (6 percent BLM and 4 percent USFS), 7 percent is State owned, and 83 percent is privately owned. The fluid mineral estate is 64 percent federal and 36 percent state and private. The BLM and USFS have determined that the Project constitutes a major federal action requiring the development of an environmental impact statement (EIS). This EIS serves the purpose of disclosing and analyzing impacts resulting from the level of development proposed within the CCPA, including the No Action (Alternative A), the Proposed Action (Alternative B), and a third alternative referred to as Alternative C. Alternatives B and C consider the OG committed design features and additional recommended mitigation measures.

Purpose and Need

The need for a federal (BLM and USFS) action is to respond to this proposal while allowing the OG to exercise its valid lease rights under pertinent laws, rules, and regulations. The Federal Land Policy and Management Act of 1976 (Public Law 94 579, 43 United States Code 1701 et seq.) recognizes oil and gas development as one of the “principal” uses of public lands. Federal mineral leasing laws (Mineral Leasing Act of 1920, 30 USC 188 et seq.) and regulations recognize the statutory right of lease holders to develop federal mineral resources to meet continuing national needs and economic demands. The purpose of this EIS is to evaluate potential impacts resulting from implementing future plans and applications related to this proposal; to facilitate the decision-making process to approve, approve with modifications, or disapprove the proposed project or project components based on an evaluation of the expected impacts; and to the extent possible, minimize or avoid environmental impacts.

Scoping

The BLM conducted internal and public scoping per the CEQ public scoping requirements set forth in 40 Code of Federal Regulations (CFR) 1501.7. The public scoping process was intended to solicit input and identify environmental issues and concerns associated with the proposed project. The process was initiated on May 16, 2014, with the publication of a Notice of Intent in the Federal Register, a news release to local media, and a posting on the BLM CFO website. On May 23, 2014, the BLM issued a second news release, identifying the venues and dates for the three public scoping meetings. In addition, BLM provided public service announcements to local radio stations, newspapers, and television stations; conducted a news interview with KCWY13; posted flyers advertising the meetings in key locations around the communities of Casper, Douglas, Glenrock, and Rolling Hills, Wyoming. Three public scoping meetings were held in June 10-12, 2014 in Douglas, Casper, and Glenrock, Wyoming. Finally, the BLM issued a third news release noting the scoping closure date of June 30, 2014. Based on internal and public scoping the following resources are discussed and analyzed in Chapters 3.0, 4.0, and 5.0:

- Air Quality
- Cultural Resources, Historic Trails, and Native American Concerns

- Geology and Mineral Resources
- Hazardous Materials, Solid Waste, and Public Health and Safety
- Land Use
- Lands and Realty
- Noise
- Paleontological Resources
- Range Resources
- Recreation
- Socioeconomics and Environmental Justice
- Soils
- Transportation and Access
- Vegetation
- Visual Resources
- Water Resources
- Wetland and Riparian Areas
- Wildlife and Aquatic Biological Resources

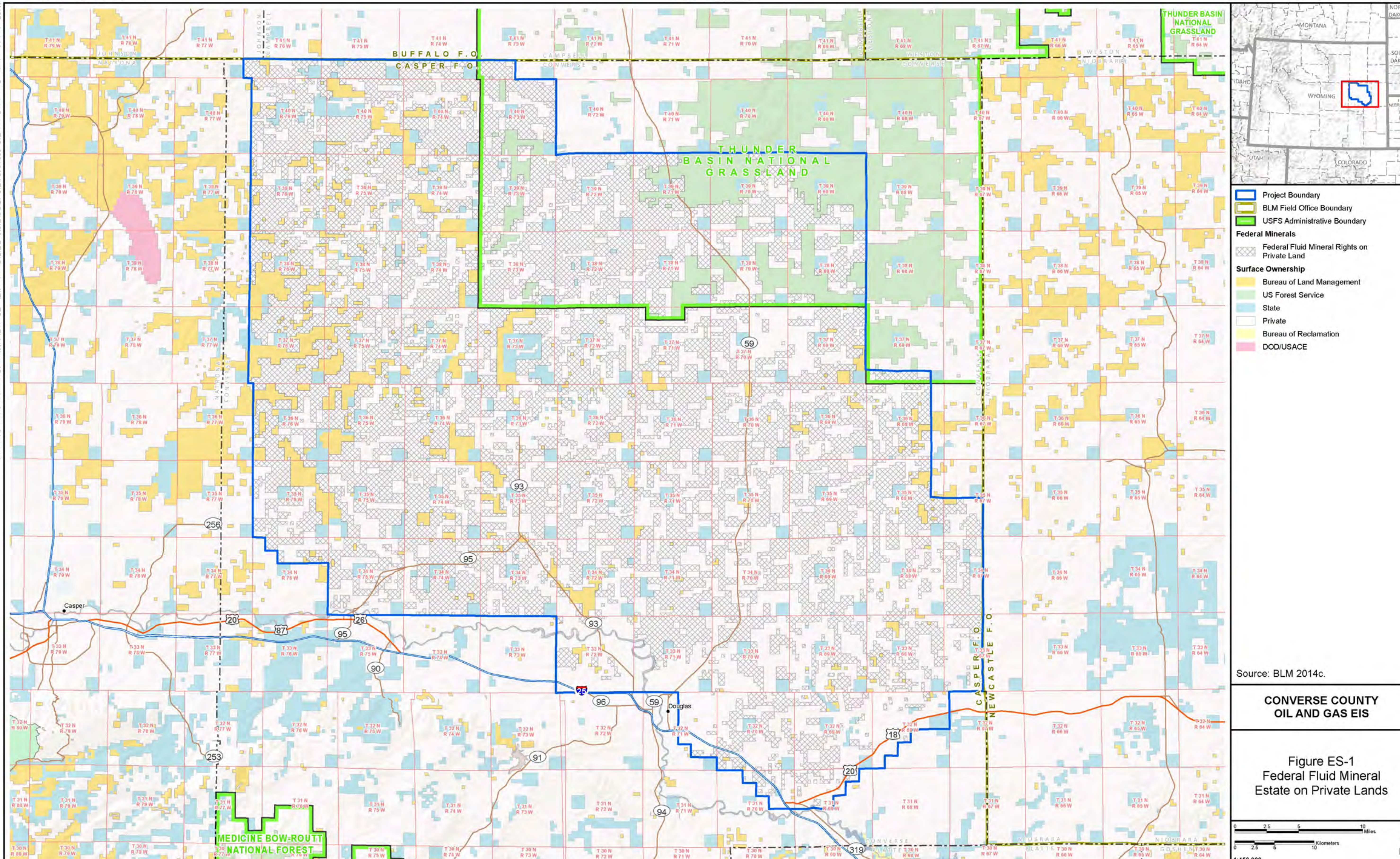
The BLM and USFS have determined that the proposed project is in conformance with the BLM and USFS management plans and policies and is consistent with other federal and local land management plans and policies. As allowed under 36 CFR 800.8, the BLM has used the public comment process under the National Environmental Policy Act (NEPA) to comply with the public consultation requirements of Section 106 of the National Historic Preservation Act.

Proposed Action and Alternatives

Chapter 2.0 of this EIS describes the existing and approved oil and gas facilities and the proposed development alternatives. In developing the alternatives, the BLM followed guidance set forth in 40 CFR 1500-1508 and the BLM NEPA Handbook H-1790-1. In addition to the No Action (Alternative A) and the Proposed Action (Alternative B), the BLM developed Alternative C to incorporate input from the cooperating agencies. As discussed in more detail below, the BLM preferred alternative is Alternative B, the Proposed Action Alternative.

As of January 9, 2015, Wyoming Oil and Gas Conservation Commission (WOGCC) information for existing oil and gas infrastructure in the CCPA indicated that 1,520 existing wells (1,280 on single well pads and 240 wells on 86 multi-well pads) have been drilled and are in operation. Supporting infrastructure associated with this existing development includes access roads, construction and production facilities, pipelines, and overhead transmission lines. The existing surface disturbance in the CCPA is estimated at 13,819 acres, which is 0.9 percent of the CCPA.

Alternative A – No Action Alternative: Under Alternative A, drilling and completion of development wells and infrastructure would continue by the appropriate permitting agency as disclosed under NEPA. An estimated 1,663 new wells on 361 new well pads remain to be drilled in the CCPA (as of January 9, 2015). As with existing development, supporting infrastructure would include access roads, construction and production facilities, pipelines, and overhead electrical distribution lines. Disturbance from new development under Alternative A is estimated at 10,253 acres, which would be 0.7 percent of the CCPA. Disturbance from existing development combined with new development would total 24,072 acres, which would be 1.6 percent of the CCPA.



Print Date: 8/15/2017

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Alternative B – Proposed Action Alternative: Alternative B consists of the OG's proposal to explore and develop potentially productive subsurface formations underlying the CCPA. This would be new development that would occur in addition to existing and new disturbance under Alternative A. The OG proposes to drill 5,000 new wells on 1,500 new well pads at a rate of 500 wells per year over ten years. The number of wells drilled from each pad would vary from 1 to 16, with an average of 3 wells per pad. An additional 455 pads would be developed for production, water source wells, and water disposal wells. Supporting infrastructure associated with this proposed development would include access roads, construction and production facilities, pipelines, and overhead electrical distribution lines. New disturbance under Alternative B is estimated at 52,667 acres, which would be 3.5 percent of the CCPA. Development under the Alternative B combined with existing and new disturbance under Alternative A would total 73,739 acres, which would be 5.1 percent of the CCPA.

To the extent possible, ***operators*** within the CCPA would ***seek relief from timing limit stipulations for drilling and development operations*** to maximize the use of horizontal development from multi-well pads. As part of Alternative B, the operators would request ***relief from timing limit stipulations*** for ***non-eagle*** raptor nests and greater sage-grouse leks in ***general habitat*** areas for several wells over extended periods of time to increase efficiencies and reduce the number of times drilling rigs would be moved on and off pads.

As part of Alternative B and in response to comments on the Draft EIS, the BLM analyzed potential land use plan (LUP) amendments to the Casper RMP that would provide relief from non-eagle raptor timing limit stipulations. The existing timing limit stipulation (Option 1) and five non-eagle LUP amendment options (Option 2 through Option 6) were analyzed in this Final EIS.

The BLM NEPA Handbook (H-1790-1) calls for expression of the BLM's preferred alternative in the ***Final*** EIS (BLM 2008c). The BLM has selected Alternative B, the Proposed Action ***and non-eagle LUP amendment Option 6***, as the preferred alternative for the Converse County Oil and Gas Development Project. The BLM believes that the Proposed Action ***and non-eagle raptor amendment Option 6 have*** the necessary elements that would address the purpose and need for ***this*** EIS and ***has*** review***ed and considered*** public comments on the Draft ***EIS and Supplemental Draft EIS in identifying*** the preferred alternative in the Final EIS.

Alternative C: This alternative also would consist of 5,000 new wells, but they would be drilled on only 938 new well pads. The BLM assumed that 4 wells would be drilled from 55 percent of the pads, 8 wells would be drilled from 35 percent of the pads, and 16 wells would be drilled from 10 percent of the pads. This would provide for drilling the same number of wells (5,000) at the same drilling rate (500 wells per year for 10 years) as Alternative B. An additional 316 pads would be developed for production, water source, and disposal wells. Supporting infrastructure associated with this proposed development would include access roads, construction and production facilities, pipelines, and overhead electrical distribution lines. New disturbance under Alternative C is estimated at 37,267 acres, which would be 2.5 percent of the CCPA. Development under Alternative C combined with existing and new disturbance under Alternative A would total 61,339 acres, which would be 4.1 percent of the CCPA. This would be a reduction of approximately 37 percent of the surface disturbance compared to Alternative B.

Under Alternative C, timing stipulations would continue to be required as outlined in the BLM Casper Resource Management Plan (RMP) and USFS TBNG Land Resource Management Plan (LRMP), only allowing for exceptions to timing stipulations as currently specified in the CFO for short-term uses for emergencies or to finish tasks. Under Alternative C, it is assumed that the entire length of all historic trails in the CCPA are contributing trail segments, and that no surface development would be permitted along any of these trails. Development also would not be permitted within the Pine Ridge Area until tribal consultation has occurred. Alternative C would require the following design features:

- Closed loop drilling on federal minerals;
- Installation of oil gathering pipelines for 50 percent of the well pads by year five;
- Installation of water pipelines for 50 percent of development by year five; and
- Water recycling for all completion and production activities for 50 percent of the well pads by year five.

Alternatives Considered but Eliminated from Detailed Analysis

Many alternatives or components of alternatives to the proposed Project were considered that were not carried forward for detailed analysis. The following is a description and rationale for elimination.

- **No further Development:** Under this alternative, no further development would be allowed in the CCPA. This alternative was eliminated from detailed analysis because it is inconsistent with the basic policy objectives for the management of the area as approved in the Casper RMP. Additionally, this alternative would not meet the purpose and need because it would not honor valid existing lease rights within the CCPA.
- **Bury All Electrical Distribution Lines:** Under this alternative, all new and existing overhead electric distribution lines would be buried throughout the CCPA. This alternative was eliminated from further detailed analysis because it is not technically or economically feasible.
- **Use of Electrical Power for Production:** Under this alternative, electrical power would be used exclusively for all proposed production facilities. This alternative was eliminated from further detailed analysis because it is not technically feasible.
- **Balanced Alternative:** Under a balanced alternative, year-round drilling activity would be balanced with enhanced protection for important habitats and offer environmental protections while recognizing the rights provided by mineral leasing agreements with the federal government. This alternative was eliminated from further detailed analysis because it would have substantially similar effects as an alternative that is analyzed in detail (Alternative C).
- **Flareless Drilling, Completion, and Production:** Under this alternative, flaring during the drilling, completion, and production phases of development would be precluded to manage the natural gas stream. This alternative was eliminated from further detailed analysis because it is not technically feasible, and it is inconsistent with the basic policy objectives for the management of the area.
- **Full Resource Protection Alternative:** Under this alternative, full recovery of fluid minerals would be allowed with the greatest conservation of the human and natural environment. This alternative was eliminated from further detailed analysis because it would be substantially similar to an alternative that was analyzed (Alternative C).
- **Greenhouse Gas Reduction Alternative:** This alternative would require carbon-neutral processes (e.g., drilling, hydraulic fracturing, and production activities) and prevent the venting or flaring of methane or other products. This alternative was eliminated from further detailed analysis because it is not technically feasible.
- **Limit Number of Wells Annually:** Under this alternative, the pace of development would be regulated by placing a limit on the number of wells that could be developed in a given year. This alternative was eliminated from further detailed analysis because its implementation is remote or speculative, and it is inconsistent with the basic policy objectives for the management of the area.
- **Limit Total Number of Wells per Operator:** Under this alternative, a set of criterion would be established that would limit the allocation of wells each operator could develop within the CCPA. This alternative was eliminated from further analysis because it would not be consistent with the purpose of the agency action, and the BLM and USFS do not have the authority to infringe upon

existing lease rights by imposing limits on the pace of development or selecting which operator(s) are allowed to drill.

- **Maximum Development Alternative:** Under this alternative, the same number of proposed well pads would be retained (1,500) while assuming operators would drill the maximum number of wells on each pad, resulting in an estimated total of 9,900 wells. This alternative was eliminated from further detailed analysis because implementation of this alternative would be remote or speculative as the rate of development (i.e., almost 1,000 wells per year) would be roughly twice the rate of Alternative B.
- **No Surface Disturbance on Federal Surface:** Under this alternative, no surface development would be allowed on BLM- or USFS -administered surface estate. This alternative was eliminated from further detailed analysis because it does not address a specific issue or resource concern, and it would be ineffective because it would apply to only ten percent of CCPA that is federal surface estate.
- **Phased/Concentrated Development:** Development under this alternative would be concentrated in one portion of the CCPA at a time and would advance to another portion of the CCPA once all development activities in the previous area are complete and reclamation has been initiated. This alternative was eliminated from further detailed analysis because it is not technically feasible, its implementation is remote or speculative, and it is inconsistent with the basic policy objectives for the management of the area.
- **Surface Disturbance Cap:** Under this alternative, a cap would be put in place to establish the maximum amount of surface disturbance that could occur within the CCPA at any one time. This alternative was eliminated from further detailed analysis because it is not technically feasible and its implementation is remote or speculative. In addition, the size of the CCPA (1.5 million acres), multiple land ownership jurisdictions, and multiple operators and leasing entities make the management of a disturbance cap extremely complex and potentially unworkable.
- **Vertical Development of the CCPA:** Under this alternative, all well development would use vertical wells (1 well per pad) for the proposed 5,000 wells. This alternative was eliminated primarily because advances in technology in the past decade have made the development of shale oil and gas using vertical wells much less efficient; therefore, vertical development is potentially not economical relative to horizontal wells.

Affected Environment

Chapter 3.0 of the EIS describes the affected environment of the CCPA for each of the resources identified and listed above. These resources are present within the CCPA and provide the basis to address substantive issues of concern brought forward during internal and public scoping. The information presented in Chapter 3.0 provides quantitative data and spatial information where appropriate to the resource that serves as a baseline for comparison of the direct, indirect, and cumulative impacts of each of the alternatives.

Environmental Consequences

Chapter 4.0 describes the environmental effects of implementing the alternatives on the affected environment as described in Chapter 3.0. The chapter is divided into subsections addressing the specific incremental impacts for each of the resources identified and listed above. The impact analysis for each resource was focused on the new disturbance over and above the existing disturbance associated with each alternative. The resource-specific effects of the alternatives are evaluated quantitatively and qualitatively, as appropriate based on available data and the nature of the resource analyzed. A comparison of disturbance within the CCPA associated with the three alternatives is provided in **Table ES-1**. A summary of the Chapter 4.0 impact analysis is provided in **Table ES-2**.

Cumulative Impacts

Cumulative impacts from past, present, and reasonably foreseeable development are presented in Chapter 5.0. For each resource, the cumulative impact study area (CISA) was developed appropriate to the geographical extent of anticipated cumulative impacts. For some resources (e.g., land use, lands and realty, soils, and vegetation), the CISA is the same as the CCPA. For other resources (e.g., air quality, groundwater, socioeconomics, visual, and wildlife), the CISA is much larger than the CCPA.

Due to the intensity of various development activities within the CISAs, the focus of this analysis was on past, present, and reasonably foreseeable oil and gas development, mining, power (transmission lines, wind farms, and power plants), and railroads.

Below is a summary of cumulative impacts for key resources:

- **Air Quality:** Near-field modeling was used to assess the cumulative impacts within and nearby the CCPA resulting from Project-related development and production emissions. Maximum air quality impacts resulting from Alternative B drilling and production activities within the CCPA were added to representative background concentrations. The resulting total cumulative concentrations were found to be below the levels of the NAAQS/WAAQS for all pollutant and averaging times, except for annual PM_{10} during periods of active construction. These sources are transient and temporary; therefore, impacts would be expected to be localized in the immediate vicinity of the construction activities. Alternative C was not modeled but would vary only slightly from Alternative B.
- **Cultural Resources, Historic Trails, and Native American Concerns:** Based on the estimated average cultural resource density used for direct and indirect impact analysis, Alternative B would account for approximately 59 percent of the total cumulative impact within the CISA, and Alternative C would account for approximately 50 percent of the total cumulative impact within the CISA. Cumulative impacts to historic trails, roads, and similar linear sites essentially would be the same as those cited for cultural resources.
- **Range Resources:** The CISA for range resources included 83 BLM and USFS grazing allotments that provide ***46,091*** permitted AUMs. The total loss of permitted AUMs from cumulative disturbance, including Alternatives B and C would be ***1,522*** and ***1,205***, respectively. The incremental disturbance from Alternatives B and C would account for ***3.3*** and ***2.6*** percent of the total cumulative loss of federally permitted AUMs within the CISA, respectively.
- **Socioeconomics and Environmental Justice:** The CISA for socioeconomics and environmental justice encompassed Converse, Natrona, and Campbell counties in geographic terms, with particular focus on the respective county governments and the larger communities in these counties. The proposed Project primarily would affect the Douglas, Glenrock, and Casper areas. Potential cumulative socioeconomic effects would include changes in employment; workforce and household migration; and demand for housing, public facilities, and services. Additional foreseeable projects would contribute to cumulative socioeconomic effects in specific areas of the CISA. Adverse cumulative socioeconomic effects such as labor force competition, housing shortages, and strained community infrastructure and services could occur primarily in the event of concurrent construction of these projects. Such adverse cumulative socioeconomic effects likely would be temporary. Cumulative socioeconomic effects, including increases in employment, economic activity and tax revenues, would be longer term, extending through the production and operations phases. Consequently, the potential for both favorable and adverse cumulative socioeconomic effects would increase during periods of elevated commodity prices and demand, which would tend to spur development. The pace of residential construction in most communities within the CISA would need to increase substantially to accommodate demand related to Alternatives B or C for longer term housing units, and would have to increase even more to accommodate cumulative demand if several of the reasonable foreseeable future projects were to overlap in time with an increase in oil and gas development activities.

- **Transportation and Access:** Mining activities make up the majority of cumulative activity in the CISA, followed by oil and gas and other types of developments. Surface disturbance resulting from the construction of new roads for Alternatives B and C would account for 39 and 32 percent of the total cumulative disturbance within the CISA, respectively. Anticipated local highway traffic for selected areas along Wyoming 59, 93, and 95 under both action alternatives would experiences increases from 16 to 1,319 percent at the junction of Route 504 and State Highway 95 by year 2028.
- **Vegetation:** Cumulative impacts within the vegetation CISA (i.e., the CCPA) including Alternatives B and C would total 89,509 and 74,109 acres, respectively. Alternatives B and C would account for 59 and 50 percent of the total cumulative disturbance within the CISA, respectively. The greatest impacts would occur in grassland and sagebrush communities because they are the most prevalent.

  Habitat for Ute ladies'-tresses orchid in the CCPA would total 6,675 acres. Cumulative impacts to this habitat including Alternatives B and C would total 379 and 311 acres, respectively. Alternatives B and C would account for 62 and 53 percent of the total cumulative disturbance within the CISA, respectively.
- **Water Resources:** The CISA for surface water resources was the HUC-12 drainages within or intersected by the CCPA. The impact indicator presented for a quantitative comparison of the cumulative impacts considering Project alternatives was surface disturbance, which has the potential to impact surface water through increased erosion and sedimentation, stream bank instability from stream crossings due to linear development, or potential leaks and spills of hazardous materials. Surface disturbance within these drainages would total 44,418 acres. The incremental disturbance from Alternatives B and C would account for 54 and 46 percent of the total cumulative disturbance within the CISA, respectively.

  The CISA for groundwater resources was bounded on the north at Township 42 North (approximately 5 to 12 miles north of the CCPA), on the west and east by the outcrop of the Fox-Hills/Lance aquifer, and on the south by the structural limit of the Powder River Basin (the Fox Hills/Lance aquifer does not outcrop on the south). The most recent available information from the USGS (2010) indicates that the overall annual groundwater use (including oil and gas) in Converse County in 2010 was approximately 12,900-acre feet (100 million barrels) per year. The estimated annual consumption of approximately 7,000 acre-feet per year of groundwater for Alternative B would represent an overall annual increase in groundwater use of approximately 46 percent. Alternative C would be less due to the requirement of recycling of hydraulic fracturing or produced water.
- **Wildlife and Aquatic Biological Resources:** With the exception of big game species and greater sage-grouse, the CISA for most terrestrial and aquatic wildlife was the HUC-12 drainages within or intersected by the CCPA, which encompasses approximately 2,206,155 acres. The CISA for big game was the WGFD herd units (based on pronghorn herd units) that intersect the CCPA. This encompasses approximately 6,208,944 acres. For greater sage-grouse, the CISA was the CCPA plus an 11-mile buffer, which is an area totaling approximately 3,226,826 acres. The cumulative impact analyses for these CISAs focused on the regional wildlife resources and how they may be susceptible to cumulative actions.

  Cumulative impacts within the CISA for most terrestrial and aquatic wildlife (i.e., including the HUC-12 drainages) including Alternatives B and C would total 97,085 and 81,685 acres, respectively. Alternatives B and C would account for 54 and 46 percent of the total cumulative disturbance within the CISA, respectively.

  Cumulative impacts within the big game CISA including Alternatives B and C would total 193,279 and 177,879 acres, respectively. Alternatives B and C would account for 27 and 21 percent of the total cumulative disturbance within the CISA, respectively, with the greatest impacts occurring in mule deer winter and yearlong ranges and pronghorn yearlong ranges.

Cumulative impacts within the greater sage-grouse CISA including Alternatives B and C would total 139,833 and 124,433 acres, respectively. Alternatives B and C would account for 38 and 30 percent of the total cumulative disturbance within the CISA, respectively.

Table ES-1 Disturbance Comparison for All Alternatives (Excluding Existing Condition)

Facility	Size (ROW width [feet] or acres/ facility)	New Surface Disturbance by Alternative					
		Alternative A (No Action)		Alternative B (Proposed Action)		Alternative C	
		Multiplier (number or miles)	Disturbance (acres)	Multiplier (number or miles)	Disturbance (acres)	Multiplier (number or miles)	Disturbance (acres)
Pads							
Well Pads	12 acres	361	4,332	1,500	18,000	938	11,256
Production Pads[1]	5 or 8 acres	20	100	375	3,000	236	1,888
Water Source Well Pad	2 acres	0	0	50	100	50	100
Disposal Well Pads	10 acres	5	50	30	300	30	300
Well Pad Subtotal			4,482		21,400		13,544
Roads							
Well Pad Access Roads[2]	50 feet	386	2,339	1,580	9,576	1,018	6,170
Primary Collector Roads	75 feet	0	0	390	3,545	244	2,218
Roads Subtotal			2,339		13,121		8,388
Construction/Production Facilities							
Gas Plants	100 acres	2	200	2	200	2	200
Oil/Condensate Storage	3 acres	0	0	6	18	6	18
Central Processing Facilities	5 acres	0	0	2	10	2	10
Compression Facilities	5 acres	14	70	50	250	50	250
Equipment/Pipe Storage Yards	50 acres	0	0	1	50	1	50
Electrical Substation	3 acres	0	0	12	36	12	36
Workforce Facility	10 acres	2	20	1	10	1	10
Freshwater Make-up Ponds	8 acres	7	56	30	240	30	240
Water Processing/Recycling Facility	15 acres	1	15	4	60	4	60
Construction/Production Facilities Subtotal			361		874		874

Table ES-1 Disturbance Comparison for All Alternatives (Excluding Existing Condition)

Facility	Size (ROW width [feet] or acres/ facility)	New Surface Disturbance by Alternative					
		Alternative A (No Action)		Alternative B (Proposed Action)		Alternative C	
		Multiplier (number or miles)	Disturbance (acres)	Multiplier (number or miles)	Disturbance (acres)	Multiplier (number or miles)	Disturbance (acres)
Linear Facilities							
Gas Gathering Pipelines within Road Disturbance	30 feet	181	658	750	2,727	469	1,705
Gas Gathering Pipelines with New Cross-country Disturbance	50 feet	181	1,097	750	4,546	469	2,842
Oil Gathering Pipelines within Road Disturbance	30 feet	-	-	-	-	188	682
Oil Gathering Pipelines with New Cross-country Disturbance	50 feet	-	-	-	-	188	1,139
Oil and Gas - Main Trunk Pipelines	75 feet	0	0	500	4,545	315	2,864
Water – Temporary Surface Pipelines (aboveground)	0 feet	0	0	900	0	-	-
Water Supply/Disposal Pipelines within Road Disturbance	30 feet	-	-	-	-	188	682
Water Supply/Disposal Pipelines with New Cross-country Disturbance	50 feet	-	-	-	-	188	1,136
Overhead Electrical Distribution along Road	30 feet	181	658	1,350	4,909	844	3,069
Overhead Electrical Distribution Cross-country	30 feet	181	658	150	545	94	342
Linear Facilities Subtotal			3,071		17,272		14,461
Surface Disturbance Summary							
New Surface Disturbance (acres)			10,253		52,667		37,267
CCPA New Disturbance (percent)			0.7		3.5		2.5
Existing Surface Disturbance (acres)			13,819		13,819		13,819
Alternative A (No Action) New Disturbance (acres)			-		10,253		10,253

Table ES-1 Disturbance Comparison for All Alternatives (Excluding Existing Condition)

Facility	Size (ROW width [feet] or acres/ facility)	New Surface Disturbance by Alternative					
		Alternative A (No Action)		Alternative B (Proposed Action)		Alternative C	
		Multiplier (number or miles)	Disturbance (acres)	Multiplier (number or miles)	Disturbance (acres)	Multiplier (number or miles)	Disturbance (acres)
Total Surface Disturbance (acres)			24,072		76,739		61,339
Total CCPA Disturbance (percent)			1.6		5.1		4.1

[1] Alternative A (No Action) production pad size assumes 5 acres per pad; Alternatives B and C assume 8 acres/pad.

[2] Assume access road length of 1 mile per well pad.

Table ES-2 Impact Comparison by Resource for All Alternatives

Resource	Alternative A (No Action)	Alternative B (Proposed Action)	Alternative C	Additional Discussion
Air Quality and Climate				
Greenhouse Gas (GHG) Emissions (total 10^3 tonne carbon dioxide [CO_2] equivalents [CO_2e]/year in year 10)	11.88	50.44	50.44	Section 4.1; **Appendix A**
Air Quality (exceed NAAQS)	24-hour PM_{10} ***1-hour NO_2***	24-hour PM_{10} 24-hour $PM_{2.5}$ ***1-hour NO_2***	Similar or slightly less than Alternative B	Section 4.1; **Appendix A**
Near-field HAPs (exceed acceptable risk limits)	Yes within 2 km of Gas Plants and Compressor Stations	Yes within 2 km of Gas Plants and Compressor Stations	Yes within 2 km of Gas Plants and Compressor Stations	Section 4.1; **Appendix A**
Visibility (Class I)	N/A	Incremental impacts > 1.0 deciview (dv) at 1 of 15 areas	Similar or slightly less than Alternative B	Section 4.1; **Appendix A**
Visibility (Class II)	N/A	Incremental impacts > 1.0 dv at 3 of 23 areas	Similar or slightly less than Alternative B	Section 4.1; **Appendix A**
Acid Deposition (Class I threshold exceedances)	N/A	Nitrogen exceeded in 3 of 15 areas	Similar or slightly less than Alternative B	Section 4.1; **Appendix A**
Acid Deposition (Sensitive Class II threshold exceedances)	N/A	Nitrogen exceeded in 7 of 23 areas	Similar or slightly less than Alternative B	Section 4.1; **Appendix A**
Cultural Resources, Historic Trails, and Native American Concerns				
Sites potentially encountered (incremental due to new surface disturbance)	101	521	369	Section 4.2
Visual impacts to historic trails (incremental acres visible with structures 60 feet in height or less)	9,886	50,781	35,932	Section 4.2; **Appendix B**
Sites of Native American concern encountered (incremental due to new surface disturbance)	31	160	115	Section 4.2
Geology and Mineral Resources				
Recoverable Oil Resource over 30-year life of the wells (billion barrels)	0.29	1.4	1.4	Section 4.3

Table ES-2 Impact Comparison by Resource for All Alternatives

Resource	Alternative A (No Action)	Alternative B (Proposed Action)	Alternative C	Additional Discussion
Recoverable Gas Resources over 30-year life of the wells (trillion cubic feet [Tcf])	1.2	5.9	5.9	Section 4.3
Aggregate used (million tons per year)	0.33	1.7	1.1	Section 4.3
Land Use				
Disturbance to agricultural lands (incremental acres disturbed)	71	360	255	Section 4.5
Disturbance to grazing allotments (incremental acres disturbed)	4,954	33,447	22,689	Section 4.5
Disturbance to Class 3/4 wind potential areas (incremental acres disturbed)	6,562	33,707	23,851	Section 4.5
Disturbance to Class 5/6 wind potential areas (incremental acres disturbed)	3,486	17,907	12,670	Section 4.5
Lands and Realty				
Potential disturbance to federal surface estate potential impacted (acres)	1,025	5,267	3,727	Section 4.6
Range Resources				
Permitted AUMs Lost – BLM	***111***	***573***	***405***	Section 4.9
Permitted AUMs Lost – USFS	***100***	***511***	***362***	Section 4.9
Total Permitted AUMs Lost	***211***	***1,084***	***767***	Section 4.9
Socioeconomics				
Energy Resource Recovery				Section 4.11
Oil (million barrels)	533	1,370	1,370	
Natural Gas (Tcf)	2.4	5.79	5.79	
Employment – peak during development (number of direct, indirect, and induced jobs)	2,200	8,421	Similar to Alternative B but with greater annual variability due to enforcement of timing limitation stipulations.	Section 4.11
Population increase in 3 counties – peak during development (number of residents)	737	9,491	Same as Alternative B	Section 4.11

Table ES-2 Impact Comparison by Resource for All Alternatives

Resource	Alternative A (No Action)	Alternative B (Proposed Action)	Alternative C	Additional Discussion
Housing - temporary and permanent demand in Converse County during development (units)	455	5,640	Similar to Alternative B but with a greater need for temporary housing.	Section 4.11
Public School Enrollment - peak increase in 3 counties (number of students)	135	1,158	Same as Alternative B	Section 4.11
Public Sector Revenues for Total for Life of Project (40+ yrs) (millions of 2015 dollars))				Section 4.11
Severance Taxes	1,915	5,109	Same as Alternative B	-
Federal Mineral Royalties	3,114	8,307	Same as Alternative B	-
State Mineral Royalties	90	249	Same as Alternative B	-
Ad Valorem Taxes, counties	373	968	Same as Alternative B	-
Ad Valorem Taxes, schools	1,400	3,621	Same as Alternative B	-
Combined Public Sector Revenues	6,892	18,254	Same as Alternative B	-
Soils				
Water Erodible (incremental acres disturbed)	1,425	7,318	5,178	Section 4.12
Wind Erodible (incremental acres disturbed)	1,930	9,913	7,014	Section 4.12
Droughty Soils (incremental acres disturbed)	4,507	23,149	16,380	Section 4.12
Hydric Soils (incremental acres disturbed)	386	1,985	1,405	Section 4.12
Shallow Depth to Bedrock (incremental acres disturbed)	3	13	9	Section 4.12
Prime Farmland (incremental acres disturbed)	5	26	18	Section 4.12

Table ES-2 Impact Comparison by Resource for All Alternatives

Resource	Alternative A (No Action)	Alternative B (Proposed Action)	Alternative C	Additional Discussion
Compaction Prone (incremental acres disturbed)	3,050	15,665	11,084	Section 4.12
Limited Reclamation Potential (incremental acres disturbed)	29	147	104	Section 4.12
Transportation and Access				
New Access Roads (miles)	386	1,970	1,262	Section 4.13
Traffic Volume increase for well development (total number of annual round trips)	N/A	491,837	476,835	Section 4.13
Vegetation				
Vegetation Type (estimated incremental acres disturbed)				Section 4.14
Grassland	6,795	34,905	24,698	-
Sagebrush shrubland	2,255	11,585	8,197	-
Barren/sparsely vegetated	860	4,418	3,126	-
Conifer	77	394	279	-
Agriculture	70	360	255	-
Developed	70	362	256	-
Wetland/riparian	75	383	272	-
Mixed shrubland	51	260	184	-
Federally Listed Species Habitat (estimated incremental acres disturbed)				
Ute ladies' tresses orchid	41	211	149	Section 4.14; **Appendix E**
Visual Resources				
Visual Resource Management (VRM) Class II areas on BLM Lands (incremental acres disturbed)	49	254	180	Section 4.15
Scenic Integrity Objective (SIO) Moderate Class on USFS Lands (incremental acres disturbed)[1]	24	124	88	Section 4.15
Water Resources				
Total Water Use (acre-feet/year)	1,500	7,000	4,200	Section 4.16; **Appendix E**
Wastewater Disposal (acre-feet per year)				Section 4.16; **Appendix E**
Flowback	858	3,870	1,935	-

Table ES-2 Impact Comparison by Resource for All Alternatives

Resource	Alternative A (No Action)	Alternative B (Proposed Action)	Alternative C	Additional Discussion
Produced Water	1,980	5,880	2,940	-
Total Wastewater to be disposed	2,838	9,750	4,875	-
Wildlife Resources				
WGFD Strategic Habitat (estimated incremental acres disturbed)				Section 4.18
Douglas Crucial Habitat Area	177	910	644	-
Ormsby Crucial Habitat Area	1,441	7,402	5,238	-
Thunder Basin Crucial Habitat Area	2,213	11,366	8,043	-
Thunder Basin Enhancement Area	1,857	9,537	6,749	-
Big Game Ranges (estimated incremental acres disturbed)				Section 4.18
Pronghorn Year-long	7,329	37,648	26,640	-
Pronghorn Winter/Year-long	2,781	14,288	10,110	-
Pronghorn Severe Winter Relief	44	228	161	-
Mule Deer Year-long	7,661	39,354	27,847	-
Mule Deer Winter/Year-long	2,556	13,128	9,290	-
White-tailed Deer Winter/Year-long	13	67	48	-
Elk Year-long	269	1,380	976	-
Federally Listed Species Habitat (estimated incremental acres disturbed)				Section 4.18; **Appendix F**
Preble's meadow jumping mouse	31	158	112	-
Black-footed ferret	108	555	393	-
Greater Sage-grouse Habitat (estimated incremental acres disturbed)				Section 4.18; **Appendix F**
PHMA	2,176	11,177	7,279	-
2.0 Mile Lek Buffer	810	4,158	2,942	-
Sagebrush Shrubland Habitat	2,254	11,584	8,197	-

Table ES-2 Impact Comparison by Resource for All Alternatives

Resource	Alternative A (No Action)	Alternative B (Proposed Action)	Alternative C	Additional Discussion
Migratory Birds - Raptors				
Relative Effects from LUP Non-eagle Raptor Amendment Options		***Option 1: Lowest impact*** ***Option 2: Highest impact*** ***Options 3, 4, 5, and 6: Less than Option 2 but greater than Option 1*** ***Option 6: Cap of 98 well pads to receive TLS relief***		***Section 4.18.2.2***

[1] There are no lands classified as SIO High within the CCPA.

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Acronyms and Abbreviations

°C	degrees Celsius
°F	degrees Fahrenheit
$\mu g/m^3$	microgram per cubic meter
ACHP	Advisory Council on Historic Preservation
amsl	above mean sea level
Anadarko	Anadarko Petroleum Company
ANC	acid neutralizing capacity
APD	Application for Permit to Drill
APE	Area of Potential Effect
APLIC	Avian Power Line Interaction Committee
AQRV	Air Quality Related Value
ARMPA	Approved Resource Management Plan Amendment for Greater Sage-grouse
AUM	Animal Unit Month
B.P.	Before Present
BCC	Birds of Conservation Concern
BGEPA	Bald and Golden Eagle Protection Act
bgs	below ground surface
BLM	Bureau of Land Management
BMP	Best Management Practice
BNSF	Burlington Northern/Santa Fe
Btu	British thermal unit
CAA	Clean Air Act of 1990
CCPA	Converse County Project Area
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFO	Casper Field Office
CFR	Code of Federal Regulations
CH_4	methane
CISA	cumulative impact study area
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
COA	Condition of Approval
CSU	controlled surface use
CWA	Clean Water Act of 1972
dBA	decibels on the A-weighted scale
DDCT	Density Disturbance Calculation Tool
dv	deciview
EA	Environmental Assessment
EIS	Environmental Impact Statement

EO	Executive Order
ESA	Endangered Species Act of 1973
FLAG	Federal Land Manager’s Air Quality Guidance
FLM	Federal Land Manager
FLPMA	Federal Land Policy and Management Act of 1976
FOOGLRA	Federal Onshore Oil and Gas Leasing Reform Act of 1987
FR	Federal Register
FSH	Forest Service Handbook
FSM	Forest Service Manual
GHG	Greenhouse gas
GHMA	General Habitat Management Area
GIS	Global Information System
GtC	Gigatonnes of carbon
H_2S	Hydrogen sulfide
HAP	Hazardous Air Pollutant
HUC	Hydrologic Unit Code
I-25	Interstate 25
IBA	Important Bird Area
IM	Instruction Memorandum
IOGCC	Interstate Oil and Gas Compact Commission
IPCC	***Intergovernmental Panel on Climate Change***
km	kilometer
KOP	Key Observation Point
kV	kilovolt
LANDFIRE	Landscape Fire and Resource Management Planning Tools Project
LRMP	Land and Resource Management Plan
MACT	Maximum Achievable Control Technology
MBTA	Migratory Bird Treaty Act
mcf	million cubic feet
mgd	million gallons per day
mg/L	milligrams per liter
MIS	Management Indicator Species
MLA	Mineral Leasing Act of 1920
MLRA	Major Land Resource Area
MW	Megawatt
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NHT	National Historic Trail
NNSR	Nonattainment New Source Review
NO_2	Nitrogen dioxide
NOAA	National Oceanographic and Atmospheric Administration
NOI	Notice of Intent

NO_X	oxides of nitrogen
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NSO	no surface occupancy
NWI	National Wetland Inventory
OG	Operator Group
OHV	Off-highway Vehicle
OSHA	Occupational Safety and Health Administration
PFYC	Potential Fossil Yield Classification
PHMA	Priority Habitat Management Area
PILT	payments in lieu of taxes
PM	Particulate Matter
PM_{10}	Particulate matter with an aerodynamic diameter of 10 microns or less
$PM_{2.5}$	Particulate matter with an aerodynamic diameter of 2.5 microns or less
ppb	parts per billion
ppm	parts per million
Project	Converse County Oil and Gas Project
PSD	Prevention of Significant Deterioration
RCRA	Resource Conservation and Recovery Act
RDF	Required Design Feature
REA	Rapid Ecological Assessment
REL	reference exposure level
RfC	reference concentration
RMP	Resource Management Plan
ROD	Record of Decision
ROW	right-of-way
RV	recreation vehicle
SDS	Safety Data Sheet
SGCN	Species of Greatest Conservation Need
SH	State Highway
SHPO	State Historic Preservation Officer
SIO	scenic integrity objective
SO_2	Sulfur dioxide
SPCC Plan	Spill Prevention, Control, and Countermeasures Plan
SRMA	Special Recreation Management Area
SSURGO	Soil Survey Geographic Database
SUPO	Surface Use Plan of Operation
SWPPP	Stormwater Pollution Prevention Plan
TBNG	Thunder Basin National Grassland
TCP	Traditional Cultural Property
TDS	Total Dissolved Solid

TLS	Timing limitation stipulations
tpy	tons per year
UIC	Underground Injection Control
UP	Union Pacific
U.S.	United States
USACE	U.S. Army Corps of Engineers
USC	United States Code
USCA	United States Code Annotated
USDA	U.S. Department of Agriculture
USDOI	U.S. Department of the Interior
USDOT	U.S. Department of Transportation
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VRI	Visual Resource Inventory
VRM	Visual Resource Management
WAAQS	Wyoming Ambient Air Quality Standards
WDEQ	Wyoming Department of Environmental Quality
WGFD	Wyoming Game and Fish Department
WISDOM	Wyoming Interagency Spatial Database and Online Management
WOGCC	Wyoming Oil and Gas Conservation Commission
WPA	Wyoming Pipeline Authority
WRCC	***Western Regional Climate Center***
WS	Wyoming State Statute
WSEO	Wyoming State Engineer's Office
WSGS	Wyoming State Geological Survey
WYDOT	Wyoming Department of Transportation
WYNDD	Wyoming Natural Diversity Database

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VOLUME II

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1.0 Introduction and Background

1.1 Project Location and Background

The Converse County Oil and Gas Project (Project) is an oil and natural gas development project proposed by an Operator Group (OG) comprised of Anadarko Petroleum Company (Anadarko ***[now Occidental Petroleum Corporation]***), Chesapeake Energy Corporation, Devon Energy, EOG Resources, Inc., and ***Northwoods*** Energy.

The OG notified the Bureau of Land Management (BLM) Casper Field Office (CFO) and the United States Forest Service (USFS) Douglas Ranger District of the Medicine Bow-Routt National Forests and Thunder Basin National Grassland that they propose to conduct drilling to develop the hydrocarbon resources from oil and gas leases owned, at least in part, by members of the OG within the Converse County Project Area (CCPA) in Converse County, Wyoming (**Figure 1.1-1**).

The CCPA encompasses approximately 1.5 million acres of land owned or administered as follows:

- Approximately 88,466 surface acres (6 percent of the CCPA) are public lands administered by the BLM CFO;
- Approximately 63,911 surface acres (4 percent of the CCPA) are public lands administered by the USFS;
- Approximately 101,012 surface acres (7 percent) administered by the State of Wyoming; and
- Approximately 1,247,477 surface acres (83 percent) that are privately owned.

The BLM administers approximately 964,566 acres of fluid mineral estate (64 percent) within the CCPA. Lands with separate surface and mineral ownership (i.e., split estate lands) comprise approximately 812,189 acres (54 percent) of land within the CCPA.

The OG intends to explore and develop all potentially productive subsurface formations underlying the CCPA. In most cases, the lease specifies the right to occupy the surface to explore, develop, operate, and produce the subsurface oil and gas resources.

Federal lands in the CCPA are under the jurisdiction of the BLM CFO and the USFS Douglas Ranger District. The BLM and USFS have determined that the Project constitutes a major federal action requiring the development of an environmental impact statement (EIS). This EIS serves to disclose and analyze impacts resulting from the level of development proposed within the CCPA, with consideration of OG-committed design features and BLM-required mitigation measures for three alternatives including the No Action Alternative and two action alternatives. The BLM is the lead agency for the EIS and the USFS is participating as a cooperating agency.

1.2 Summary of Proposed Action

The OG's proposed drilling project within the CCPA (the Proposed Action) would explore and develop potentially productive subsurface formations underlying the CCPA by drilling up to 5,000 oil and natural gas wells on 1,500 multi-well pads within the CCPA over a period of 10 years. The productive life of each well is estimated to be approximately 30 years. The OG would use directional, vertical, horizontal, and other drilling techniques, and would develop infrastructure to support oil and gas production in the CCPA including: well pads, roads, pipelines, power lines, compressor and electrical substations, and ancillary facilities such as water supply wells and water disposal facilities. The total estimated new surface disturbance for the Proposed Action would be approximately 53,000 acres, of which approximately

21,000 acres could remain for the life of the Project. The OG has requested exception to timing limitation restrictions that serve to protect several raptors and greater sage-grouse.

1.3 Purpose and Need

The need for a federal (BLM and USFS) action is to respond to this proposal while allowing the OG to exercise its valid lease rights under pertinent laws, rules, and regulations. The Federal Land Policy and Management Act of 1976 (FLPMA) (Public Law 94-579, 43 United States Code [USC] 1701 et seq.) recognizes oil and gas development as one of the “principal” uses of public lands. Federal mineral leasing laws (Mineral Leasing Act of 1920 [MLA], 30 USC 188 et seq.) and regulations recognize the statutory right of lease holders to develop federal mineral resources to meet continuing national needs and economic demands. The purpose of this EIS is to evaluate potential impacts resulting from implementing future plans and applications related to this proposal; to facilitate the decision-making process to approve, approve with modifications, or disapprove the proposed project or project components based on an evaluation of the expected impacts; and to the extent possible, minimize or avoid environmental impacts.

1.4 Environmental Analysis Process

This EIS was prepared in accordance with the National Environmental Policy Act (NEPA) and in compliance with FLPMA; ***MLA;*** Council on Environmental Quality (CEQ) regulations (40 Code of Federal Regulations [CFR] Parts 1500-1508); U.S. Department of the Interior (USDOI) regulations and requirements (Department Manual 516, Environmental Quality, under 43 CFR Part 46); guidelines in the BLM NEPA Handbook, H-1790-1 (BLM 2008e); guidelines in the USFS National Forest Management Act Forest Service Manual (FSM) 1920, Forest Service Handbook (FSH) 1909.12 (USFS 2015a); and guidelines in the USFS NEPA Handbook, FSH 1909.15 (USFS 2012).

Approximately 10 percent of the surface of the CCPA and 64 percent of the mineral interests underlying the CCPA are owned by the U.S. and administered by the BLM or USFS. According to MLA as amended by the Federal Onshore Oil and Gas Leasing Reform Act of 1987 (FOOGLRA), the BLM is the agency authorized to manage all federal mineral interests underlying federal or split estate lands; however, this is done in coordination with USFS for mineral estate under USFS administered surface estate. Therefore, the BLM is the lead agency for this EIS, the USFS is participating as a cooperating agency, and federal jurisdiction of the CCPA for development under the Project is assumed by the BLM and USFS, which would each issue Record of Decisions (RODs) for this EIS.

Within the RODs, the BLM and USFS Authorized Officers (AOs) ***or Responsible Official*** would identify:

- Whether the analysis contained within this document is adequate for the purpose of reaching informed decisions regarding Project development within the CCPA;
- Whether to approve the Proposed Action, a different alternative, or a combination of alternatives;
- Whether the Proposed Action or other alternatives are in conformance with applicable land and resource management plans and programmatic plans developed under NEPA, FLPMA, CEQ regulations, USDOI Department Manual 516, the BLM NEPA Handbook H-1790-1 (BLM 2008e), the National Forest Management Act FSM 1920 FSH 1909.12 (USFS 2015a), and the USFS NEPA Handbook FSH 1909.15 (USFS 2012); and
- The Conditions of Approval (COAs), if any, that may be attached to the approved Applications for Permit to Drill (APDs).

The BLM and USFS decisions would apply only to federal surface and mineral estate; however, the analyses in this EIS considers the impacts for all proposed activities regardless of surface or mineral ownership.

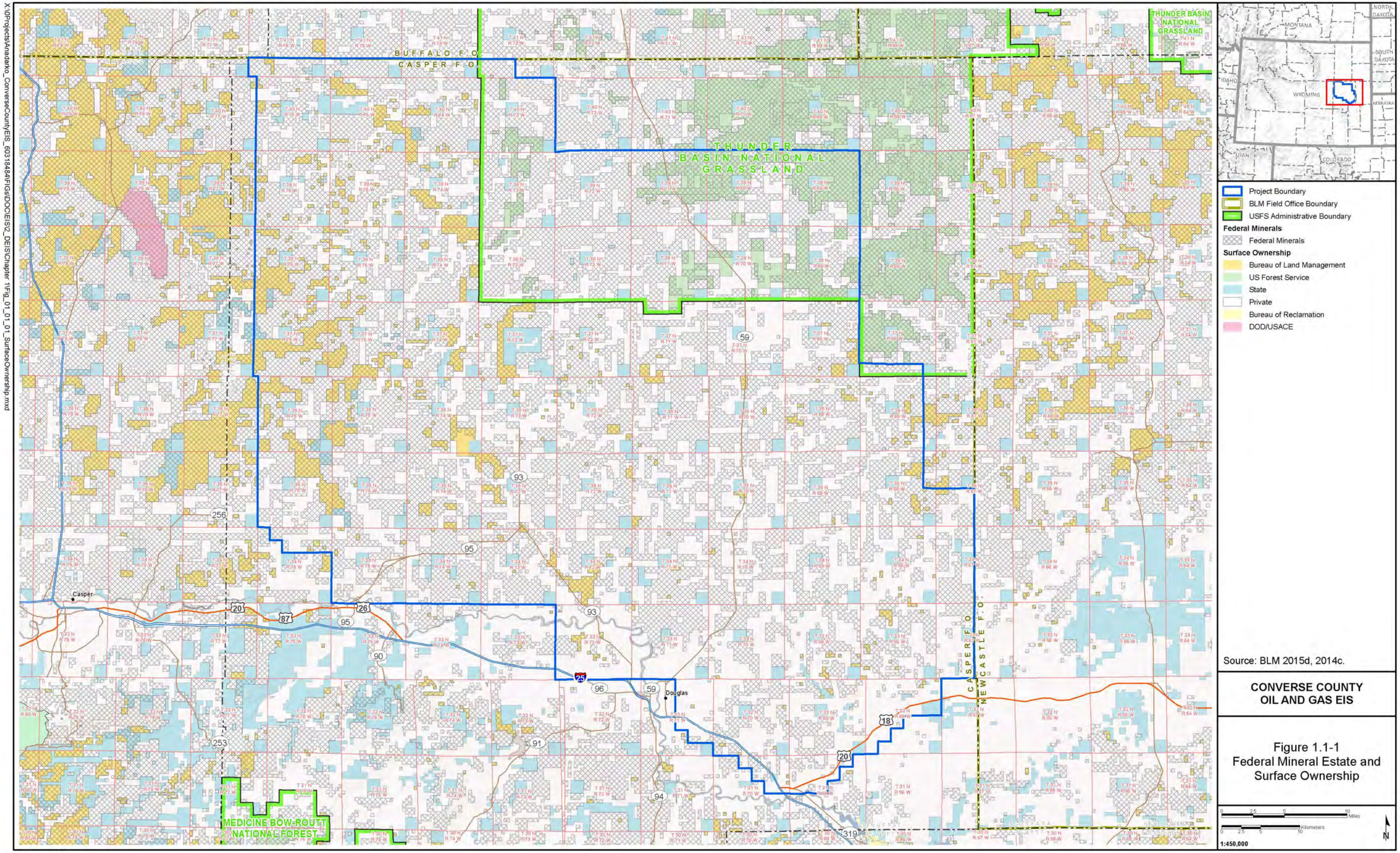

Figure 1.1-1
Federal Mineral Estate and Surface Ownership

Print Date: 8/4/2017

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Cooperating agencies include:

- USFS Medicine Bow-Routt National Forests and Thunder Basin National Grassland Douglas Ranger District
- U.S. Environmental Protection Agency (USEPA)
- U.S. Fish and Wildlife Service (USFWS)
- ***National Park Service (NPS)***
- State of Wyoming
- Campbell Board of County Commissioners
- Converse Board of County Commissioners
- Converse County Conservation District
- Johnson Board of County Commissioners
- Natrona Board of County Commissioners
- Niobrara Board of County Commissioners
- Platte Board of County Commissioners
- City of Casper
- City of Douglas
- Town of Evansville
- Town of Lost Springs
- Town of Rolling Hills

Copies of the Preliminary Draft EIS ***and Preliminary Final EIS*** were submitted to the cooperating agencies for their review and comment prior to distribution to the public. Comments received from the cooperating agencies ***during these reviews*** were considered and incorporated as appropriate into this document.

1.4.1 Decisions to be Made after the EIS Process

Although the RODs may approve the proposed oil and gas wellfield development on a conceptual basis, a site-specific environmental review of areas proposed for surface disturbance and sub-surface mineral extraction would be completed ***to the extent required by NEPA.*** Prior to drilling on BLM- or USFS-administered surface and mineral estate, the project proponent must submit an APD to the BLM or USFS, as appropriate, which would include a Surface Use Plan of Operation and a Drilling Plan. At that time, the BLM/USFS would conduct a site-specific NEPA review and attach appropriate measures to the permit to protect natural and human resources. The BLM is responsible for approval of the drilling program, protection of groundwater and other sub-surface resources, and final approval of the APD on BLM-administered surface and/or mineral estate. Granting of surface uses on BLM-administered surface would be approved by the BLM. Access roads and utilities such as pipelines and electrical powerlines on federal land and surface may require a right-of-way (ROW) grant from the BLM or a special use permit from the USFS, based on the APD applications or other independent applications.

The Thunder Basin National Grassland (TBNG) surface is administered by the USFS. While the BLM would approve APDs on the TBNG, disturbance and granting of surface uses would be approved by the USFS. All lands belonging to the State of Wyoming within the CCPA are administered by the Wyoming Office of State Lands and Investments. The Wyoming Office of State Lands and Investments issues oil and gas leases and would approve surface disturbance activities on state lands. Approval of APDs on state and privately owned lands would be subject to requirements of the Wyoming Oil and Gas Conservation Commission (WOGCC).

1.4.2 Supplemental Draft EIS

In response to comments on the Draft EIS for the Converse County Oil and Gas Project, the BLM developed a Supplemental Draft EIS (SDEIS) to address comments specific to a Land Use Plan (LUP) amendment for the Casper Resource Management Plan (RMP) regarding timing

limitation stipulations (TLS) for all non-eagle raptor species. The stipulations are described in Decision No. 4047 in the Casper RMP, which require surface disturbance buffer distances and timing restrictions for all raptor species. Nine raptors species are identified in Decision No. 4047 with a buffer requirement of 0.25-mile. Four LUP amendment options to the existing non-eagle raptor TLS (two proposed by the OG, one proposed by the BLM, and one proposed by the U.S. Fish and Wildlife Service) were analyzed in this SDEIS along with the existing non-eagle raptor stipulations.

Option 1, the No Land Use Plan Amendment Option, consists of the existing management action for Decision No. 4047 and does not require amendment of the Casper RMP. Four additional options that would require amendment of the existing non-eagle raptor stipulations in the Casper RMP were analyzed in the SDEIS:

- ***Option 2 (Proposed by the OG) – Under this option the timing limit stipulations would not apply to non-eagle raptor nests within the CCPA.***
- ***Option 3 (Proposed by the OG) – Under this option the timing limit stipulations would not apply to non-eagle raptor nests within the CCPA, if the applicant applies conservation measures set forth in Appendix G1.***
- ***Option 4 (Proposed by the BLM) – Under this option the timing limit stipulations may be relieved within the CCPA if other management practices or plans agreed upon by the applicant/operator and the BLM alleviate impacts to non-eagle raptors within the buffer distances defined within the existing Decision No. 4047. An example process for approval of a plan is provided in Appendix G2.***
- ***Option 5 (Proposed by the USFWS) – The timing limit stipulation may be relieved within the CCPA if the applicant works with the BLM and USFWS to alleviate impacts to non-eagle raptors within buffers by developing a Migratory Bird Conservation Plan (MBCP). A proposed outline for the MBCP is provided in Appendix G3.***

The SDEIS was prepared as a complete document that followed the same organization as the Draft EIS dated January 2018. However, the SDEIS focused on new information and analyses regarding the non-eagle raptor amendment options. Revisions in the SDEIS were provided in applicable sections as new text and were shown in bold italics. Reference was provided to the Draft EIS sections where there was no amended text.

The SDEIS was released for public review as a separate document on April 26, 2019, to obtain comments on the revised and newly added sections. The BLM has reviewed and responded to public comments and made appropriate revisions to the revised and newly added text sections and these have been incorporated into this Final EIS. Based on SDEIS comments the BLM added an additional option to the Final EIS as follows:

- ***Option 6 (Additional Option proposed by the BLM) – Under this option timing limit stipulations may be relieved for non-eagle raptors within the CCPA if the applicant applies the conservation measures set forth in Appendix G4.***

1.4.3 Extent of BLM Authority within the CCPA

As detailed in Section 1.1, ten (10) percent of the surface estate within the CCPA is administered by the BLM (6 percent) and USFS (4 percent), whereas 64 percent of the fluid mineral estate underlying the CCPA is administered by the BLM. In contrast, 83 percent of the surface estate and 36 percent of the mineral estate is either privately owned or non-federal. As a result of this ownership pattern the BLM's authority over development activities on the ground surface varies throughout the project area. The following bullets describe the extent of BLM's management authority relative to several ownership scenarios:

- ***Federal surface/Federal minerals (10 percent of the CCPA): under this ownership scenario the surface estate is controlled by either the BLM or the USFS and the underlying fluid mineral estate is controlled and managed by the BLM; as a result the federal agencies have full authority to management development activities.***
- ***Non-federal surface/Federal minerals (54 percent of the CCPA; also known as "split-estate"): under this ownership scenario a non-federal entity (either private or state) owns the surface estate and the underlying fluid mineral estate is controlled and managed by the BLM. The BLM does not have the authority to regulate a surface owner's use of the surface estate, but does have the authority to regulate the activities of federal mineral lessees. Per BLM policy the agency will invite the surface owner to participate in on-site inspections or meetings and seeks the surface owners input on development and reclamation plans. In general, the BLM provides the surface owner's lands the same level of resource protection as would be required on BLM-administered public lands. The BLM will not apply standards or conditions that exceed those that would normally be applied to Federal surface. In practice, the CFO defers to the desires of the surface owner in developing mitigation and reclamation requirements on split estate lands.***
- ***Non-federal surface/non-federal minerals (36 percent of the CCPA): BLM has no authority to manage development activities on non-federal surface underlain by non-federal minerals except where a well is drilled horizontally to access federal minerals, a scenario known as "Fee-Fee-Fed." As detailed in Permanent Instruction Memorandum (PIM) No. 2018-014 BLM's authority under a Fee-Fee-Fed scenario is limited to assuring production accountability from Federal mineral leases. Hence, the BLM has no involvement in the management of development activities on the surface estate including mitigation actions or reclamation plans.***

Under any scenario in which BLM has approval authority the agency must ensure compliance of its activities with NEPA, ESA and NHPA.

1.4.4 Final EIS

Changes in this Final EIS are presented in bold italics and indicated by vertical bars that appear in the left margin. These changes were made in response to comments received from the public on the Draft EIS and the SDEIS.

1.5 Legal and Policy Considerations

1.5.1 Leases and Leasing History

The OG holds oil and gas leases in the CCPA. ***An oil and gas lease is a contract between the federal government and the lessee, under which the lessee has certain rights, and neither the ROD nor any decisions implementing the ROD will limit, restrain, or unreasonably interfere with these rights.***

Some of the leases covering BLM-administered minerals within the CCPA were issued before the current Resource Management Plan (RMP) and/or Land RMP (LRMP) for the area was approved; therefore, these leases contain stipulations reflective of the land use plan in place at the time of issue. Typical lease notices and stipulations that may apply to federal oil and gas leases in the vicinity of the CCPA include those that protect areas not specifically addressed by lease stipulations that may contain special values, be needed for special purposes, or require special attention (e.g., steep slopes, surface waters, saturated soils, near Interstate highways or other existing ROWs, occupied dwellings, or material sites). Typical lease notices and stipulations also pertain to historic properties; National Historic Trails (NHTs), including the viewsheds of NHTs; and greater sage-grouse habitat, raptors, and special status species.

Where wells are proposed to be located on private land directly above private minerals but would penetrate and produce from federal mineral estate (i.e., in a fee-fee-fed scenario; WO IM 2009-078), BLM and USFS authority to regulate and/or mitigate impacts for surface resources is severely limited to compliance only with required federal statutes beyond NEPA. Mitigation for these resources beyond these required federal statutes would necessitate implementation by the landowner and/or the State of Wyoming.

1.5.2 Conformance with BLM and USFS Management Plans and Policies

Land use decisions for federal lands and minerals within the CCPA are contained in the following federal documents.

- BLM Casper ROD and Approved RMP (BLM 2007b)
- BLM Greater Sage-grouse Land Use Plan Amendment ROD for the Rocky Mountain Region (BLM 2015b) and Approved Resource Management Plan Amendment for the Wyoming Greater Sage-grouse Sub-region (Attachment 4 to BLM 2015b)
- TBNG ROD and Approved LRMP (USFS 2002)
- USFS Greater Sage-grouse Land Use Plan Amendment ROD for Northwest Colorado and Wyoming (USFS 2015b) and Land Management Plan Amendment for TBNG (Attachment B to USFS 2015b)

Further analysis and information in the CCPA is contained in the following NEPA documents and regional reports.

- BLM Casper Proposed RMP and Final EIS (BLM 2007b), including amendments and maintenance actions conducted from 2009 to present as contained on the BLM CFO website
- TBNG LRMP (USFS 2001)
- Wyoming Greater Sage-grouse Proposed Land Use Plan Amendment and Final EIS (BLM 2015a)
- Environmental Assessment (EA) No. WY-060-EA14-079, EA for Anadarko Petroleum Corporation Mohawk Oil and Gas Exploration and Development Project (BLM 2014a)
- EA No. WY-060-EA13-067, EA for Samson Resources Company Scott Field Development Project (BLM 2013a)
- EA No. WY-060-EA12-225, EA for Spearhead Ranch Exploratory Oil and Gas Development Project (BLM 2012a)
- EA No. WY-060-EA12-226, EA for Highland Loop Road Exploratory Oil and Gas Development Project (BLM 2012b)
- EA No. WY-060-EA12-227, EA for East Converse Exploratory Oil and Gas Development Project (BLM 2012c)
- EA No. WY-060-EA12-266, EA for Samson Resources Company Hornbuckle Field Development Program EA Update (BLM 2012d)
- EIS No. WY-070-02-065, Final EIS and Proposed Amendment for the Powder River Basin Oil and Gas Project (BLM 2003)
- Powder River Basin Coal Review Phase II – multiple reports developed 2011 through 2014 regarding Past, Present, and Reasonably Foreseeable Development Activities (Task 2 Report), Current 2008 Conditions as of 2008 (Task 1 Reports) and Cumulative Environmental Effects (Task 3 Reports) for various resources (AECOM 2014a).

Management objectives within the Casper RMP ROD include leasing, permitting, and development of oil and gas resources on BLM-administered surface and mineral estate within the planning area while minimizing impacts to other resource values and without compromising the long-term health and diversity of public lands. BLM management objectives for mineral resources also include the need to support the domestic need for energy resources (BLM 2007b). Management objectives within the TBNG LRMP ROD include “providing multiple uses and sustainability in an environmentally acceptable manner” as well as “emphasizing co-operation with individuals, organizations, and other agencies to coordinate planning and project implementation” (USFS 2002). As such, the proposed Project conforms with the management decisions contained in these RODs.

1.5.3 Consistency with Other Applicable Federal Laws and Regulations

BLM authority derives from the FLPMA, as amended (43 USC 1701). General land management regulations are provided in 43 CFR 2000, Subchapter B.

The MLA, as amended (30 USC 181 et seq.), provides for the leasing of deposits of minerals including oil, oil shale, bituminous rock or gas, and lands containing such deposits owned by the U.S. Regulations for onshore oil and gas leasing are provided in 43 CFR 3100.

Private exploration and production from federal oil and gas leases is an integral part of the BLM oil and gas leasing program under authority of the MLA and FLPMA. The BLM oil and gas leasing program encourages development of domestic oil and gas reserves in accordance with the Mining and Minerals Policy Act of 1970.

BLM Onshore Oil and Gas Orders, COAs, and general requirements constitute the range of standard operating procedures and environmental protection measures that are applied to individual operators and projects, as applicable, and are authorized by 43 CFR 3160 and 43 CFR 3170. The Onshore Oil and Gas Orders include:

- Onshore Order No.1 – Approval of Operations;
- Onshore Order No. 2 – Drilling Operations;
- Onshore Order No. 3 – Site Security (43 CFR 3173);
- Onshore Order No. 4 – Oil Measurement (43 CFR 3174);
- Onshore Order No. 5 – Gas Measurement (43 CFR 3175);
- Onshore Order No. 6 – Hydrogen Sulfide Operations;
- Onshore Order No. 7 – Disposal of Produced Water;
- Onshore Order No. 9 – Waste Prevention and Resource Conservation (43 CFR 3179); and
- Notices to Lessees.

The exploration and production of domestic oil and gas reserves is in accordance with the President’s National Energy Policy, set forth in EO 13212 (2001), the Energy Policy Act of 2005 (42 USC 15801)*, **and the March 28, 2017 Executive Order on Promoting Energy Independence and Economic Growth***. All project-related activities would be conducted in compliance with the terms and conditions of the applicable federal leases, federal regulations, and the requirements of the appropriate RMP/LRMP.

In addition to the BLM, numerous other federal, state, and local governmental agencies may be involved in regulation of oil and gas development. Other key federal and state regulations and permits that are relevant to the proposed project include those listed in **Table 1.5-1**, which is not all-inclusive. In addition to various Converse County permits, other agency or government authorizations (approvals, permits) may be necessary.

Table 1.5-1 Key Federal, State, and Local Permits, Approvals, and Authorizing Actions for Construction, Operation, Maintenance, and Abandonment of the Proposed Action

Issuing Agency	Name and Nature of Permit/Approval	Regulatory Authority (if appropriate)
FEDERAL AGENCIES		
USDOI BLM	Application for Permit to Drill, Deepen, or Plug Back (APD/Sundry Process); Controls drilling for oil and gas on federal onshore lands.	MLA (30 USC 181 et seq.); 43 CFR 3162; National Mining and Minerals Policy Act of 1970, the FOOGLRA of 1987, (Onshore and Gas Orders #1 and #2 [43 CFR 3164])
	ROW Grants and Temporary Use Permits; grants ROW use on BLM-managed lands.	MLA as amended (30 USC 185); 43 CFR 2880; FLPMA (43 USC 1761-1771); 43 CFR 2800
	Antiquities, Cultural, and Historic Resource Permits; issue antiquities and cultural resources use permits to inventory, excavate, or remove cultural or historic resources from federal lands.	Antiquities Act of 1906 (16 USC Section 431-433); Archaeological Resources Protection Act of 1979 (16 USC Sections 470aa - 47011); Preservation of American Antiquities (43 CFR Part 3); Section 106 of the National Historic Preservation Act (NHPA), as amended 2006
	Approval to dispose of produced water; controls disposal of produced water from federal leases.	MLA (30 USC 181 et seq.); 43 CFR 3164; Onshore Oil and Gas Order No. 7
	Pesticide Use Proposal and Daily Pesticide Application Record.	BLM Authorization for Herbicide Applications on federal lands
	Federal Noxious Weed Act compliance.	Plant Protection Act of 2000 (Public Law 106-224, 7 USC 7701); Federal Noxious Weed Act of 1974, as amended (USC 2801-2814); EO 13112 of February 3, 1999
	Initiation of Section 7 consultation.	Section 7 of the ESA, as amended (16 USC et seq.)
	Mineral Material Sales Permit; for use of BLM-managed borrow pits in road construction.	Materials Act of 1947 as amended (30 USC, 601 et seq.)
	Paleontological Resource Use Permit; approval for surveys and potential data collection at well pads and road sites; management of unanticipated discoveries.	FLPMA (302[b]); Paleontological Resource Preservation Act of 2009; Assessment and Mitigation of Potential Impacts to Paleontological Resources (Instruction Memorandum [IM] 2009-011.B.4.a)
	Multiple mineral development of the same tracts of public land.	Multiple Mineral Development Act of 1954
USFWS	ESA Section 7 consultation / Biological Assessment; protection of federally listed threatened and endangered species through coordination and consultation.	Section 7 of the ESA, as amended (16 USC et seq.)
	Migratory Bird Treaty Act (MBTA) consultation.	MBTA of 1918, as amended (15 USC 703-712); EO 13186
	Bald and Golden Eagle Protection Act (BGEPA) consultation.	Bald Eagle Protection Act of 1940, as amended (16 USC 668-668d)

Table 1.5-1 Key Federal, State, and Local Permits, Approvals, and Authorizing Actions for Construction, Operation, Maintenance, and Abandonment of the Proposed Action

Issuing Agency	Name and Nature of Permit/Approval	Regulatory Authority (if appropriate)
	Section 404 Permit Consultation; review of permit for compliance with ESA.	Section 404 of the Clean Water Act of 1972 (CWA) (33 USC 1344)
Advisory Council on Historic Preservation	Cultural resources compliance (Section 106); coordinated with the Wyoming State Historic Preservation Officer (SHPO).	NHPA, Section 106
U.S. Department of Agriculture USFS	Approval of the Surface Use Plan of Operations (APD) and Sundry Notices.	MLA (30 USC 181 et seq.); 43 CFR 3162; National Mining and Minerals Policy Act of 1970, the FOOGLRA of 1987, (Onshore and Gas Orders #1 and #2 [43 CFR 3164])
	Biological Assessment, Biological Evaluation and Management Indicator Species Analysis; protection of threatened, endangered, proposed, and sensitive species and analysis of effect for management indicator species.	Section 7 of ESA as amended (16 USC et seq.); National Forest Management Act
	Antiquities, Cultural, and Historic Resource Permits; issue antiquities and cultural resources use permits to inventory, excavate, or remove cultural or historic resources from federal lands.	Antiquities Act of 1906 (16 USC Section 431-433); Archaeological Resources Protection Act of 1979 (16 USC Sections 470aa - 47011); Preservation of American Antiquities (43 CFR Part 3); Section 106 of the NHPA, as amended 2006
	Review and approve all Pesticide Use Proposals (PUPs) for the use and application of pesticides on National Forest System lands; maintain Daily Pesticide Application Record.	FSM 2100 (Pesticide Use Policy)
	Federal Noxious Weed Act compliance.	Plant Protection Act of 2000 (Public Law 106-224, 7 USC 7701); Federal Noxious Weed Act of 1974, as amended (USC 2801-2814); EO 13112 of February 3, 1999
	Participate in Section 7 consultation.	Section 7 of the ESA, as amended (16 USC et seq.)
	Mineral Material Sales Permit; for use of mineral materials on USFS administered lands.	Materials Act of 1947 as amended (30 USC, 601 et seq.)
U.S. Department of Defense Army Corps of Engineers (USACE) – Omaha District	Section 404 permit (Nationwide and Individual); controls discharge of dredged or fill materials into waters of the U.S.	Section 404 of the CWA (33 USC 1344)

Table 1.5-1 Key Federal, State, and Local Permits, Approvals, and Authorizing Actions for Construction, Operation, Maintenance, and Abandonment of the Proposed Action

Issuing Agency	Name and Nature of Permit/Approval	Regulatory Authority (if appropriate)
USEPA Region 8	USEPA has responsibility for oversight of environmental programs under the Clean Air Act (CAA) and CWA. Regardless of surface ownership, USEPA's responsibility is to provide scoping comments, review EISs, and provide CAA and CWA permitting, information, and appropriate technical assistance during and following the environmental analysis process.	CAA, as amended, 42 USC Annotated (USCA) Section 7410-762 (Public Law 95-604, Public Law 95-95) Federal Water Pollution Control Act, as amended by the CWA, 33 USCA Section 1251-1376 (Public Law 92-500, Public Law 95-217) Safe Drinking Water Act, 452 USCA Section 300F-300J-10 (Public Law 93-523)
	Underground Injection Control (UIC): USEPA must concur with aquifer exemption for UIC permits.	UIC (40 CFR 146.21 through 146.24)
U.S. Department of Transportation (USDOT) Pipeline Hazardous Materials and Safety Administration	Special Permits and compliance with safety regulations specific to pipeline construction and operations. Prescribes minimum safety requirements for pipeline facilities and the transportation of oil and gas.	Pipeline safety regulations (49 CFR 190-199)
STATE AGENCIES		
Wyoming Department of Agriculture	Controls introduction and spread of weeds and pests	Wyoming Weed and Pest Control Act (Wyoming Statute [WS] 11-5-119)
Wyoming Department of Environmental Quality (WDEQ) Water Quality Division	National Pollutant Discharge Elimination System (NPDES) General Permit for Construction: for discharge of construction dewatering and hydrostatic test waters from property to U.S. waters; controls offsite stormwater runoff from construction activities resulting in 1 acre or more of disturbance.	Wyoming Environmental Quality Act; Sections 401 and 405 of the CWA (40 CFR 122, 123, and 124); WDEQ Water Quality Rules and Regulations, Chapters 1, 2, and 18.
	Section 401 Certification; for stream and wetland crossings.	Blanketed under USACE Section 404 authorization
	Commercial Oilfield Waste Disposal Facility (COWDF).	***WDEQ Water Quality Division Rules and regulations Chapters 2, 3, 7, 8, 11, and 20.***
	Subsurface injection of waste water. Class I and Class V wells.	***Safe Drinking Water Act, Underground Injection Control. WDEQ Water Quality Division Rules and regulations Chapter 27.***
Air Quality Division	Permits to construct and operate certain emissions sources including New Source Review and Title V Permits	CAA and implementing regulations in 40 CFR 70; Wyoming Environmental Quality Act (WS 35-11-201 through 35-11-21); Wyoming Air Quality Standards and Regulations Chapter 6, Section 2

Table 1.5-1 Key Federal, State, and Local Permits, Approvals, and Authorizing Actions for Construction, Operation, Maintenance, and Abandonment of the Proposed Action

Issuing Agency	Name and Nature of Permit/Approval	Regulatory Authority (if appropriate)
WOGCC	Regulates drilling of oil and gas wells in the state of Wyoming, including: • Well location and spacing of units • Well control and measurement • Directional drilling • Flaring and venting • Protection of surface waters and productive formations • Underground disposal of water • Plugging and abandonment • Control of spills and fires • Workmanlike operations • Processing and production facilities	WOGCC Rule Chapters 3 and 4; WS 30-5-104; WS 30-5-109; WS 30-5-115
Wyoming State Engineer's Office (WSEO)	Water well permit: Issue permit to appropriate water	WS 41-3-938
Wyoming State Lands and Investments Office	ROWs and easements on state lands	WS 36-9-118
Wyoming Department of State Parks and Cultural Resources SHPO	Cultural resource protection	NHPA Section 106 and Advisory Council Regulations (36 CFR 800)
Wyoming Game and Fish Department (WGFD)	Consultations regarding state-listed species	Wyoming State Wildlife Action Plan
	Consultations regarding noxious weeds and invasive species of concern	Wyoming Weed and Pest Control Act (WS 11-5-119); Wyoming Game and Fish Commission Rule Chapter 62 Aquatic Invasive Species (WS 23-1-102, WS 23-4-201 through 23-4-205)
Wyoming Department of Transportation (WYDOT)	Class W Permits and Superload Authorization; authorizes oversize, over length, and overweight load transportation on state highways.	WS 31-18-801 through 31-18-808
	Encroachment Permit; authorizes construction of utilities (e.g., pipelines, transmission lines) across or within a state or federal ROW.	Utility Accommodation Regulation 1991
LOCAL AGENCIES		
Converse County Board of County Commissioners	County zoning/land use plan consultation; incorporates land use plans of the City of Douglas, Town of Glenrock, and Town of Rolling Hills, and Town of Lost Springs	Converse County Land Use Plan (WS 18-5-202(a)); WS 9-8-301(c)
	Roadway Use Agreement	WS 139-101 et seq.

Table 1.5-1 Key Federal, State, and Local Permits, Approvals, and Authorizing Actions for Construction, Operation, Maintenance, and Abandonment of the Proposed Action

Issuing Agency	Name and Nature of Permit/Approval	Regulatory Authority (if appropriate)
	Bore, Cut, and Public Utilities ROW Permit: authorizes construction of utilities (pipelines, electric transmission/distribution lines, telegraph/telephone lines) across or within a county road.	Converse County Resolution 05-14
	Oversize/Overweight Loads Permit Authorization; authorizes oversize, over length, and overweight load transportation on county roads.	Converse County Resolution 05-15; WS 31-18-802(a)(x)

1.6 Scoping

1.6.1 Public Scoping

The BLM conducted internal and public scoping per the CEQ public scoping requirements set forth in 40 CFR 1501.7. The public scoping process was intended to solicit input and identify environmental issues and concerns associated with the proposed project. The process was initiated on May 16, 2014, with the publication of a Notice of Intent (NOI) in the Federal Register (FR), a news release to local media, and a posting on the BLM CFO website. On May 23, 2014, the BLM issued a second news release, identifying the venues and dates for the three public scoping meetings. In addition, BLM provided public service announcements to local radio stations, newspapers, and television stations; conducted a news interview with KCWY13; posted flyers advertising the meetings in key locations around the communities of Casper, Douglas, Glenrock, and Rolling Hills, Wyoming. Three public scoping meetings were held in June 10-12, 2014 in Douglas, Casper, and Glenrock, Wyoming. Finally, the BLM issued a third news release noting the scoping closure date of June 30, 2014.

The public scoping meetings were held in the evenings in an open house/presentation format. Attendance at all three meetings totaled 123 people. Written comments received during the public scoping period included a total of 90 written submittals. Most submittals were provided via mail or email, and most commenters were from within Wyoming. Of the 90 submittals, 2 were from federal agencies, 3 were from the state agencies, 1 was from a county agency, 8 were from non-governmental organizations, 24 were from industry or businesses, and 52 were from private individuals.

Based on the substantive comments submitted during scoping, the BLM developed issue statements, in the form of questions to describe the general issues and concerns. These issue statements were grouped into larger issue categories. The following key resource issue statements were identified for consideration in preparing the Converse County EIS.

<u>Process</u>

- What level of detail in Chapter 2.0 is necessary for an adequate and defensible NEPA process and EIS?
- How would the EIS best convey project information, especially information that is conceptual and programmatic?
- What is the process by which permitting would proceed from a programmatic EIS analysis to more site-specific analyses at the APD level?
- How should unknown or inadequate information be addressed?

- How would the project comply with applicable policies, regulations, and permitting, including air quality?
- How could cooperators, agencies with regulatory authority, affected stakeholders, and other interested parties participate during the NEPA process?

Purpose and Need

- To what degree should the Operator’s request for ***relief from timing limit stipulations*** be incorporated in the purpose and need?

Alternatives

- What equipment, techniques, and design features would be implemented on the project to respond to local and regional resource issues?
- What design features are technically and/or economically feasible?
- What is a reasonable range of alternatives?
- What is an appropriate project area?

Air Quality and Climate Change

- What methodologies should be used for a robust and quantitative modeling for all appropriate air pollutants and sources such as drilling, production, vehicle use, and other sources?
- Would the project conform to National Ambient Air Quality Standards (NAAQS)?
- How would the project affect greenhouse gases and contribute to climate change?
- What is the long-term impact to the surrounding air quality if produced gas is flared compared to collecting the gas and not flaring?
- What methods or actions can minimize or mitigate air quality impacts and potential effects on human health and other resources from the project?
- What elements should be included in an air monitoring plan?

Geology and Paleontology

- How does area geology affect the potential for gas and liquid to migrate from one formation or zone to another?
- How would the potential for gas and liquid migration be affected by drilling, hydraulic fracturing, injection of produced water, or other project activities?
- What is the potential for impacts to important paleontological resources and how can this be minimized?

Soils

- How does area soil type affect the potential for erosion, runoff, and subsequent sediment loading?
- How would impacts to erodible soils, saline soils, or other sensitive soil types be minimized or mitigated?

Water Resources

- What water sources would be used for drilling, hydraulic fracturing, and oil production activities? How would the projected water use affect long-term availability of these sources for use due to depletion caused by oil activities in conjunction with use by other entities?

- How would the characteristics of the oil/gas formations, aquifer formations, and their interconnectedness affect water quality during project activities such as drilling, hydraulic fracturing, injection of produced water, or other project activities?
- How would the proponents handle the collection, storage, treatment, and disposal of produced water?
- What design features, best management practices (BMPs), mitigation measures, and conditions of approval can be incorporated into the project to reduce risk to water resources?
- What are appropriate setbacks for protection of public and private wells, lakes and streams, impaired waters, floodplains, or other water resources?
- How should water quantity and quality be monitored over the life of the project?

Wildlife/Threatened and Endangered Species

- How would impacts to wildlife habitat be analyzed at a programmatic level?
- How would planned habitat disturbance, vehicle use, and other project elements affect wildlife, special status species, and their habitat?
- What design features, BMPs, mitigation measures, and conditions of approval can be incorporated into the project to reduce risk to wildlife and special status species?
- How would the project affect big game, including effects on habitat fragmentation and connectivity and the potential for additional human disturbance or poaching from roads?
- How would proposed changes to the current protective stipulations for special status species affect habitat and species viability?
- What are the direct and cumulative impacts to sage-grouse leks and surrounding nesting and brood-rearing habitats with consideration of habitat restoration and other mitigation measures?
- What research, impact assessment tools, and conservation strategies for greater sage-grouse should inform the project design, alternatives, and impacts analysis?
- How would the project comply with existing regulations and policies associated with special status species, including the Governor's Greater Sage-Grouse Core Area Protection EO?
- What is the potential for the project to affect the Platte River System through consumptive use or impacts to water quality?

Vegetation

- How would vegetation resources such as sagebrush habitat be protected, maintained, or restored?
- How would special status plant species be protected?
- How would the spread of noxious weeds and invasive plant species be mitigated?
- How would surface disturbance or changes in hydrology affect wetland or riparian areas and how would these areas be protected?

Cultural Resources

- How can the BLM protect and conserve cultural resources?
- What specific protective measures including buffers would be applied to linear and non-linear cultural resources?
- How would consultation with cultural preservation groups be incorporated?
- What cultural importance do local tribes place on the project area?

- How can the setting of regional historic trails and routes, early highways, and other linear resources in the project vicinity be protected?

Hazardous Materials

- What are the types and amounts of hazardous materials that would be used for this project?
- What methods would be used for hazardous materials transport and storage to reduce risk of adverse impact to physical, biological, and other resources?
- How would contaminants be disposed of and can planned disposal facilities accommodate the projected waste levels?
- How can waste disposal on private lands be regulated?
- What contingencies exist to handle unexpected contaminations such as naturally occurring radioactive materials or spills?

Human Health and Safety

- How would the BLM protect public health and safety in and around the project area?
- What are appropriate setbacks for residences, towns, and other areas where people live or work?
- How would the project impact emergency and health care services?
- What avenues can be used to inform the public about potential hazards?

Land Use

- How would development in the project area affect access to federal, state, and private lands?
- How would the project comply with county and local policies concerning development?
- How would private property rights and property values be protected?
- How would the BLM address split estate lands in terms of survey or reclamation requirements?

Livestock Grazing

- How would the EIS analyze the direct, indirect, and cumulative impacts to livestock grazing, including impacts on range improvements, potential loss of animal unit months (AUMs), reduction in allotments, and declines in economic returns?
- What mitigation measures should be used to reduce the impacts to livestock grazing?
- What opportunities exist for the BLM, oil and gas operators, and livestock permittees to work collaboratively to minimize conflicts?

Special Designations

- How would areas of critical environmental concern (ACECs) and inventoried roadless areas be protected?
- How could impacts to key landscape settings around historic trails be minimized?

Recreation and Visual

- How would the project affect access to recreation and the quality of the recreational experience?

- How would the effects of the extraction industry on recreational resources and opportunities (as well as the recreation industry) be mitigated?
- How would visual impacts on recreational areas within the project area be reduced?
- What are the hunting values of lands in the project area and how would hunting activities be impacted?

Socioeconomics

- How would the project affect social and economic conditions on local and regional levels?
- How would resource conservation measures and other actions that would restrict or limit oil and gas development affect social and economic conditions?
- How could impacts to less tangible social issues such as quality of life be analyzed?
- What mitigation strategies could be used to minimize adverse social or economic impacts?
- How can the direct and indirect impacts to social and economic resources be balanced with the positive impacts brought by the extraction industry?

Transportation

- How would the project affect traffic on local and regional levels on a daily and annual basis?
- How would the project affect the local road system in terms of existing road standards, usage, condition, dust abatement, maintenance, noise, and traffic safety?
- How would the project minimize adverse impacts to traffic and the local transportation network?

Cumulative Impacts

- How would the cumulative impacts from oil and gas and other regional development affect air quality, visibility, water resources, greater sage-grouse, and other wildlife?
- What reasonable foreseeable actions are appropriate for inclusions in resource-specific cumulative impact analyses?

Mitigation

- How would the project comply with new regulations and policy associated with mitigation, including the Secretarial Order 3330 and BLM's Interim Regional Mitigation Manual?
- What off-site mitigation opportunities or other compensatory mitigation management options should be considered?
- How would mitigations be applied to private property?

Reclamation

- What elements should be required as part of a comprehensive reclamation plan that addresses post-reclamation monitoring, annual reporting, and bonding?
- How will the BLM ensure that reclamation requirements are being met?

Land Use Plan Amendments

- How would the project consider and comply with applicable federal land use plans?
- Would the project result in revision to the Casper RMP or TBNG LRMP to ***accommodate relief from timing limit stipulations***?

- How would the ongoing Casper RMP revision affect the project?
- How would valid existing rights be maintained?

1.6.2 Internal Scoping and Issue Identification

The BLM and USFS have compiled a list of resources potentially present in the CFO or TNBG areas that also are likely within the CCPA. These resources represent issues considered in all CFO EAs and EISs and are discussed and analyzed in Chapters 3.0, 4.0, and 5.0 of this document.

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2.0 Proposed Action and Alternatives

This chapter presents a description of the alternatives analyzed in this document. In addition, this chapter defines the CCPA boundaries, describes the existing and approved oil and gas facilities present within the CCPA, and discusses standard development and production activities. In developing the alternatives, guidance set forth in the BLM IM 2005-247, Attachment 1, was followed. This guidance provides recommendations on developing a range of reasonable alternatives for oil, gas, and geothermal development activities. Based on this guidance, the following alternatives were developed for analysis in this EIS.

- **Alternative A – No Action Alternative:** This alternative assumes that approval of the OG's proposed Project would be denied and new drilling would continue by the appropriate permitting agency as approved under NEPA (Section 2.3).
- **Alternative B – Proposed Action Alternative**: This alternative consists of the OG's proposal to explore and develop potentially productive subsurface formations underlying the CCPA by drilling up to 5,000 oil and natural gas wells on 1,500 single and multi-well pads within the CCPA over a period of 10 years (Section 2.4). This alternative would include analysis in areas where timing limitation restrictions serve to protect several wildlife species. As discussed in more detail in Section 2.4.1, the BLM preferred alternative is Alternative B ***and LUP amendment Option 6*** the Proposed Action Alternative.
- **Alternative C:** This alternative would reduce the surface disturbance and related impacts based on the assumption that a higher average number of wells would be drilled from each pad. Specifically, 55 percent of the CCPA would be developed on pads with up to 4 wells, 35 percent of the CCPA would be on pads with 5 to 8 wells, and 10 percent of the CCPA would be on pads with 9 to 16 wells. This would provide for drilling the same number of wells (5,000) under the same drilling rate (500 wells per year) as Alternative B. This would reduce the total number of well pads to 938, which subsequently would reduce the miles of access roads, gas gathering pipelines, water pipelines, and overhead electrical lines needed, as well as the acreage encumbered by the well pads (Section 2.5). This alternative would continue to require the multiple timing stipulations as outlined in the BLM RMP and USFS LRMP, thus not ***providing relief from timing limit stipulations***.

The No Action Alternative (Alternative A) and each of the action alternatives (Alternatives B and C) are discussed in terms of alternative-specific activities and schedule, alternative-specific design features, and surface disturbance summaries. Alternatives considered but eliminated from detailed analysis are discussed in Section 2.6. The analysis of each alternative in Chapter 4.0 focuses on the new disturbance that would occur under each alternative and would be in addition to existing and permitted disturbance.

There would be no changes in project construction or operation activities as a result of the LUP non-eagle raptor amendment options. Options 1 through 5 are analyzed under Alternative B.

2.1 Converse County Project Area

The CCPA consists of approximately 1.5 million acres of land generally located within Townships 32 through 40 North, Ranges 67 through 76 West, Sixth Principal Meridian in Converse County, Wyoming. As shown on **Table 2.1-1**, the wells and facilities would be constructed and operated within the CCPA on lands administered and owned by the federal government, the State of Wyoming, and private landowners. Approximately 88,466 surface acres (6 percent of the CCPA) are public lands administered by the BLM CFO and approximately 63,911 surface acres (4 percent of the CCPA) are administered by the USFS. The BLM administers approximately 964,566 acres of fluid mineral estate (64 percent) within the CCPA. Lands with mixed federal surface and mineral ownership, often referred to as split estate lands, comprise approximately 812,189 acres (54 percent) of land within the CCPA.

Table 2.1-1 Surface and Oil and Gas Minerals Ownership within the CCPA

Owner / Administrator	Surface Ownership / Administration		Minerals Estate	
	Acreage	Percentage	Acreage	Percentage
BLM	88,466	6	964,566[1]	64
USFS	63,911	4		
State of Wyoming	101,012	7	537,815	36
Private	1,247,477	83		
Water	1,515	<1		
Totals	1,502,381	100	1,502,381	100

[1] All federal minerals within the CCPA are administered by BLM; USFS does not manage federal minerals.

The CCPA is vast in scale and scope, and numerous small and large oil and gas operators have ongoing operations in the area. Topography ranges from steep rugged rock outcrops to relatively gentle slopes. Elevations within the CCPA range from approximately 4,800 to 6,300 feet above mean sea level (amsl). The CCPA encompasses a number of physiographic provinces and is located within the Platte River and Cheyenne River basins. The area historically has been used for livestock grazing, oil and gas development, wildlife habitat, and recreation. Much of this area provides summer and fall grazing for cattle, sheep, and horses. The OG and other operators active in the CCPA continue to explore oil and gas, including drilling new wells and constructing new infrastructure. The OG proposes to explore and drill new wells to multiple productive formations.

2.2 Common to All Alternatives

The following sections summarize general pre-construction, construction, drilling and completion operations, production and maintenance operations, and abandonment and reclamation procedures common to all alternatives. All new development must comply with the Casper RMP (BLM 2007b), the TBNG LRMP (USFS 2002, 2001), and the Required Design Features provided in Appendix C of the Approved Resource Management Plan Amendment for Greater Sage-grouse (BLM 2015b). All appropriate COAs, mitigations, and ROW stipulations from all resources would be applied as dictated in the appropriate land use plans. **Table 2.2-1** provides a summary of the applicable Approved Resource Management Plan Amendment Required Design Features.

Table 2.2-1 Approved Resource Management Plan Amendment Required Design Features

General Habitat Management Area Required Design Features – Construction and Operational Activities
• Cover (e.g., fine mesh netting or use other effective techniques) all drilling and production pits and tanks regardless of size to reduce sage-grouse mortality. • Equip tanks and other above ground facilities with structures or devices that discourage nesting of raptors and corvids. • Control the spread and effects from non-native plant species. (e.g., by washing vehicles and equipment). • Construct road crossing at right angles to ephemeral drainages and stream crossings.
General and Priority Habitat Management Area Required Design Features – Construction and Operational Activities
• Cluster disturbances, operations (fracture stimulation, liquids gathering, etc.), and facilities. • Restrict the construction of tall facilities and fences to the minimum number needed. • Restrict pit and impoundment construction to reduce or eliminate augmenting threats from West Nile virus.

Table 2.2-1 Approved Resource Management Plan Amendment Required Design Features

• Use directional and horizontal drilling to the extent feasible as a means to reduce surface disturbance in relation to the number of wells. • Use remote monitoring techniques for production facilities and develop a plan to reduce the frequency of vehicle use. • Clean up refuse. • Design roads to an appropriate standard, no higher than necessary, to accommodate their intended purpose. • Establish speed limits to reduce vehicle/wildlife collisions or design roads to be driven at slower speeds. • Apply dust abatement on roads, well pads, and other surface disturbances.
General and Priority Habitat Management Area Required Design Features – Reclamation Activities
• Include restoration objectives to meet sage-grouse habitat needs in reclamation practices/sites. • Address post-reclamation management in reclamation plan such that goals and objectives are to enhance or restore sage-grouse habitat. • Close and reclaim duplicate roads by restoring original landform and establishing desired vegetation.
Priority Habitat Management Area Required Design Features – Construction and Operational Activities
• When possible, require perch deterrents on existing or new overhead facilities. • Where the Federal government owns the surface, and the mineral estate is in non-Federal ownership, apply appropriate BMPs to surface development. • Control the spread and effects of invasive non-native plant species, including treating weeds prior to surface disturbance and washing vehicles and equipment at designated wash stations when constructing in areas with weed infestations. • Place infrastructure in already disturbed locations where the habitat has not been fully restored. • Place new utility developments (power lines, pipelines, etc.) and transportation routes in existing utility or transportation corridors. • Pipelines must be under or immediately adjacent to the roads. • Require sage-grouse-safe fences. • Restrict the construction of tall facilities, distribution power lines, and fences to the minimum number and amount needed. • To reduce truck traffic and perching and nesting sites for ravens and raptors, do not place tanks at well locations within priority habitat areas. • Design or site permanent structures to minimize impacts to sage-grouse, with emphasis on locating and operating facilities that create movement (e.g., pump jacks) or attract frequent human use and vehicular traffic (e.g., fluid storage tanks) in a manner that will minimize disturbance of sage-grouse or interference with habitat use. • Bury distribution power lines to the extent technically feasible. • Site and/or minimize linear ROWs or special use authorizations to reduce disturbance and fragmentation of sagebrush habitats. • Place liquid gathering facilities outside priority areas. • Apply a phased development approach with concurrent reclamation.   • Locate roads to avoid important areas and habitats. Coordinate road construction and use among Federal fluid mineral lessees and ROW or special use authorization holders. • Construct road crossings of ephemeral, intermittent, and perennial streams to minimize impacts to the riparian habitat, such as by crossing at right angles to ephemeral drainages and stream crossings. • Coordinate Required Design Features/BMPs and vegetative objectives with the Natural Resources Conservation Service (NRCS) for consistent application across jurisdictions where the BLM and NRCS have the greatest opportunities to benefit greater sage-grouse, particularly as it applies to the NRCS's National Sage-Grouse Initiative. • If the geology is exploratory and there is the potential that subsequent wells may not be drilled, do not disturb additional habitat until geology has proven additional wells can go on the pad and it is necessary to do so. • Cover all fluid-containing pits and open tanks with netting (maximum 1.5-inch mesh size) regardless of size to reduce sage-grouse mortality.

Table 2.2-1 Approved Resource Management Plan Amendment Required Design Features

• Equip tanks and other above-ground facilities with structures or devices that discourage nesting and perching of raptors and corvids. • Use only closed-loop systems for drilling operations, with no reserve pits. • Artificial water impoundments will be managed for the prevention and/or spread of West Nile virus where the virus poses a threat to sage-grouse. This may include but is not limited to: (a) the use of larvicides and adulticides to treat waterbodies; (b) overbuilding ponds to create non-vegetated, muddy shorelines; (c) building steep shorelines to reduce shallow water and emergent aquatic vegetation; (d) maintaining the water level below rooted vegetation; (e) avoiding flooding terrestrial vegetation in flat terrain or low-lying areas; (f) constructing dams or impoundments that restrict seepage or overflow; (g) lining the channel where discharge water flows into the pond with crushed rock, or use a horizontal pipe to discharge inflow directly into existing open water; (h) lining the overflow spillway with crushed rock and construct the spillway with steep sides to preclude the accumulation of shallow water and vegetation. • Manage produced waters that could present additional vectors for West Nile virus with remedies including re-injection under an approved Underground Injection Control permit, transfer to single/centralized facility, etc. • Limit noise to less than 10 decibels above ambient measures (20 to 24 decibels on the A-weighted scale [dBA[) at sunrise at the perimeter of a lek during active lek season. • Require noise shields when drilling during the lek, nesting, brood-rearing, or wintering season. • Locate new compressor stations outside priority habitats and design them to reduce noise that may be directed towards priority habitat. • Locate man camps outside priority sage-grouse habitats. • Establish trip restrictions or minimization through use of telemetry and remote well control (e.g., Supervisory Control and Data Acquisition). • Designate all newly constructed routes for authorized use only (using signage, gates, etc.).
Priority Habitat Management Area Required Design Features – Reclamation Activities
• Implement irrigation during interim or final reclamation for sites where establishment of seedlings has been shown or is expected to be difficult due to dry conditions. • Use mulching, soil amendments, and/or erosion blankets to expedite reclamation and to protect soils. • Restore disturbed areas at final reclamation to the pre-disturbance landforms and desired plant community. • Maximize the area of interim reclamation on long-term access roads and well pads, including reshaping, topsoiling, and revegetating. • Conduct reclamation on unused roads as soon as possible using appropriate sage-grouse seed mixes. • Reclaim the permitted ROWs used in the construction of the running surface immediately.

Source: Appendix C of the Approved Resource Management Plan Amendment (BLM 2015b).

2.2.1 Pre-construction Activities and Construction Initiation

2.2.1.1 Applications, Notices, and Surveys

Prior to the start of construction activities on BLM- or USFS-managed land and/or mineral estate, operators would:

- Submit site-specific applications (Notices of Staking, APDs, ROW applications, Sundry Notices), as applicable including any additional information as needed (e.g., surface use plan of operations [SUPO]) and modify them, as needed;
- Notify the surface owner prior to entry for planning, staking, or resource surveying;
- Survey and stake each location, access road, and pipeline;
- Participate in on-site evaluations with BLM personnel and surface owners in split estate situations;
- Submit detailed construction plans, as needed; and

- Perform cultural resource, paleontological, biological (including threatened and endangered plant and animal species), and/or other surveys, as required by BLM or USFS.

Each operator would obtain required permits from the BLM and/or the USFS prior to initiating activities on BLM- or USFS-administered land. To initiate the permitting process, operators would file a Notice of Staking and/or APD/SUPO for each proposed well and the BLM (and USFS on USFS-administered surface) would process the applications to determine if they meet all requirements.

APDs would be submitted to the BLM, where appropriate. Per BLM Onshore Order 1, any submitted APD must be technically and administratively complete and include a completed 3160-3 form, well plat, drilling plan, SUPO, bonding, operator certification, and onsite inspection. The SUPO would contain information describing construction operations, access roadways and pipeline corridors, water supply and haul route, well site layout, production facilities, waste disposal, and reclamation associated with the site-specific well development proposal. The drilling plan generally would include information describing the technical drilling aspects of the specific proposal, including subsurface resource protection and royalty accountability. The BLM would determine the suitability of the proposed design, construction techniques, and procedures during the APD-review process. For activity on USFS-administered lands, the BLM typically would provide a copy of the APD and the SUPO to the USFS for review, the USFS would approve the SUPO with any needed COAs, and BLM would be responsible for reviewing the drilling plan and ultimately approving the APD.

Prior to construction and APD approval, the BLM and/or USFS would conduct on-site inspections to assess potential impacts and recommend additional methods to avoid, minimize, and/or compensate impacts as warranted. The BLM and/or USFS may impose mitigation measures as COAs to the APD. These additional environmental protection measures could address all aspects of oil and gas development, including construction, drilling, production, reclamation, and abandonment. The BLM and/or USFS would notify the operator of a date, time, and place to meet to perform on-site inspections for the proposed locations. Survey stakes would be used to indicate the orientation of the well pad and flagging would be used to indicate the routing of access roads, pipelines, or other linear features. Changes or modifications would be made during the inspection if needed to avoid or mitigate impacts to resources. Cut and fill and construction issues also would be addressed, as necessary.

2.2.1.2 Access Roads

The main routes within and adjacent to the CCPA include Interstate 25 (I-25), U.S. Highway 20/26/87, and U.S. Highway 18/20 along the southern portion of the CCPA; Wyoming State Highway (SH) 59 passing north to south in the eastern portion of the CCPA; and Wyoming SHs 93 and 95 in the southwest portion of the CCPA. In addition, there is an existing network of well pad access roads and primary collector roads in the CCPA. Roads within the CCPA generally are under the jurisdiction of the BLM, USFS, WYDOT, private landowners, and Converse County. Converse County issues road use permits to oil and gas companies for use of certain roads under their jurisdiction. Interstate 25 is under the jurisdiction of the Federal Highway Administration and maintained by WYDOT.

Oil and gas development would result in the construction of new roads and the use of existing roads within the CCPA. The existing road network would be used or upgraded to the extent practicable. Existing roads would be upgraded as necessary to facilitate safe transport and to maximize use of the existing road system. Upgrades may include, but are not limited to, ditching, drainage improvements, graveling, crowning, and/or placing additional surfacing on the roadway.

New roads to support development would provide primary access to large blocks of land in the CCPA, and well pad access roads (spur roads) would provide access from collector roads to a specific well pad or group of well pads. All new roads would be designed, constructed, and maintained to provide year-round access in accordance with standards described in Chapter 4 (Construction and Maintenance) of Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development, 4th Edition (commonly referred to as the Gold Book) (USDOI-U.S. Department of Agriculture [USDA] 2007) and BLM Manual 9113 (BLM 2011e). Precise design characteristics for new roads would follow standard operating procedures as described below and would vary based on site-specific topography and soil characteristics supplied with individual well plats in APDs. Whenever practicable, roads would be designed to disturb less than the identified construction disturbance width, potentially through the incorporation of additional turnouts or other methods so long as traffic and safety concerns would be satisfied. However, in limited circumstances, larger disturbance widths may be necessary to meet engineering and safety standards.

New local access roads would be constructed based on specific soil conditions with surfacing and base depths required to support the anticipated loads and with less than a 6-inch base of 3-inch minus gravel with a 3:1 slope for ditches. Where necessary, wing ditches and culverts would be installed within the ROW to provide proper drainage along the road based on Gold Book (USDOI-USDA 2007) requirements and BLM Manual 9113 (BLM 2011e) (i.e., culverts designed to pass a 10-year flood without development of static head at the entrance; major culverts designed to pass a 25-year flood). Construction activity would not be conducted on frozen or saturated soils material or during periods when watershed damage is likely to occur.

Surfacing and base coarse materials would be obtained from permitted gravel pits near the CCPA. Specific gravel suppliers to support the construction of each road would be identified during Project siting. It is anticipated that surfacing and base coarse materials would be obtained from within the CCPA and from sources located within 100 miles of the CCPA. As of March 2014, there were 29 active salable mineral permits for sand and gravel in the CCPA (WDEQ 2016d). Most were located at the fringes of the CCPA where the topography is more conducive to mineral extraction.

New primary collector roads and well access roads would be built to be permanent, and would remain in place for at least the productive life of the wells. Roads would be maintained and kept in good repair while in use, including maintaining serviceability (i.e., minimizing roughness, loose gravel, and dust); ditching; and drainage conveyance. The appropriate operator(s) would be responsible for road maintenance to the extent set forth in applicable road use agreements with private surface owners and Converse County.

Interim and final reclamation activities for all road disturbances would be consistent with the guidance contained in Chapter 6 (Reclamation and Abandonment) of the Gold Book (USDOI-USDA 2007) and the BLM Wyoming IM 2012-032. Following road construction, stockpiled topsoil would be evenly redistributed over the road embankment and borrow ditch slopes. These areas would be stabilized and reclaimed with the approved seed mix as soon as practicable in the next appropriate seeding season. Temporary roads required for the construction of facilities and other roads not needed for operations would be reclaimed fully as soon as practicable. Temporary roads primarily would serve pipeline, electrical distribution line, or other facility construction.

2.2.2 Well Drilling and Completion

Operators would determine the location of a proposed well by the location of the subsurface reservoir, the topography of the area, and WOGCC spacing rules. Operators also are encouraged to consider other resource values (e.g., wildlife, cultural, water, and soils) when determining well locations. The productive life of each well is assumed to be approximately 30 years. It is assumed that less than 1 percent of the drilled wells would be dry and those wells would be plugged and abandoned as soon as practicable.

2.2.2.1 Well Pad Layout and Construction

Drilling and completion well pads would be an average of 12 acres and constructed as shown in the typical well pad layout provided in **Figure 2.2-1**. If productive, the portions of the well pad not required for routine operations would be reclaimed; thereby, reducing the pad size by approximately half the size (average of 6 acres) for the life of the multiple wells on the pad (**Figure 2.2-2**). On multi-well pads, some operators utilize one pad that contains the wells and all facilities needed for drilling and completion (e.g., drill rig, cuttings disposal pits, hydraulic fracturing pit) and then pump the product to another nearby pad that contains facilities for initial processing (e.g., heater treaters, separators, meters, and combustors) and storage. This second pad is referred to as the production pad (**Figure 2.2-3**). Production pads would be an average of 8 acres and would not be subject to interim reclamation; therefore, they would remain at the same approximate size throughout operation.

Well pads for water supply wells would be much smaller in size (typically 1 to 2 acres). Water disposal well pads constructed to handle some of the produced water disposal needs would be larger than production pads (typically 10 acres); typically consisting of one disposal well, water storage tanks, and a pump station.

Construction of individual pads would be requested through subsequent APDs and analyzed in site-specific NEPA. The actual sizes of these individual pads would vary based on the number of wells proposed for the pad, constraints related to lease/landowner agreements, operational safety regulations (e.g., required setback distances and placement considerations for equipment and facilities), and location-specific topography. Final determination on the size of individual well pads would be made during the APD process. Per the BLM Casper RMP (BLM 2007b), total long-term surface disturbance from all BLM-authorized activities is limited to 80 acres per square mile.

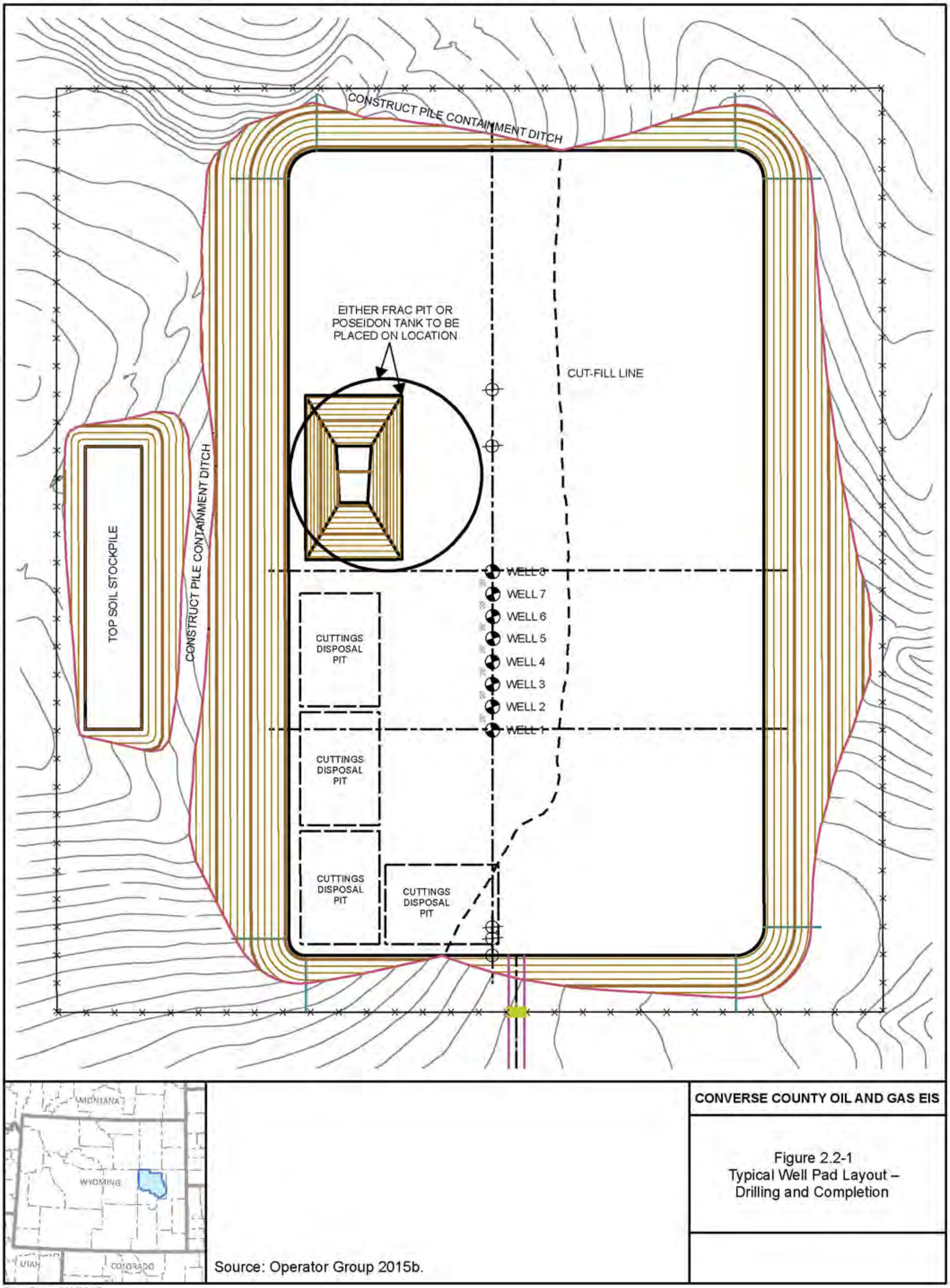
Well pad construction activities would be conducted in accordance with the guidelines and standards as set forth in the Gold Book (USDOI-USDA 2007). Well pads would be constructed to create a level surface for drilling and/or production equipment utilizing the native materials present at the site. Locations would be leveled by balancing cut and fill areas. Site-specific reclamation and construction plans would be developed for individual locations based on on-the-ground conditions.

2.2.2.2 Well Drilling

Following road and well pad construction, drilling rigs would be transported to the well site and erected on the well pad. This is commonly referred to as mobilization. Horizontal wells would first be drilled vertically from each surface location to a predetermined point above the target formation, referred to as the kick-off point. From the kick-off point, the wellbore would curve to a horizontal trajectory to intersect the target reservoir at the entry point. It would then continue horizontally through the reservoir until reaching the desired bottom hole location.

The quantity and composition of drilling fluids would be determined on a well-by-well basis. Drilling fluids typically consist of freshwater- and oil-based mud. Drilling mud would be specifically engineered and managed throughout the drilling operation to control the flow of fluids (water, oil, and gas) from the wellbore. The use of oil- versus water-based mud would be formation-dependent. Cuttings would either be removed and hauled off-site to authorized disposal facilities or buried in cuttings pits on location. A closed-loop drilling system or a reserve pit with an impermeable liner may be used to protect groundwater resources and soil per recommendation of the Gold Book (USDOI-USDA 2007).

X:\0Projects\Anadarko_ConverseCountyEIS_60316484\FIGs\DOC\EIS\2_DEIS\Chapter 2\FIG_02_02_01_Typical_WellPadLayout_Drilling and CompletionRv1.mxd

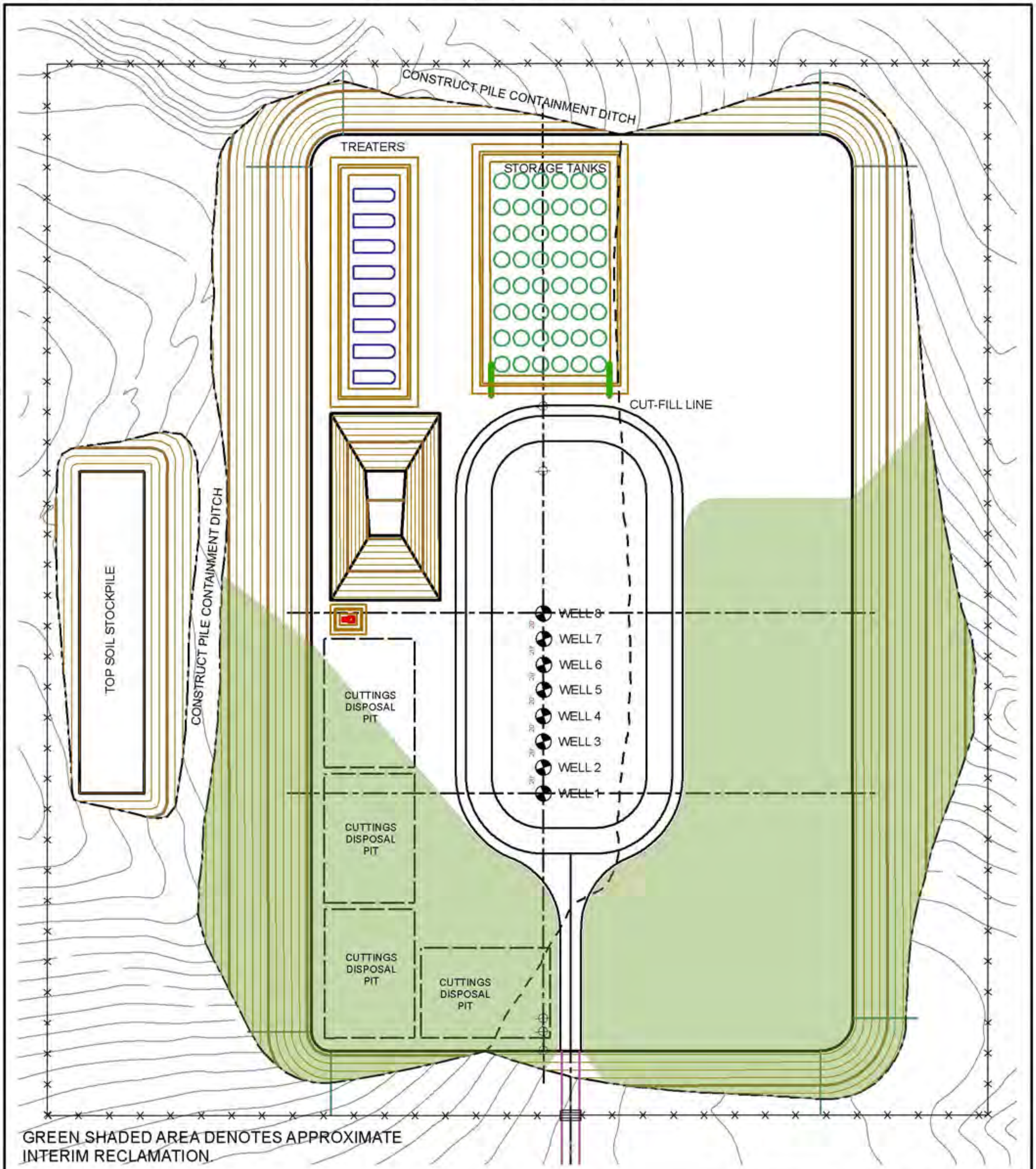


Source: Operator Group 2015b.

CONVERSE COUNTY OIL AND GAS EIS

Figure 2.2-1
Typical Well Pad Layout – Drilling and Completion

Print Date: 8/8/2017

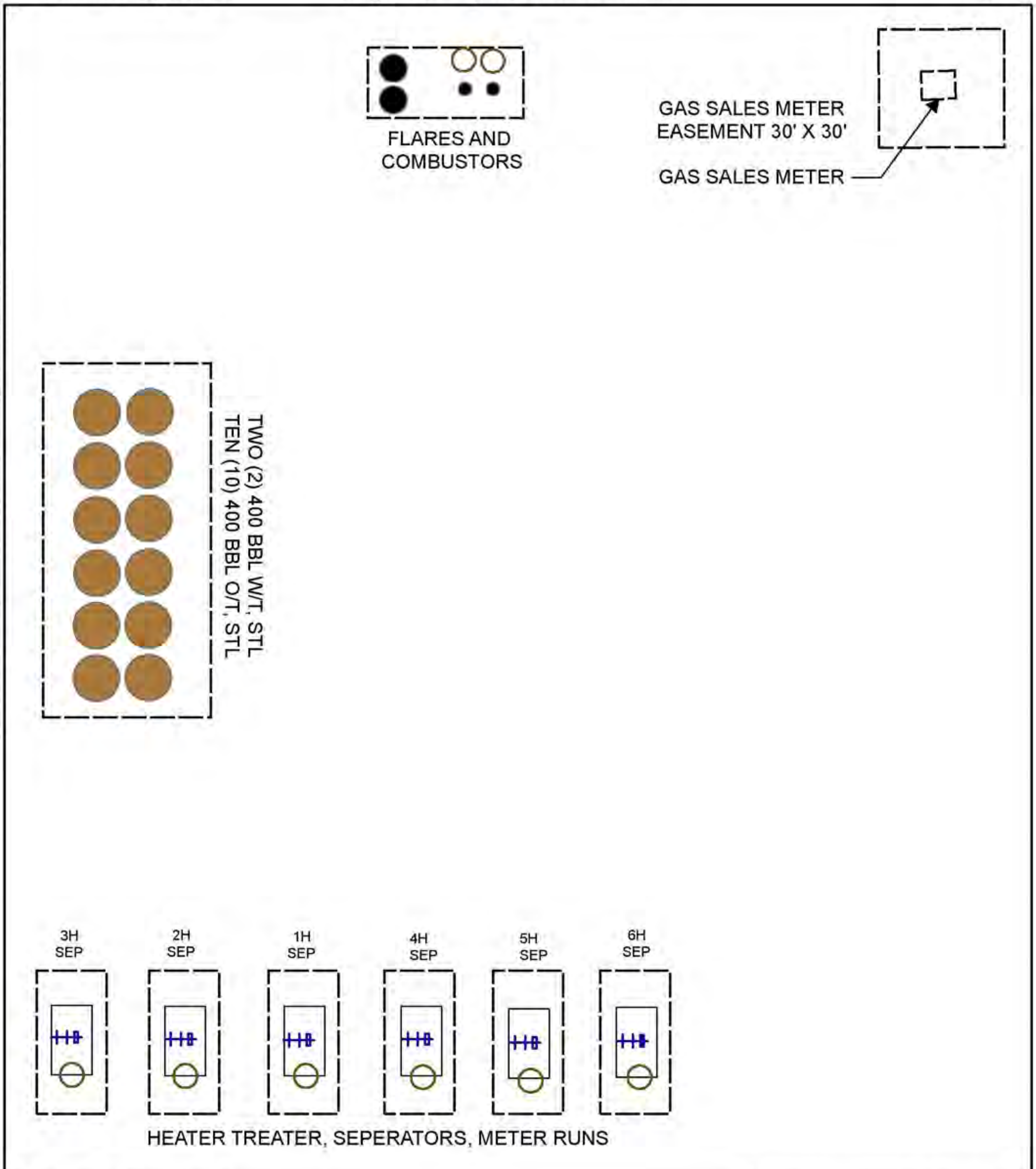


Source: Operator Group 2015b.

CONVERSE COUNTY OIL AND GAS EIS

Figure 2.2-2
Typical Well Pad Layout – Production

Print Date: 8/8/2017



CONVERSE COUNTY OIL AND GAS EIS

Figure 2.2-3
Typical Production Pad Layout

Source: Operator Group 2015b.

Print Date: 8/8/2017

The casing and cementing program would be designed to isolate and protect shallower formations encountered during drilling as well as prohibit pressure communication or fluid migration and cross-contamination between zones. ***The initial casing that is set into the well (also known as the conductor casing) is a large-diameter (24 to 36 inches) pipe that is set to a relatively shallow depth (20 to 60 feet). This initial casing is mainly used to stabilize unconsolidated surficial deposits and may be cemented in place. The next casing string that is placed into the hole is the surface casing. Surface casing anchors the hole and provides protection to shallow aquifers that contain useable groundwater which is defined by the USEPA as "an aquifer or portion of an aquifer that:***

- ***Supplies any public water system or that contains a sufficient quantity of groundwater to supply a public water system; and***
- ***Currently supplies drinking water for human consumption; or***
- ***Contains fewer than 10,000 mg/L total dissolved solids and is not an exempted aquifer. (USEPA 2002)."***

In order to protect deeper usable groundwater, additional surface casing string(s) would be set and cemented to a depth below the deepest aquifer with useable water. The surface casing is set in place by circulating cement into the annular space between the borehole and casing from the bottom of the casing to ground surface. Any subsequent casing string used for the protection of usable water will be cemented from the bottom to a minimum of 50' above the usable water zone. Once the cement has reached its specified curing time, the casing will then be pressure tested before drilling can resume. A wireline tool also can be run to verify continuous cement over the length of the casing. If defects are detected, remedial measures may be taken to ensure a competent cement job.. At the kick-off point, the well would be directionally drilled with specialized tools in a curve to the target formation. Frequently, once the wellbore is drilled into the target formation, the intermediate casing is run and cemented. Occasionally, the well is drilled through the formation to its total planned depth before casing is run and cemented. In this case, the casing string run also would be the production casing. After the intermediate casing is run and cemented, the lateral (horizontal) leg of the wellbore is drilled in the formation until the total measured depth is reached. The production casing is run to the total measured depth and may or may not be cemented in the formation. Laterals drilled for horizontal wells in the Powder River Basin range in length from 1,590 to 11,276 feet based on data from 2009 to 2014 (Ruhle and Orth 2015). The production casing also may have annular packers on it to compartmentalize the lateral section for completion. Another technique commonly used in conjunction with the production casing incorporates fracturing sleeves in combination with the annular packers or cement.

After drilling operations are complete but before completion equipment and personnel are moved to the location, all productive wells drilled on a particular location typically would be equipped for production. This would include the installation of production equipment and tanks, which is described in more detail in Section 2.2.3. Depending on the availability of personnel and equipment, there may be a delay between the termination of drilling activities, the installation of production equipment, and the commencement of completion operations.

2.2.2.3 Well Completion

After a well is drilled, cased, and cemented, the drilling rig would be moved off location (i.e., demobilization). The location would be redressed to accommodate the completion activities and facilities, which would include cleaning out the wellbore, pressure testing the casing, perforating the horizontal portion of the wellbore, and running production tubing to facilitate commercial production. A completion rig would then be moved onto the well pad.

Hydraulic fracturing would be performed at selected intervals or stages in the target formation to create fractures in the target zone to increase the surface area available for mineral drainage and facilitate the movement of fluids from the rock into the wellbore. Hydraulic fracturing ***stages*** can vary in length from approximately 200 to over 400 feet (Ruhle and Orth 2015). These hydraulic fracturing operations typically would consist of pumping a thick fluid mixture (proppant), consisting of approximately 98 percent sand and water, into the wellbore under pressure. Chemical additives would be used to improve performance. The fracturing fluid composition would be determined based on compatibility with the formation minerals, fluid composition, and recoverability.

The proppant mixture would enter the target formation through perforations in the production casing or openings in a temporarily installed casing string designed to facilitate the fracturing process. Pumping pressures would be monitored throughout the entire program and increased to the point at which fractures initiate in the target formation at the perforations in the formation. The proppants prop the created fractures open after the pumping pressure is reduced, which facilitates the flow of reservoir fluids into the wellbore and to the surface.

Hydraulic fracturing processes and required disclosures would be conducted in accordance with all WOGCC, BLM, and other applicable rules. The WOGCC requires operators to disclose the types and amounts of hydraulic fracturing chemicals used (WOGCC 2010). The operator also would disclose the contents of hydraulic fluid used in the proposed wells to the public through FracFocus, a website managed jointly by the Ground Water Protection Council and the Interstate Oil and Gas Compact Commission. FracFocus allows the public access to general information, water volumes, and chemical information for registered wells in a format consistent with safety data sheets (SDSs), including the Chemical Abstract Service number and the ingredient percentage in both the additive and hydraulic fracturing fluids. This registry provides a means for oil and gas operators to voluntarily provide key information to the public in a timely fashion.

Both freshwater pits and tanks would be used to store water used for the hydraulic fracturing fluids. Freshwater pits would be permitted through the WOGCC and/or WSEO with surface owner agreement. After completion operations are finished, additional equipment such as pumps may be installed.

Flaring would be used during well production testing to determine the pressure, flow, and composition of the gas or oil from the well. Testing duration would depend on well performance but typically would be conducted only long enough for fluid rates to drop to a level that production equipment could safely process. Flaring also would be used in emergency situations where equipment or piping is in danger of being over-pressured. In such instances, valves on the equipment would automatically release gas to flare stacks. All flaring would occur at a distance from the wellhead that protects equipment, structures, and personnel.

2.2.2.4 Water Requirements, Supply, and Use

Water needs for drilling and completions may range from ***19.7 to 26.2*** acre-feet (or approximately ***153,000 to 203,000*** barrels) per well depending on the length of the lateral and number of hydraulic fracturing stages. Additionally, approximately 0.1 acre-feet of water per well per year would be required for dust abatement for the duration of the Project. The water demand would be ***26.2*** acre-feet (***203,000*** barrels) of water per well. Water primarily would be obtained from existing and proposed groundwater supply wells and existing permitted surface water sources; however, new groundwater wells may be drilled as needed. Based on information provided by the OG, more than ***21,000*** acre-feet (or ***163*** million barrels) per year of water potentially is available from existing groundwater and surface water sources. It is assumed that most of the water supply would be provided by 71 existing groundwater wells proposed for use by the OG for the Project. These groundwater wells have an appropriated capacity of 12,400 acre-feet (96.4 million barrels) per year. The other 700 acre-feet (5.4 million barrels) would be from surface water. The capacity of the groundwater wells is based on the amount of water that can be produced, which is a limit determined by the WSEO when they issue a permit to appropriate groundwater. It is expected that existing and new water supply wells primarily would draw from the Wasatch/Fort Union Aquifer and, to a lesser extent, the Fox Hills/Hell Creek Aquifer System. All water used for development in the CCPA would be drawn from valid water rights holders ***and*** be in full compliance with existing laws and regulations. ***The BLM also expects that additional sources of water would be derived from water recycling and leasing of supplemental surface water (North Platte River).***

Transportation of water would include the use of temporary surface pipelines and trucked water. Freshwater for drilling and completion purposes would be transported from centralized sources to individual well pads, then stored in permitted impoundments, lined pits on well locations, or water tanks. Stored freshwater would then be transported to well locations for use in well drilling and completion.

2.2.3 Production, Distribution, and Maintenance

2.2.3.1 Production Equipment

Production facilities at each pad location typically include a wellhead and pump jack, heater-treater, recirculating pump, and a tank battery typically comprised of four to eight storage tanks. A gas lift system or electric submersible pump also may be used instead of a pump jack. Any of these artificial lift methods used on non-flowing wells require power. In the CCPA, this power would be provided by natural gas or diesel engines permitted and approved by the WDEQ Air Quality Division under standard air permitting practices and the pumping unit engine emissions policy (WDEQ 2012a). Production facilities typically would be installed on the disturbed portion of each well pad. In some cases production equipment would be placed on a separate production pad (**Figure 2.2-3**).

Although burying all electrical lines would not be required, it should be noted that USFS Standard Special Uses #1 for the Broken Hills Geographic Area requires burial of all electrical utility lines of 33-kilovolt (kV) or less and telephone lines. On the remainder of the TBNG within the CCPA, this is a USFS guideline that may be waived under certain conditions when scenic integrity objectives of the area can be met using an overhead line, burial is not feasible due to geologic hazard or unfavorable geologic conditions, it is not reasonable as determined by a cost-effectiveness analysis, greater long-term site disturbance would result, or it is not technically feasible. It should be noted that the need to bury electrical lines would be determined on a site-specific basis.

2.2.3.2 Pipelines and Mid-stream Facilities

Compression facilities also would include equipment to strip and recover liquids from the gas (dehydration equipment). The recovered liquids would be transported via truck; however, the produced gas would be collected and transported through a system of gas gathering pipelines designed to collect the natural gas produced from each individual well for transport to a main trunk line, which would transport the gas to tie-in points with a third-party tie-in/gas processing plant. Gas from the field would go to processing facilities for distribution. Newly constructed pipelines would be ***pressure*** tested to ensure structural integrity of the line. Approximately 2,700 gallons of water typically is required to test 1 mile of 4-inch pipeline. Hydrostatic test water would be disposed of as approved by the BLM, USFS, and the State, as applicable.

2.2.3.3 Routine Operations

During the course of production, most wells would require a workover or other routine maintenance activities. Well maintenance activities may require the mobilization of a smaller workover rig to repair the wellbore equipment (casing, tubing, rods, or pumps) or the wellhead. In some cases, a workover may involve development activities designed to improve or restore production from the target formation. Workovers also may involve reservoir evaluation and stimulation treatments. Workover operations typically are performed during daylight hours and are of short duration. Depending on the scope of work to be completed, workovers could take either a few days or several weeks. Additional surface disturbance rarely is necessary to conduct workover operations. Approval from the BLM or USFS would be requested, as applicable, should the need for new surface disturbance arise. The definition of routine operations varies by agency. Per CFR 3162.3.2, the operator must submit a proposal (Form 3160-5) to the authorized officer for further well operations prior to commencing such operations. If there is additional surface disturbance, the proposal would include a surface use plan of operations, and a subsequent report on these operations also would be filed on Form 3160-5.

2.2.3.4 Produced Water Management and Disposal

Wastewater from development would include flowback water and produced water. Flowback water is water injected during hydraulic fracturing that is returned (or “flows back”) from the well after completion of fracturing. Produced water is water from the producing formation that flows from the well along with the hydrocarbon resource (oil and gas). It is estimated that an average of 1.2 acre-foot (or approximately 9,125 barrels) per year per well (or 25 barrels per day) over the life of a well would be produced. Actual rates of produced water may range from 0 to 5 acre-feet (or approximately 38,800 barrels) per year from individual wells. Produced water volumes would decline as wells reach the end of their anticipated life and are plugged and abandoned.

Flowback and produced water would be separated from the oil and gas and stored in tanks on or adjacent to the well pads. Both oil tanks and water tanks typically would have 400- or 500-barrel capacities and would be placed inside containment constructed completely around the production facilities. The containment devices would consist of impervious compacted subsoil or lined structures, and secondary containment would hold at least 110 percent of the volume (capacity) of the largest tank in the containment. Some of the collected flowback and produced water would be transported to disposal facilities authorized for Resource Conservation and Recovery Act (RCRA) exempt waste within the CCPA, including disposal wells and third-party evaporation ponds. ***According to the BLM’s recent experience in the CCPA water recycling is anticipated.*** Measurement of all produced fluids would be made per Onshore Order Nos. 4 and 5 and State of Wyoming rules and would be reported to the State of Wyoming and the federal government in compliance with reporting requirements. ***There will be no point source discharge of flowback water, produced water, or any other waste streams to any surface waters.***

Another method of disposal of produced water is to apply it on roads for dust suppression. However, road application of produced water is a regulated activity. The WDEQ and the WOGCC have joint authority for road application of exempt oil field waste including produced water. The permitting process would determine if deleterious constituents are present in the water that would be used for road application.

2.2.4 Reclamation

A Reclamation Plan that provides anticipated reclamation techniques, strategies, and monitoring efforts to be implemented would be provided by the oil and gas operator. This plan would be prepared in compliance with a variety of statutes, regulations, and guidelines and would be developed as separate site-specific reclamation plans to support federal APDs. On private surface within the CCPA, operators would be required to comply with any additional terms, conditions, and reclamation requirements set forth in private surface use agreements. On State of Wyoming lands, additional reclamation requirements also would be required by the Wyoming Office of State Lands and Investments and, if applicable, the surface lessees of State of Wyoming Lands.

Portions of well pads not needed for production would be reclaimed primarily through backfilling the cuttings pits, leveling, and recontouring of “nonworking” disturbed areas, redistribution of stockpiled topsoil over these disturbed areas, installation of erosion control measures, and reseeding as recommended by the BLM, USFS, and/or private surface owner. The pad would be reclaimed after the last well is plugged and abandoned.

Due to the large amount of private and state ownership, it is recognized that reclamation is inconsistent in the CCPA. Therefore, for purposes of analysis in this EIS, the total short-term surface disturbance for the Project alternatives was used without consideration of reclamation. Generally, site-specific reclamation on non-federally managed lands would follow requirements of the Wyoming Office of State Lands and Investments or agreements with individual surface land owners. In all cases, reclamation would follow and adhere to all applicable BLM RMP requirements specified by the field office within which the reclamation may occur.

2.2.5 Hazardous Materials and Solid Waste

2.2.5.1 Hazardous Materials

A variety of chemicals and materials would be used during drilling, completion, and operational phases of development. Some of these substances may contain constituents that are hazardous under Occupational Safety and Health Administration (OSHA) Standard 29 CFR 1910.1200 (Hazardous Communication). Commonly used hazardous materials include greases or lubricants, gasoline, diesel, methanol, solvents, acids, paint, herbicides, and materials that may be necessary for well completion (fracturing fluids), drilling mud, and cement. Produced water also is considered a hazardous material under the OSHA hazardous communication standard. Also included in the kinds of hazardous materials that would be at production sites are produced hydrocarbons including crude oil, natural gas, condensate, and natural gas liquids. In compliance with 29 CFR 1910.1200, operators would maintain a file containing current SDSs for all chemicals, compounds, and/or other substances used or stored at Project well sites and other facilities.

Activities associated with the transportation of these materials, including packing, container handling, labeling, vehicle placarding, and other safety aspects, are regulated by the USDOT under 49 CFR Parts 171-180. None of the chemicals that would be used during drilling, completion, or production operations meet the criteria to be considered acutely hazardous materials/substances or meet the quantities criteria per the BLM IM 93-344. The operators would comply with the Superfund Amendments and Reauthorization Act Title III reporting requirements for materials used or stored in quantities greater than 10,000 pounds during drilling and completion operations. For example, cement used to isolate the steel casing from the surrounding wellbore would be a reportable Superfund Amendments and Reauthorization Act Title III material. In addition, extremely hazardous substances, as defined in 40 CFR Part 355, would not be used, produced, stored, transported, or disposed of while drilling or completing a well.

In the event reserve pits are constructed, the concentration of nonexempt hazardous substances in any one reserve pit at the time of backfilling would not exceed the standards set forth in Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act. All oil and gas drilling-related CERCLA hazardous substances removed from a location and not reused at another drilling location would be disposed of in accordance with applicable federal and state regulations. Only those hazardous wastes that qualify as exempt under RCRA may be disposed of in the reserve pit, if such pits are constructed.

2.2.5.2 Solid Waste

Most waste generated would be excluded from regulation as hazardous wastes under RCRA under the exploration and production exemption in Subtitle C (40 CFR 261.4[b][5]) and Subpart D. Development-generated waste generally would be considered solid waste commonly referred to as exploration and production waste or exploration and production-exempt waste. The management of exploration and production waste is regulated by the WOGCC, WDEQ, or the BLM, depending on the waste and how it is to be disposed. Exempt wastes include produced water, drilling mud, well stimulation flowback, and hydrocarbon-bearing soils. The operators would comply with regulatory requirements associated with the storage, transportation, and disposal of hazardous waste.

2.2.5.3 Spills of Hazardous Materials and Solid Wastes

Each operator would develop and maintain an emergency response plan that would provide the procedures and notifications to be carried out in the event of a spill or other incident involving hazardous materials or solid waste. Incidents also would include blow outs, fires, spills of chemicals, waste, or petroleum, and medical emergencies. Spills would be reported to the appropriate authorities within the regulatory time limits for reporting. Reportable spills of oil, gas, produced water, or other regulated substances would immediately be contained and cleaned up; if excavated, impacted soil would be transported to an approved disposal site. ***Agencies that may need to be notified in the event of a spill include the BLM, USFS, WDEQ, WOGCC, and USEPA depending on the location, substance, and circumstances of the spill.***

As part of the Emergency Response Plans, site-specific Spill Prevention, Control, and Countermeasures (SPCC) plans would be developed and maintained for each facility in the CCPA subject to the USEPA oil spill prevention program under 40 CFR Part 112. To satisfy SPCC Plan requirements, if storage facilities or tanks are to be constructed, they would be constructed in accordance with applicable regulations.

To support the Plan of Development, the OG submitted several example plans to the BLM and USFS, including an example SPCC, an example Hazardous Materials Management Summary, and an example Emergency Response Plan. Any of these site-specific plans submitted by individual operators would comply with applicable rules and regulations using each company's specific format and content requirements.

2.3 Alternative A – No Action Alternative

The No Action Alternative (Alternative A) consists of disturbance from existing development as well as disturbance from new development that is anticipated based on recently approved NEPA projects for proposed development in the CCPA and the recent trend in the number of wells drilled annually in the CCPA. Existing surface disturbance is presented in Section 2.3.1, while new disturbance associated with Alternative A is presented in Section 2.3.2. The combined disturbance from existing and new surface disturbance under Alternative A also is provided in Section 2.3.2. In a similar fashion this combined total also is reflected in the Proposed Action (Alternative B) and Alternative C disturbance tables in Sections 2.4 and 2.5, respectively.

2.3.1 Existing Oil and Gas Infrastructure in the CCPA

The use of publicly available information that includes information for operators who may not be part of the OG (e.g., oil and gas well data from WOGCC) provides the most complete picture of existing conditions in the CCPA. As of January 9, 2015, WOGCC information for existing oil and gas infrastructure in the CCPA indicated that 1,520 existing wells (1,280 on single well pads and 240 wells on 86 multi-well pads) have been drilled and are in operation. **Table 2.3-1** identifies the existing oil and gas facilities present within the CCPA. Existing oil and gas well pads in the CCPA (as of January 9, 2015) are shown in **Figure 2.3-1**, and the existing pipelines and oil and gas infrastructure is depicted in **Figure 2.3-2**.

The majority of existing well pads in the CCPA are single well pads (1,280 or approximately 88 percent), with the remainder consisting of multi-well pads (86 or approximately 6 percent), production pads (67 or approximately 5 percent), and disposal well pads (16 or approximately 1 percent). Existing wells in the CCPA are accessed by the public road network (e.g., county roads) and existing oil and gas access roads. Oil and gas products are either transported via truck or via oil and gas pipelines to central processing facilities.

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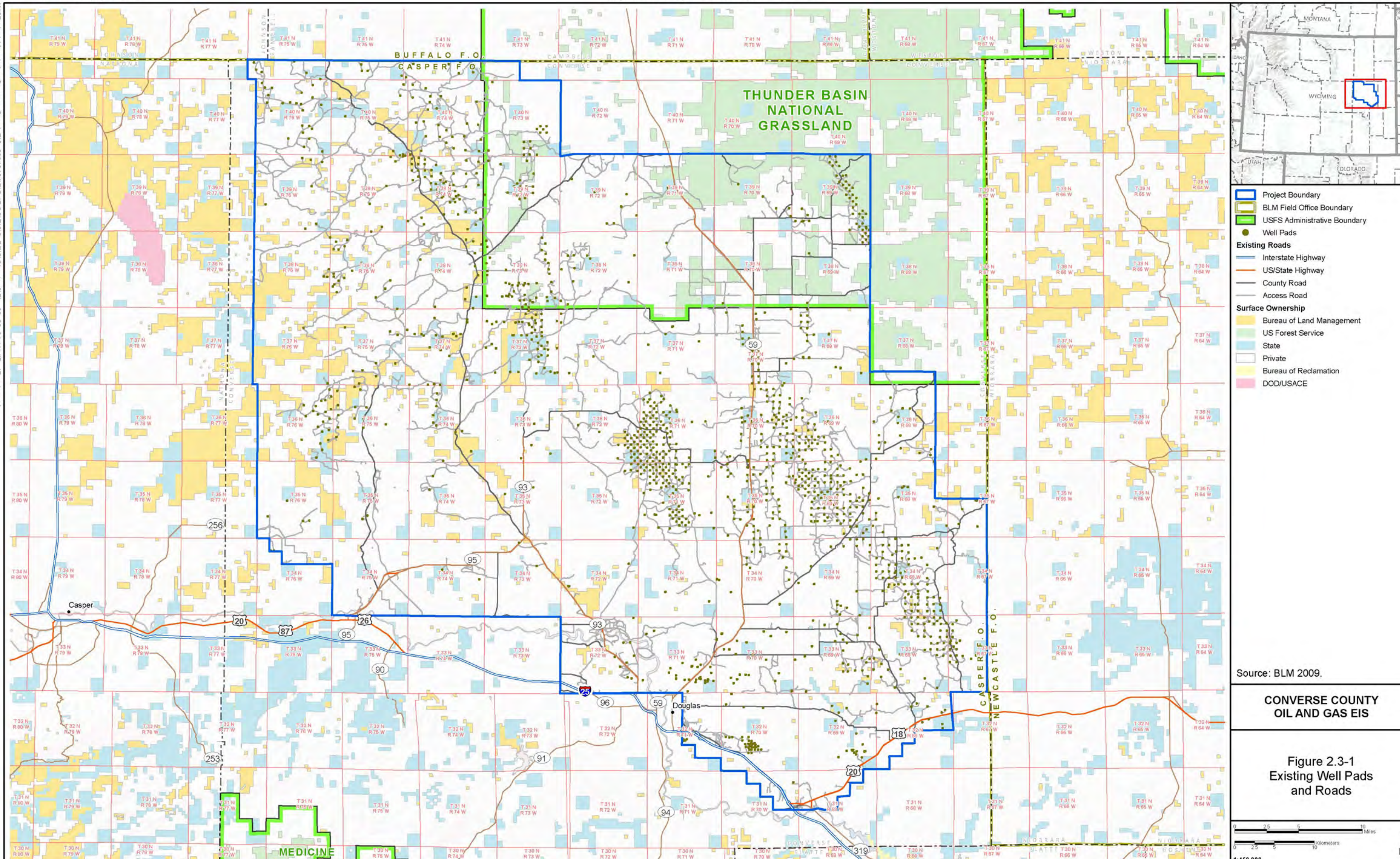

Figure 2.3-1 Existing Well Pads and Roads

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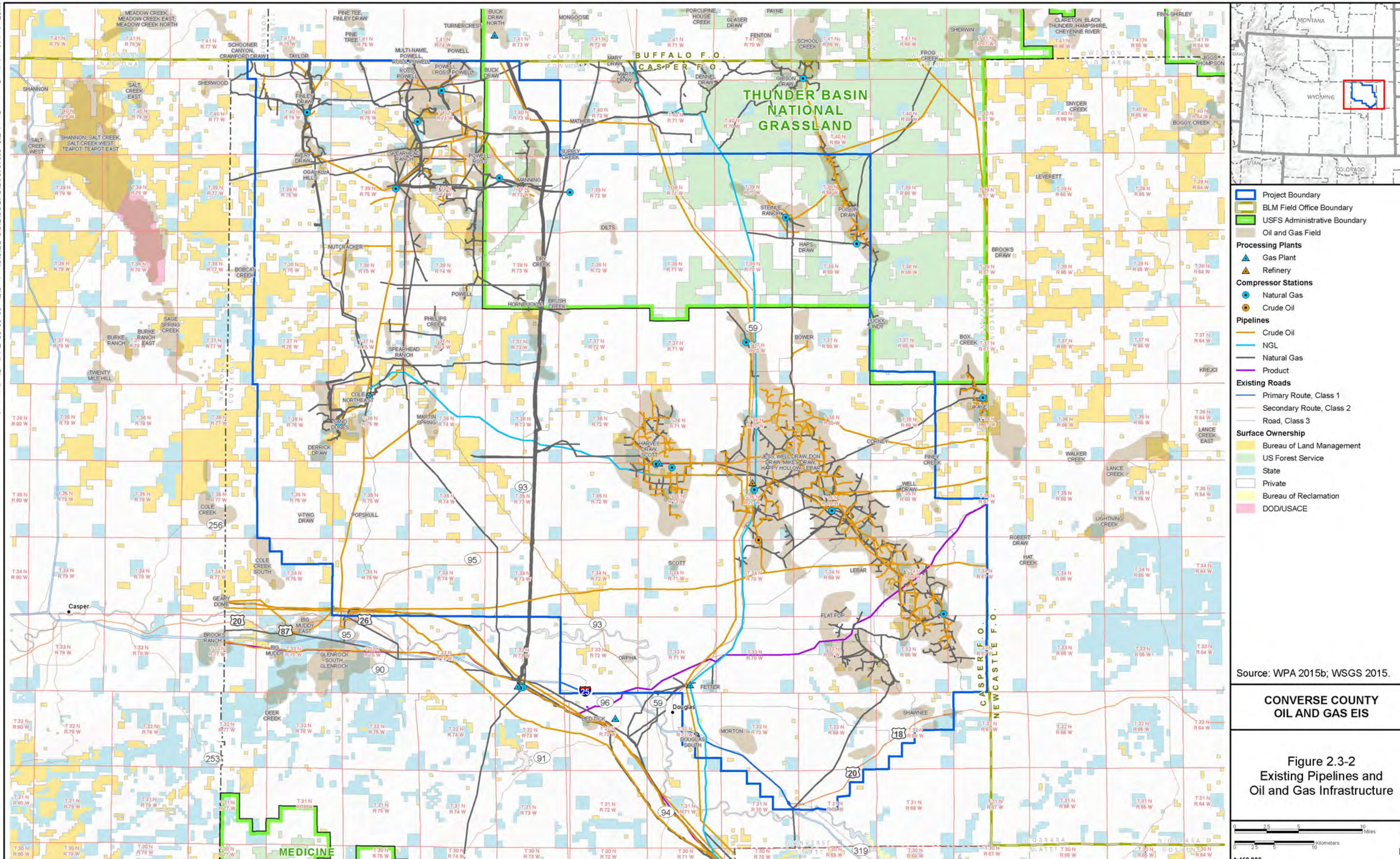

Figure 2.3-2
Existing Pipelines and Oil and Gas Infrastructure

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Table 2.3-1 Summary of Existing Oil and Gas Development Surface Disturbance

Facility	Number or Length	Area or Width[1]	Existing Surface Disturbance[2]
Pads	**(number)**	**(acres)**	**(acres)**
Single Well Pads	1,280[3]	2.5	3,200
Multi-well Pads	86[3]	12	1,032
Production Pads	67	5	335
Water Source Well Pads	0	--	--
Disposal Well Pads	16	10	160
Pads Subtotal	**1,449**		**4,727**
Roads	**(miles)**	**(feet)**	**(acres)**
Well Pad Access and Primary Collector Roads	1,822[4]	35	7,730
Roads Subtotal	**1,822**		**7,730**
Construction/Production Facilities	**(number)**	**(acres)**	**(acres)**
Gas Plants	5	40	200
Oil/Condensate Storage	0	--	--
Central Processing Facilities	1	10	10
Compression Facilities and Crude Oil Pump Stations	18	5	90
Equipment/Pipe Storage Yards	1	10	10
Electrical Substations	0	--	--
Workforce Facilities	1	10	10
Fresh Water Make-up Ponds	6	8	48
Water Processing Facilities	0	--	--
Construction/Production Facilities Subtotal	**32**		**368**
Linear Facilities	**(miles)**	**(feet)**	**(acres)**
Gas Gathering Pipelines	1,112	--	0
Oil Gathering Pipelines	500	--	0
Gas Main Trunk Pipeline	72	--	0
Oil Main Trunk Pipeline	38	--	0
Water Temporary Surface Pipelines (aboveground)	0	--	0
Overhead Electrical Distribution	911	9	994
Linear Facilities Subtotal	**2,501**		**994**
Total Existing Oil and Gas Surface Disturbance			**13,819**
Existing Disturbance Percent of CCPA			**0.9 percent**

1 Well pad area and linear feature width consistent with assumptions for other alternatives.

2 Assumes that interim reclamation has been completed and only operational disturbance remains.

3 Single well pads based on the number of wells not co-located with another well. Multi-well pads based on the number of well clusters with two or more co-located wells. Does not include wells currently being permitted or wells that have been plugged and abandoned, which are assumed to be reclaimed.

4 Existing access roads from BLM database (BLM 2009).

Source: BLM 2009; WOGCC 2015b; WPA 2015b.

According to the Wyoming Pipeline Authority (WPA), rig counts across Wyoming fluctuated between 50 and 70 between April 2014 and January 2015, dropping to approximately 20 by May 2015 (WPA 2015a). Data specific to Converse County (Baker Hughes 2014) indicates that on average 13 rigs were active in the CCPA during 2014 and 6 rigs were active during the first three quarters of 2015.

2.3.1.1 Access

There are more than 1,822 miles of existing well pad access roads and primary collector roads in the CCPA, most of which are associated with energy exploration and development activities as well as residential and business travel, livestock operations, and recreational activities. For purposes of reporting in this EIS and consistency with the Proposed Action, only a portion of these roads are assumed to support oil and gas development. For more detail regarding classification and use of the existing road network in and adjacent to the CCPA as well as trends in average daily traffic, see Section 3.13, Transportation.

In addition, the CCPA is crossed by approximately 96 miles of existing rail lines. These railroads primarily serve coal mines in eastern Wyoming; however, they also serve a variety of other resource purposes, including oil and gas development and production.

2.3.1.2 Construction/Production Facilities

Existing production facilities within the CCPA include five gas plants, a central processing facility, and multiple compression facilities. Existing construction facilities include an equipment and pipe storage yard, a workforce facility (i.e., mancamp), and six fresh water make-up ponds. The five gas plants include the Douglas, NorthCut, Sand Dunes, Sage Creek, and the inactive Morton plant. The Bucking Horse plant was completed and began operations in February 2015, which was after the cut-off date associated with the WOGCC data of January 9, 2015. Therefore, the Bucking Horse plant is included in Section 2.3.2, New Development Under No Action. The compression facilities are owned by Anadarko ***(now Occidental Petroleum Corporation)***, DCP Midstream, El Paso, Kinder Morgan, and Interline Resources. One crude oil pump station is owned by Interline Resources (WPA 2015b).

2.3.1.3 Pipeline and Electrical Line Infrastructure

Existing linear facilities in the CCPA include 1,722 miles of oil and gas pipelines and 911 miles of overhead electrical lines. Approximately 20 pipeline operators service the various oil and gas fields within the CCPA with 6 of these operating approximately 80 percent of the pipelines. The greatest concentration of gathering pipelines occurs in the southeastern and northwestern portions of the CCPA (**Figure 2.3-2**). In the center of the CCPA, four co-located gas trunk pipelines run north to south passing through the USFS administrative boundary for the TBNG (**Figure 2.3-2**). Rocky Mountain Power and Niobrara Electric provide power to the CCPA through 911 miles of electrical distribution lines. Of the 911 miles of electrical distribution lines, 779 are owned and operated by Rocky Mountain Power (2015) and 132 are owned and operated by Niobrara Electric (Niobrara Electric 2015).

2.3.2 New Development Under No Action

Excluding the proposed 5,000 new wells, other planned federal oil and gas development in the CCPA includes those facilities described in the NEPA documents for the following previously approved development projects:

- Mohawk EA: up to 32 wells on 6 well pads (BLM 2014a);
- Scott Field EA: up to 150 wells on 40 well pad (BLM 2013a);
- Spearhead Ranch EA: up to 224 wells on 56 well pads (BLM 2012a);
- Highland Loop Road EA: up to 148 wells on 37 well pads (BLM 2012b);

- East Converse EA: up to 72 wells on 18 well pads (BLM 2012c); and
- Samson Hornbuckle EA: up to 288 wells on 48 well pads (BLM 2012d).

In addition to the 914 wells on 205 well pads disclosed in the six EAs listed above, an additional 150 wells from the Powder River Basin EIS (BLM 2003) could still be drilled in the portion of the Basin that falls within the CCPA. This equates to a total of 1,064 wells that could be drilled on federal mineral estate under Alternative A. Federal minerals underlie approximately 64 percent of the CCPA; therefore, an estimated 599 additional wells could be drilled on non-federal minerals. Based on this analysis, an estimated 1,663 wells remain to be drilled on 361 new well pads in addition to the 1,520 existing wells in the CCPA (as of January 9, 2015). In addition to the 1,663 wells, supporting infrastructure also would be installed as disclosed in the above NEPA documents. Based on a review of historic drilling data from WOGCC (**Table 2.3-2**), a drilling rate of approximately 110 wells per year is projected under the No Action Alternative.

Table 2.3-2 Historic Annual Drilling Rates in the CCPA since Approval of the Casper RMP

Year	Number of Wells Drilled by Land Ownership				Annual Total
	Federal	Mixed Mineral[1]	Private	State	
2008	7	0	11	0	**18**
2009	1	0	3	0	**4**
2010	8	0	6	3	**17**
2011	21	2	17	13	**53**
2012	20	13	27	19	**79**
2013	11	6	42	13	**72**
2014	8	14	71	14	**107**
Total	**76**	**35**	**177**	**62**	**350**

[1] Mixed minerals represent land that could be a mix of federal, state, and/or private ownership.

Source: WOGCC 2015b.

Under the No Action Alternative, drilling and completion of wells and installation of new infrastructure would continue as described in approved NEPA decision documents. A summary of surface disturbance associated with implementation of the No Action Alternative is presented in **Table 2.3-3**. This includes facilities disclosed through other NEPA documents or approved by other agencies but not yet constructed as of January 9, 2015, as well as drilling data obtained from WOGCC. This date was selected as a fixed point in time to represent information that is continuously changing. While the BLM recognizes there is a gap between this point in time and the publication date of this document, the information provides a consistent basis for evaluation of the Project alternatives. All appropriate COAs, mitigations, and ROW stipulations from all resources would be applied as dictated in the appropriate land use plans.

Table 2.3-3 Alternative A Summary of New Surface Disturbance

Facility	Number or Length	Construction Area or Width[1]	Construction Surface Disturbance	Operational Area or Width[1]	Operational Surface Disturbance
Pads	**(number)**	**(acres)**	**(acres)**	**(acres)**	**(acres)**
Well Pads	361[2]	12	4,332	6	2,166
Production Pads	20	5	100	5	100
Water Source Well Pads	0	--	--	--	--
Disposal Well Pads	5	10	50	10	50
Well Pad Subtotal	**386**		**4,482**		**2,316**
Roads	**(miles)**	**(feet)**	**(acres)**	**(feet)**	**(acres)**
Well Pad Access Roads	386[3]	50	2,339	35	1,638
Primary Collector Roads	0	--	--	--	--
Roads Subtotal	**386**		**2,339**		**1,638**
Construction/Production Facilities	**(number)**	**(acres)**	**(acres)**	**(acres)**	**(acres)**
Gas Plants	2	100	200	100	200
Oil/Condensate Storage	0	--	--	--	--
Central Processing Facilities	0	--	--	--	--
Compression Facilities	14	5	70	5	70
Equipment/Pipe Storage Yards	0	--	--	--	--
Electrical Substations	0	--	--	--	--
Workforce Facilities	2	10	20	10	20
Fresh Water Make-up Ponds	7	8	56	8	56
Water Processing Facilities	1	15	15	15	15
Construction/Production Facilities Subtotal			**361**		**361**
Linear Facilities	**(miles)**	**(feet)**	**(acres)**	**(feet)**	**(acres)**
Gas Gathering Pipelines within Road Disturbance	181	30	658	0	0
Gas Gathering Pipelines with New Cross-country Disturbance	181	50	1,097	0	0
Oil and Gas – Main Trunk Pipelines	0	--	--	--	--
Water – Temporary Surface Pipelines (aboveground)	0	--	--	--	--
Overhead Electrical Distribution along Road	181	30	658	9	197

Table 2.3-3 Alternative A Summary of New Surface Disturbance

Facility	Number or Length	Construction		Operational	
		Area or Width[1]	Surface Disturbance	Area or Width[1]	Surface Disturbance
Overhead Electrical Distribution Cross-country	181	30	658	9	197
Linear Facilities Subtotal	**724**		**3,071**		**394**
Total New Surface Disturbance			**10,253**		**4,709**
New Disturbance Percent of CCPA			0.7 percent		0.3 percent
Existing Surface Disturbance			13,819		13,819
Total Alternative A (Existing and New) Surface Disturbance			24,072		18,528
Total Disturbance Percent of CCPA			**1.6 percent**		**1.2 percent**

1 Well pad area and linear feature width consistent with assumptions for other alternatives.

2 Based on the number of wells and pads estimated for future development based on historic WOGCC drilling rate data and previous EAs in the CCPA.

3 Assumes a road length of 1 mile per pad, consistent with assumptions for other alternatives.

Source: BLM 2014b; 2013a,b,c; 2012a,b,c,d; WOGCC 2015b.

As noted in Section 2.2.4, the surface disturbance that would remain after interim reclamation is disclosed in the surface disturbance summary tables in recognition of the fact that the BLM would require the proponents to reclaim unused disturbance on federal surface during operations; however, the BLM could only recommend reclamation on private and state surface. The disturbances listed in **Table 2.3-3** are in addition to the existing disturbance summarized in **Table 2.3-1**.

2.3.2.1 Access Roads

Access to the planned well and production pad locations would require construction of approximately 386 miles of new access roads. An average road length of 1 mile per well pad has been assumed.

2.3.2.2 Well Drilling and Completion

Implementation of Alternative A would result in the drilling, completion, and construction of associated production facilities for an estimated 1,663 wells on 361 pads, most of which have been analyzed under previous NEPA actions. The majority of wells are assumed to be horizontal wells constructed on multi-well pads; however, some are anticipated to be vertical wells drilled on individual well pads. At an estimated drilling rate of approximately 110 wells per year (current rate based on WOGCC data; **Table 2.3-2**), drilling activity in the CCPA would continue for approximately 15 years.

2.3.2.3 Water Requirements, Supply, and Use

Under Alternative A, it is assumed that fresh water used for well drilling and completion purposes would continue to be obtained from the existing groundwater supply wells and existing permitted surface water sources proposed to be used by the OG for the Project. The total potentially available water from these sources throughout the CCPA is approximately ***21,000*** acre-feet (or ***163*** million barrels) per year (Section 2.2.2.4). Approximately ***3,000*** acre-feet (or ***23*** million barrels) per year of fresh water would be needed for well drilling and completion as well as dust abatement for Alternative A. The water demand would be ***26.2*** acre-feet (***203,000*** barrels) per well.

Operators currently use surface lines to transport freshwater from centralized sources to individual well pads or truck freshwater from locations within an approximately 20-mile radius of the water source. Once delivered via pipeline or trucks, freshwater is stored in permitted impoundments, lined pits on well locations, or water tanks. Water stored in the permitted impoundments is transported to well locations via surface lines. In addition to the six existing freshwater make-up ponds, an additional seven freshwater make-up ponds would be constructed.

2.3.2.4 Production, Distribution, and Maintenance

Two gas plants and 14 compression facilities would be constructed under this alternative. All of the additional compression would be gas-fired. Each gas plant would require approximately 100 acres and each compression facility would require approximately 5 acres for the life of the facility. One of the two gas plants (Bucking Horse) was completed and began operations in February 2015. It is included with New Development Under No Action rather than Existing Infrastructure because it did not start operation until after the cut-off date associated with the WOGCC data (January 9, 2015). The construction of two workforce facilities would require approximately 10 acres each.

Approximately 361 miles of gathering pipelines would be installed to transport oil and gas from wells to larger pipelines that connect to processing facilities. Approximately 181 miles (50 percent) of the gathering pipeline system would be placed near available access road ROWs. Any activity within or adjacent to a county road ROW would be in coordination with the county. It is not within the purview of the county to authorize a pipeline or the use of the road or road ROW to any entity. It is under the jurisdiction of the BLM to authorize the use of the road or road ROW; however, it is not typical to put pipelines within a county road ROW. An additional 181 miles (50 percent) of the gathering system is expected to require cross-country routing outside of access road ROWs; cross-country routing would require a 50-foot ROW for construction.

2.3.2.5 Produced Water Management and Disposal

In the CCPA, total produced water estimates also include flowback water. Based on produced water data from 2009 to 2013 from 92 wells already permitted in the CCPA, each well produces an average of approximately 1.8 acre-feet (or 14,000 barrels) of water annually.

Nine commercial evaporation ***facilities located*** within the CCPA and a 15-mile buffer of the CCPA would be used to reduce water trucking requirements. As of January 9, 2015, there also were 17 active disposal wells recorded in the WOGCC database in the CCPA, with the majority of wells injecting into the Teapot and Parkman formations. The depth of disposal wells ranges from approximately 6,500 to 13,700 feet below ground surface (bgs) with an average depth of approximately 7,400 feet bgs. The appropriate aquifer zone for disposing of produced water is determined during the water disposal permitting process. One additional water processing facility would be constructed under Alternative A.

2.4 Alternative B – Proposed Action Alternative

A summary of surface disturbance associated with implementation of Alternative B (the Proposed Action Alternative) is presented in **Table 2.4-1**. The disturbance indicated in **Table 2.4-1** is new disturbance that would occur in addition to existing and new disturbance under the No Action Alternative (Section 2.3).

Table 2.4-1 Alternative B Summary of New Surface Disturbance

Facility	Number or Length	Construction Area or Width	Construction Surface Disturbance	Operational Area or Width	Operational Surface Disturbance
Pads	**(number)**	**(acres)**	**(acres)**	**(acres)**	**(acres)**
Well Pads	1,500	12	18,000	6	9,000
Production Pads	375	8	3,000	8	3,000
Water Source Well Pads	50	2	100	1	50
Disposal Well Pads	30	10	300	10	300
Well Pad Subtotal	**1,955**		**21,400**		**12,350**
Roads	**(miles)**	**(feet)**	**(acres)**	**(feet)**	**(acres)**
Well Pad Access Roads	1,580[1]	50	9,576	35	6,703
Primary Collector Roads	390	75	3,545	50	2,364
Roads Subtotal	**1,970**		**13,121**		**9,067**
Construction/Production Facilities	**(number)**	**(acres)**	**(acres)**	**(acres)**	**(acres)**
Gas Plants	2	100	200	100	200
Oil/Condensate Storage	6	3	18	3	18
Central Processing Facilities	2	5	10	5	10
Compression Facilities	50	5	250	5	250
Equipment/Pipe Storage Yards[2]	1	50	50	50	50
Electrical Substation	12	3	36	3	36
Workforce Facility	1	10	10	10	10
Fresh Water Make-up Ponds	30	8	240	8	240
Water Processing Facility[3]	4	15	60	15	60
Construction/Production Facilities Subtotal	**108**		**874**		**874**
Linear Facilities	**(miles)**	**(feet)**	**(acres)**	**(feet)**	**(acres)**
Gas Gathering Pipelines within Road Disturbance	750	30	2,727	0	-
Gas Gathering Pipelines with New Cross-country Disturbance	750	50	4,546	0	-
Oil and Gas – Main Trunk Pipelines	500	75	4,545	0	-
Water – Temporary Surface Pipelines (aboveground)	900	0	0	0	-
Overhead Electrical Distribution along Road	1,350	30	4,909	9	1,473
Overhead Electrical Distribution Cross-country	150	30	545	9	164
Linear Facilities Subtotal	**4,400**		**17,272**		**1,637**

Table 2.4-1 Alternative B Summary of New Surface Disturbance

Facility	Number or Length	Construction Area or Width	Construction Surface Disturbance	Operational Area or Width	Operational Surface Disturbance
Total Alternative B New Surface Disturbance			**52,667**		**23,928**
New Disturbance Percent of CCPA			3.5 percent		1.6 percent
Alternative A Surface Disturbance			24,072		18,528
Total Surface Disturbance (Alternative A + Alternative B)			76,739		42,456
Total Disturbance Percent of CCPA			**5.1 percent**		**2.8 percent**

[1] Assumes a road length of 1 mile per pad, consistent with assumptions for other alternatives. Includes well pads, water source well pads, and disposal well pads. Production pads would be located close to well pads and would not have a separate access road.

[2] The total surface disturbance anticipated from the development of storage yards is 50 acres. However, due to the involvement of multiple operators in the Project, it is anticipated that the 50-acre disturbance could take the form of multiple, smaller, operator-specific storage yards instead of a single larger storage yard.

[3] Water processing facilities are included for purposes of analysis.

2.4.1 Development Overview

Alternative B (the Proposed Action) would result in the drilling of up to 5,000 wells on 1,500 new well pads at an average rate of 500 wells per year over 10 years. Prospective geological target formations for the Project include (but are not limited to) the Frontier, Muddy, Mowry, Niobrara, Parkman, Shannon, Sussex, Teapot, Tekla, and Turner. Other prospective zones may be identified in the future.

To the extent possible, ***operators*** within the CCPA would ***seek relief from timing limit stipulations for drilling and development operations*** to maximize the use of horizontal development from multi-well pads. As part of the Proposed Action, the operators would request ***relief from timing limit stipulations*** for ***non-eagle*** raptor nests and greater sage-grouse leks in ***General Habitat Management Areas (GHMA)*** for several wells over extended periods of time to increase efficiencies and reduce the number of times drilling rigs would be moved on and off pads. ***This relief would be requested for lands under BLM authority since exceptions are not typically granted*** on USFS-administered surface where TBNG stipulations for wildlife would be followed.

The number of wells drilled from each pad would vary from 1 to 16, with an average of 3 wells per pad. After the last well on each pad is plugged and abandoned, the pad would undergo final reclamation. Construction and operational surface disturbances for Alternative B from the 1,500 proposed multi-well pads and all associated infrastructure would be 52,667 acres and 23,928 acres, respectively. The total estimated construction and operational surface disturbance from Alternative B would be approximately 3.5 and 1.6 percent of the CCPA, respectively.

Project construction generally would include well pads, roads, pipelines, electrical lines, compressor stations, and ancillary facilities. Refer to Chapter 6.0 for a more detailed discussion regarding regulatory requirements and guidance, as well as additional operator committed measures that would apply to Project development unless superseded or modified by site-specific COAs. In general, the OG would:

- Comply with all applicable federal, state, county, BLM, and USFS regulations and land use plans (including any applicable interagency memorandums of understanding) for all operations associated with the Project;

- Adhere to all lease stipulations and COAs; and
- Conduct its operations in accordance with the standards contained in the APD.

The BLM NEPA Handbook (H-1790-1) calls for expression of the BLM's preferred alternative in the Draft EIS if one exists (BLM 2008c). The BLM has selected Alternative B, the Proposed Action, ***and LUP non-eagle raptor amendment Option 6*** as the preferred alternative for the Converse County Oil and Gas Development Project. The BLM believes that the Proposed Action ***and non-eagle raptor amendment Option 6 have*** the necessary elements that would address the purpose and need for the Draft EIS and will review public comments on the Draft before the preferred alternative is identified in the Final EIS.

2.4.2 Pre-construction Activities and Construction Initiation

2.4.2.1 Access Roads

The surface disturbance associated with collector roads would be 75 feet wide during construction (reclaimed to a 50-foot wide surface disturbance following interim reclamation), and the surface disturbance associated with well pad access roads would be 50 feet wide (reclaimed to a 35-foot-wide surface disturbance following interim reclamation). ROW applications and special use authorizations would be submitted for proposed roads across BLM- and USFS-managed lands. Roads on federal surface and over federal minerals would be constructed to BLM standards presented in the Gold Book (USDOI-USDA 2007) and Manual 9113 (BLM 2011e). Any roads developed on private surface would be sited, constructed, and maintained in accordance with the landowner's executed surface agreements.

Alternative B would result in the construction of 1,970 miles of new roads, which equates to approximately 1 mile of new road per well pad (1,580 miles) plus 390 miles of additional primary collector roads. Estimated construction and operational surface disturbances from roads would be 13,121 and 9,067 acres, respectively. New roads would be constructed and maintained to provide year-round access.

2.4.3 Well Drilling and Completion

A limited number of vertical exploratory oil and gas wells could be drilled; these vertical wells are included in the 5,000 oil and gas well and 1,500 well pad counts and surface disturbance estimates and would not increase the number of wells or pads.

2.4.3.1 Well Pad Layout and Construction

The anticipated initial drilling and completion pad size would be 12 acres, on average; however, individual pad sizes may vary based on the number of wells per pad and constraints related to lease/landowner agreements, operational safety, and topography. Each well pad would be designed to accommodate the drilling of multiple wells. If productive, the portions of the well pad not required for routine operations would be reclaimed; thereby, reducing the pad to an average size of 6 acres for the life of the multiple wells on the pad. Production pads would be approximately 8 acres in size. The operators would attempt to limit surface disturbances from well pads, particularly in circumstances including, but not limited to, areas of extensive cuts and/or fills, and proximity to ephemeral drainages.

Well pads for water supply wells would be 2 acres in size, but would be reduced to 1 acre following interim reclamation. Additionally, 30 disposal well pads constructed to handle a portion of the produced water disposal needs would be 10 acres in size.

Topsoil would be removed and separately stockpiled to ensure that this resource is protected until it can be reapplied during site reclamation. Based on experience in the CCPA, it is anticipated that an average of 6 inches of topsoil would be available. If plans call for topsoil to be stored for longer than 6 months, it would be stabilized and re-vegetated until needed. Topsoil would be stored in an area where it could be retrieved without causing additional disturbance and where it would not impede watershed and drainage flows.

2.4.3.2 Well Drilling

Each rig would be expected to drill an average of 10 to12 wells each year, and up to 50 drill rigs would be anticipated to be operating in the CCPA at the peak of the drilling phase. Up to 16 wellbores could be drilled per pad. Drilling fluids containing oil-based muds would not be used in formations that contain water with total dissolved solids of 10,000 or less. In the CCPA, this generally means that oil-based mud would only be used below the Fox Hills Formation.

Closed loop systems are defined as those that are fully contained and all waste goes to an off-site facility. Semi-closed loop systems are those in which some of the solids are dewatered and buried on-site according to WOGCC and BLM regulations for reserve pit applications. In general, semi-closed loop systems would be used. Cuttings from oil-based muds would not be placed in an onsite cuttings pit unless properly treated (fly ash or Soilbond®). In addition, the solidification process must be permitted through the WOGCC. Although not specifically proposed or anticipated, reserve pits could be constructed, as appropriate based on site-specific conditions. It is not reasonably foreseeable at this time to predict when or under what conditions reserve pits would be necessary; therefore, additional NEPA analysis may be required at the site-specific stage if reserve pits are to be constructed. If reserve pits are constructed, they would be located entirely within cut material and would not be located in drainages or where groundwater occurs in shallow aquifers. All pits would be fenced until reclamation is complete to preclude access by persons, livestock, or wildlife.

2.4.3.3 Well Completion

Both freshwater pits and tanks would be used to store water used for the hydraulic fracturing fluids. Pits on location or freshwater make-up ponds only would be used to hold freshwater; no wellbore fluids would be flowed back into the freshwater pits. Where shallow groundwater is available, Poseidon tanks may be used in place of permitted impoundments for water storage. Upon completion of the hydraulic fracturing operation, as much of the flowback fluids as practicable would be recovered and properly disposed.

2.4.3.4 Water Requirements, Supply, and Use

Under Alternative B, approximately ***19.7 to 26.2*** acre-feet (or approximately ***153,000 to 203,000*** barrels) of water per well would be required during well drilling and completions. Although actual water needs for drilling and completions may vary depending on the length of the lateral and the number of fracturing stages, the overall estimated water needs for the Project would not change as longer laterals would result in fewer wells within a given area. Additionally, approximately 0.1 acre-feet (or 776 barrels) of water per well would be required for dust abatement for the duration of the Project. ***Water*** use for the Proposed Action of approximately ***14,000*** acre-feet (or ***108*** million barrels) per year. The total water usage for development would require ***up to 140,000*** acre-feet (or approximately ***1 billion*** barrels) of water.

If necessary, an additional 50 water supply wells would be installed, with an assumed average appropriated capacity of 100 gallons per minute per well for an annual volume of 8,050 acre-feet (62.4 million barrels). The existing surface water (700 acre-feet per year) plus existing and proposed groundwater supply wells would result in a total potential water supply of 21,150 acre-feet (164 million barrels) per year.

To cover the annual anticipated needs of the Proposed Action, up to 50 new groundwater wells may be drilled, providing as much as 8,050 acre-feet (or 62.5 million barrels) per year of additional source water, as necessary. It is assumed that new wells would draw from the same aquifers as existing water supply wells. The specific source of the freshwater used in drilling operations for each well would be identified at the time of APD submittal. ***Additional sources of water would be derived from water recycling and leasing of supplemental surface water.***

The 50 proposed new groundwater supply wells would require an Application for Permit to Appropriate Ground Water (i.e., a U.W. 5 form) with the WSEO prior to any water well drilling. For groundwater or surface water withdrawals attributed to existing water rights, there would be two methods to obtain water. The first method would be to acquire a temporary water use agreement from an existing water right that has demonstrated recent beneficial use. The second method would be to file a petition to permanently change the beneficial use with the Board of Control. Under the first method, the State Engineer is authorized to grant temporary water use agreements provided by Wyoming Statute Section 41-3-110 for a period not to exceed two years. The quantity to be transferred would be only the amount that has been consumptively used historically. When obtaining water under an existing water right through a change in use petition to the Board of Control pursuant to Wyoming Statute 41-3-104, the quantity of water transferred would be limited to the amount or rate of water historically diverted under the existing use, increase in historic consumptive use, or increase in return flow.

Under Alternative B, freshwater for drilling and completion purposes would be transported from centralized sources to individual well pads via surface pipelines, or by trucks where surface pipelines are not available. Water stored in the permitted impoundments (30 additional to be constructed under Alternative B) would be transported to well locations via surface pipelines. Impoundments would be lined with high density polyethylene liners. Freshwater make-up ponds would have a capacity of 20 acre-feet (or approximately 155,200 barrels) each and would be off-channel and lined. These freshwater make-up ponds or the pads on which they would be located would be fenced. Freshwater makeup ponds also would be designed to discourage their use by breeding mosquitos. Mosquito-deterring design features would include lining the ponds and a lack of “shoreline” (land-water transition area), both of which would reduce the likelihood of stagnant water conditions conducive to mosquito breeding. See **Table 2.4-1** for miles of pipelines and acres per freshwater makeup pond.

2.4.4 Production, Distribution, and Maintenance

2.4.4.1 Production Equipment

Where electrical distribution lines are unavailable, initial development would be powered by diesel or natural gas generators. As development advances into the completion or production phase, generators would be phased out as electric lines are constructed where feasible. In some remote locations, natural gas generators could remain on-site for the life of the well. Aboveground electrical distribution lines would be installed adjacent to new and existing roads where feasible, and would require a construction disturbance width of 30 feet and an operational disturbance width of 9 feet. It is anticipated that a trunk line would have 60-foot poles. For cross-country lines, the third-party power provider would select a route that is accessible by truck. Additionally, it is assumed that power providers would follow guidance in the Gold Book (USDOI-USDA 2007) during design and installation of these lines on BLM- and USFS-administered land.

All permanent aboveground production facilities be installed on the producing federal well sites would be painted one of the standard environmental colors recommended by the Rocky Mountain Five-state Interagency Committee and would be selected at the BLM’s discretion in consideration of the surface landowner’s wishes.

Alternative B would include approximately 1,500 miles of aboveground electric distribution lines required to bring power to the proposed wells and facilities. Aboveground electrical distribution lines would be installed adjacent to new and existing roads where feasible, and would require a construction surface disturbance of 5,454 acres and a long-term surface disturbance of 1,637 acres.

2.4.4.2 Pipelines and Mid-stream Facilities

Gas compression facilities capable of handling approximately 100 wells each would be constructed to facilitate the flow of gas from the proposed wells through the pipelines. Based on expected production rates, it is estimated that approximately 50 gas compression facilities of approximately 16,000 horsepower each would be constructed. Each compression facility would occupy approximately 5 acres in both the construction and operational phases. Dehydration equipment would be co-located with the compression equipment and generally would not increase the facility footprint.

Approximately 50 percent of the gas gathering pipelines would be installed adjacent to or in a common ROW with new or upgraded roads, where feasible; the remainder would be located in new cross-country ROWs. Pipelines in road ROWs would require 30 feet width of additional construction disturbance. An initial 50-foot ROW would be required for installation of new cross-country gathering lines as well as for main trunk lines. All surface disturbances resulting from pipeline installation would be subsequently reclaimed.

The Proposed Action would require approximately 2,000 miles of gas pipelines: 750 miles of gathering lines installed adjacent to existing roads, resulting in 2,727 acres of temporary disturbance; 750 miles of gathering lines installed cross-country, resulting in 4,546 acres of temporary disturbance; and 500 miles of main trunk pipelines, resulting in 4,545 acres of temporary disturbance.

New processing facilities for product distribution under Alternative B would include two gas plants (100 acres each) and two centralized processing facilities (5 acres each). These facilities also could house other facilities, including dehydration units, required to process oil and gas products for transport. Oil would be transported by truck or rail to an existing refinery for further processing and distribution. No new rail loadouts are proposed under this alternative.

Other construction and production facilities that would be required include 6 oil/condensate storage facilities (3 acres each), an equipment and pipe storage yard (50 acres), 12 electrical substations (3 acres each), a workforce facility (10 acres), 30 fresh water make-up ponds (8 acres each), and 4 water processing facilities (15 acres each).

2.4.4.3 Produced Water Management and Disposal

The projected annual volume of wastewater from development under Alternative B would peak in year 10 at approximately 9,750 acre-feet (or 75.6 million barrels) per year (i.e., 3,870 acre-feet [or 30.0 million barrels] from flowback and 5,880 acre-feet [or 45.6 million barrels] from produced water). In addition to the existing disposal wells in the CCPA, another 30 disposal wells are proposed under Alternative B to manage wastewater produced by the Project. Disposal at third-party evaporation ponds in or near the CCPA also would be considered, but the development of such facilities to support the disposal of wastewater for this Project is not proposed at this time. ***Based on current experience the BLM anticipates recycling of produced water in the CCPA.***

2.4.5 Reclamation

A Programmatic Reclamation Plan has been drafted by the OG that provides anticipated reclamation techniques, strategies, and monitoring efforts to be implemented. The Programmatic Reclamation Plan was prepared in compliance with a variety of statutes, regulations, and guidelines; however, because site characteristics are likely to vary in the field, individual operators would develop separate site-specific reclamation plans to support federal APDs submitted to the BLM and USFS. Upon completion of construction activities on all federally managed lands, all disturbed areas not necessary for production would undergo interim reclamation to minimize environmental impacts. Interim and final reclamation would be required to comply with BLM and USFS policy and land use plan requirements in consultation with the surface landowner as applicable. Final reclamation would occur after decommissioning activities are complete.

2.4.5.1 Interim Reclamation

Sufficient topsoil to facilitate revegetation would be segregated from the subsoil during construction and stockpiled for future reclamation of the disturbed areas. Topsoil stockpiles would be graded to a "rounded" appearance and would be maintained in a weed-free condition through treatment and use of sterile and/or desired native cover crops for soil that is stockpiled for more than 6 months. The salvaged topsoil would be evenly distributed over those disturbed surfaces subject to reclamation upon termination of drilling and completion operations. All disturbed surfaces would be reclaimed as soon and as near as practicable to their original condition.

Erosion control measures would be implemented and could include surface roughening, wattles, silt fence, crest and toe of slopes, berms, and check dams. Rat and mouse holes would be filled and compacted from bottom to top immediately upon release of the drilling rig from the location or in accordance with guidelines established by the BLM or USFS.

Seeding would occur in the next appropriate seeding season following the completion of surface disturbing activities, which generally would be within 180 days of the last well being completed on the pad. In the fall, seeding would take place after September 15 and prior to ground frost, and in the spring after the frost has left the ground and prior to June 1. Seed mixes would be prescribed by the surface owner, BLM, or USFS.

Following road construction, stockpiled topsoil would be evenly redistributed over the road embankment and borrow ditch slopes. As discussed for well pad reclamation, these areas would be stabilized and reclaimed with the approved seed mix as soon as practicable in the next appropriate seeding season. Pipeline ROW disturbance areas would be completely reseeded as soon as practicable in the next appropriate seeding season in accordance with the seeding recommendations obtained from the surface owner, BLM, or USFS, as appropriate. Prior to re-seeding, soil compaction would be assessed using onsite visual inspections. Compacted areas would be ripped or chiseled to loosen compacted soils where underlying material would not degrade topsoil, with a goal of improving seed establishment. Any required monitoring for reclamation success would be conducted by a qualified operator representative (in coordination with the surface owner).

2.4.5.2 Final Reclamation

Following decommissioning and at the time of final abandonment, all surface equipment, including surface gathering pipelines, would be removed from the site. Site and access road locations would be cleared of all production equipment, gravel, surfacing materials, and any other material/equipment that had been imported (including culverts, cattle guards, and fence materials). Drainage basins would be reclaimed to the natural (i.e., pre-disturbance) conditions, which would include contouring to maintain the profile and dimensions approximate to the natural or otherwise pre-existing conditions of the location. Appropriate erosion control measures would be taken to prevent run-off into drainages in proximity to disturbed areas, and no depressions would be left to trap water. With the exception of roads or other facilities retained for future use, all remaining disturbances would be reclaimed according the same procedures for interim reclamation. Any follow-up surveys and weed treatments would be conducted by a qualified operator representative.

At final abandonment of wells, the casing would be cut off at the base of the collar or three feet below the final restored ground level, whichever is deeper. The casing would be capped with a metal plate at least 0.25 inch thick welded in place, and the well location and identity would be permanently inscribed on the cap. The cap would be constructed with a weep hole.

2.4.6 Solid Waste

Trash containers and portable toilets would be located on construction sites. Garbage, trash, and other waste materials would be collected in portable, self-contained, fully enclosed trash cages during construction, drilling, and completion operations and disposed of at an approved landfill. Trash would not be burned on location. Motor oil would be placed in closed containers and disposed of at an approved disposal facility. In the event that small quantities of hazardous wastes are generated at any site (e.g., from equipment maintenance), they would be properly stored and disposed of at an off-site approved disposal facility. Construction locations and well sites would be cleaned of debris and waste materials removed from the location after drilling and completion operations.

2.4.7 Project Workforce and Workforce Facilities

Table 2.4-2 shows the estimated timing and phasing of development activities, duration of activities, and approximate numbers of employees anticipated for a typical well in the CCPA. One new 10-acre workforce facility containing offices would be constructed to support the proposed development under Alternative B. Based on local housing availability and other factors, construction of a mancamp to house rig crews at the workforce facility site also may be considered. No initial reclamation would occur while the facility is in use, so surface disturbances would continue throughout operation. See Sections 3.11 and 4.11, Socioeconomics, for further detail regarding employment and workforce analysis.

Table 2.4-2 Employment Needs

Activity	Workers per Crew[1]	Typical Activity Duration[1,2] (days)
Location staking / surveying / permitting	4	3
Location construction	6	19
Rig mobilization / demobilization (each)	16	5
Drilling	26	29
Completion	15	10
Tank battery and other wellhead/ production equipment set-up	18	40
Interim reclamation	2	1
Gas-gathering system (per mile)	11	8
Electrical system (per mile)	8	21
Production pad (per pad)	18	13
Water source well pad	10	1
Well pad access road (per mile)	5	4
Primary collector road (per mile)	5	9
Gas plant (each)	225	160
Oil/condensate storage site (per site)	18	5
Centralized processing facilities (each)	14	8
Produced water injection well/ disposal site	7	1
Compression facilities (each)	30	8
Equipment/ pipe storage yard	10	80
Electrical substation (each)	10	5
Workforce facility (each)	8	16
Freshwater make-up ponds (each)	8	13
Water processing facility (each)	5	90

1 Numbers are rounded to whole days.

2 Numbers provided are based on single well pads; additional information on multi-well pads is available in the source spreadsheet supplied to the BLM in March 2015.

Source: OG 2015.

2.4.8 Transportation

The OG submitted a Project-specific Transportation Plan, which describes and identifies existing roads and primary routes most likely to be used for the Project. The Transportation Plan provides estimates of vehicle trips and vehicle use associated with the proposed Project on primary routes in the transportation network during well pad construction, drilling, completion, and production and operation under Alternative B. Peak traffic volumes are anticipated to be reached in year 10 of Project development.

Traffic associated with Alternative B would consist of both light/medium and heavy duty vehicles. Light/medium duty vehicles include pickup trucks and fuel trucks. Heavy duty vehicles consist of flatbed and belly dump semi-trucks, which are used to transport equipment, materials, or special equipment; they also consist of water trucks, welding trucks, winch trucks, and sidebooms. Dozers, graders, scrapers, and other similar construction equipment are assumed to be transported to/from the pad via semi-truck. The number of vehicle trips per day would vary depending on the development phase. **Table 2.4-3** provides the estimated vehicle trips associated with the well development phases (i.e., well pad construction, drilling, and completion). ***Under this alternative the BLM has assumed there would be one rig move per well pad, or a total of 1,500 rig moves over the 10-year well development phase.***

Table 2.4-3 Estimated Vehicle Trips for Well Development

Well Development Phase	Average Duration (days)	Average Round Trips per *Development Phase*		Average Round Trips per Day		Average Daily Trips per *Phase*	
		L/M	**H**	**L/M**	**H**	**L/M**	**H**
Pad Construction	19	176 (per pad)	38 (per pad)	9	2	18 ***(per pad)***	4 ***(per pad)***
Drilling[1]	30	209	69	7	2	14	4
Rig Moves[2]	*5*	10	300	***2***	***60***	***4***	***120***
Completions[3]	10	114	198	12	*20*	24	*40*

[1] Drilling operations would occur around the clock in 12-hour shifts at each drilling site.

[2] Mobilization and demobilization efforts ***(i.e., rig moves) are assumed to occur at a rate of one move per pad***. For each rig, initial rig-up activities would involve transportation of the drill rig, drill pipe, and drilling fluid products. This entire mobilization/demobilization process ***is assumed to*** take 5 days.

[3] Completions generally would occur concurrently with drilling operations on multi-well pads.

NOTE: Traffic estimates are based on the Project emissions inventory and are estimates only. The actual number of trips would vary. Estimates have been rounded to the nearest whole trip.

L/M = light/medium duty vehicles; H = heavy duty vehicles.

Table 2.4-4 provides average daily trips for production and operations phases for selected Project years. Traffic to support the production and operations at wells would occur throughout the anticipated 30-year life of each well. The number of trips required to transport oil would vary over the life of each well as production declines. Therefore, to estimate the vehicle round trips needed for oil transport, a generalized field-wide type curve was applied to estimate the volume of oil produced per year. Based on the proposed drilling schedule, approximately 500 wells would begin producing each year, and the associated round trips would increase during years 1 to 10. Similarly, the number of vehicle round trips needed to transport wastewater (i.e., flowback and produced water) would increase as new wells begin producing and the volume of water to be disposed increases. A flat rate of wastewater per well after flowback was assumed; however, this volume also would increase on a pro-rata basis in years 1 to 10 as the number of producing wells increased. The peak production period for oil and wastewater would occur at the end of year 10, with a total of approximately 1,270 oil truck trips and 1,727 wastewater truck trips per day. Light vehicle trips to support well operations also would increase as new wells come online in years 1 to 10. Additionally, one workover per well per year would be anticipated. Both light/medium and heavy truck traffic associated with workovers would increase on a pro-rated basis in years 1 to 10 as the number of producing wells increased.

In addition to traffic for the construction and operation of oil and gas wells and well pads, traffic also would occur as a result of the construction of support facilities and linear features associated with the Project. It is assumed that facilities and linear features would be constructed during years 1 through 10.

Table 2.4-4 Average Daily Trips for Production and Operations Activities During Selected Project Years

	Average Daily Trips[1]									
Project Year	**1**		**5**		**10**		**31**		**39**	
Number of Producing Wells	**500**		**2,500**		**5,000**		**4,500**		**500**	
Vehicle Type	**L/M**	**H**	**L/M**	**H**	**L/M**	**H**	**L/M**	**H**	**L/M**	**H**
Production	333	1,237	1,667	2,207	3,333	2,997	3,000	1,077	333	117
Operations	6	15	31	75	63	150	56	135	6	15
Total	**339**	**1,252**	**1,698**	**2,282**	**3,396**	**3,147**	**3,056**	**1,212**	**339**	**132**

[1] L/M = light/medium duty vehicles; H = heavy duty vehicles.

Table 2.4-5 provides a summary of the total round trips for construction of one each (number or mile) of the support facilities and linear features and indicates the anticipated duration of construction, which provides the anticipated number of round trips per day per facility. Construction represents the anticipated peak traffic count for these facilities.

Table 2.4-5 Average Daily Trips for Construction of Support Facilities and Linear Features

Facility	Average Construction Duration (days)	Average Round Trips / Facility		Average Round Trips / Day		Average Daily Trips / Facility	
		L/M	**H**	**L/M**	**H**	**L/M**	**H**
Gas Plant	160	1,630	580	10	4	20	7
Centralized Processing Facilities	8	82	29	10	4	20	7
Compression Facilities	8	82	29	10	4	20	7
Workforce Facility (offices)	16	163	58	10	4	20	7
Disposal Wells	16	163	308	10	19	20	39
Oil/Condensate Storage	5	49	17	40	4	20	7
Equipment/Pipe Storage Yard	80	815	290	10	4	20	7
Freshwater Makeup Ponds	13	130	46	10	4	20	7
One mile of Gas Gathering Pipeline and Main Trunk Pipeline (construction traffic)	10	98 (per mile)	15 (per mile)	10	1	19	3
One mile of Road (construction traffic)	12	127 (per mile)	240 (per mile)	10	***20***	20	***40***
Electric Substations	5	49	17	10	4	20	7

L/M = light/medium duty vehicles; H = heavy duty vehicles.

2.4.9 Land Use Amendment

As part of Alternative B and in response to comments on the Draft EIS, the BLM analyzed modifications to the Casper RMP to provide for relief from TLS for non-eagle raptors in the CCPA. Option 1 (existing raptor TLS from the Casper RMP, Decision No. 4047) and five LUP non-eagle raptor amendment options (designated as 2 through 6) are analyzed in this Final EIS. The specific RMP wording for each of the options are described in Table 2.4-6.

As noted above, Option 1 would retain the existing raptor TLS in the Casper RMP under Decision # 4047. This existing raptor TLS calls for avoidance of surface disturbance or occupancy within a defined buffer around raptor nests (0.5-mile buffer for all raptors except nine species which have a 0.25-mile buffer) from February 1st through July 31st or until young birds have fledged. Decision # 4047 also includes an exception to this TLS which is granted on a case-by-case basis by the authorized office. As detailed in Appendix F of the Casper RMP, the BLM's expectation is that exception requests would be submitted within 2 weeks of conducting work within the TLS time frame. In addition, the BLM grants exceptions, in consultation with WGFD, if granting the exception would not jeopardize the wildlife population being protected. While RMP Appendix F sets forth criteria used in considering an exception request, professional judgment plays a role and there is no clear-cut formula for the granting of exceptions.

In practice over the past several years the CFO has received exception requests for roughly half the APDs submitted for approval. Comments on the Draft EIS revealed a need for a more clearly defined process for the granting of exceptions to the use of horizontal drilling technology which involves continuous drilling activity on a single drill pad for extended periods of time. For example, a drill pad with four horizontal wells could take approximately one year for construction, drilling and completion operations.

Option 2 consists of an amendment to the Casper RMP that would modify all existing leases and development within the Converse County Oil and Gas Project area, removing all non-eagle raptor nest timing limitations in lease stipulations, conditions of approval, mitigations or other stipulations through the operation of the pertinent resource's laws, rules, and regulations. Future leases or development within the CCPA area would not include the non-eagle raptor nest timing limitations.

Table 2.4-6 Land Use Plan Amendment Options

Option Number	Proposed Text Changes for Land Use Plan Amendment Options
Option #1: No Land Use Plan Amendment	***Decision #: 4047; Decisions/Management Actions:*** ***Avoid surface disturbance or occupancy within a 0.5-mile buffer of raptor nests, except for the species listed below, for which a 0.25-mile buffer will be required:*** ***Red-tailed hawk*** ***Swainson's hawk*** ***American kestrel*** ***Osprey*** ***Great horned owl*** ***Long-eared owl*** ***Northern saw-whet owl*** ***Common barn owl*** ***Western screech owl*** ***The seasonal restriction will be February 1 to July 31, or until young birds have fledged (TLS).*** ***The authorized officer, on a case-by-case basis, may grant exceptions to seasonal stipulations.***
Option #2: Proposed by the OG	***For existing text in RMP Decision #4047, see Option 1 above.*** ***Proposed text to be appended at the end of Decision #4047:*** ***These timing limit stipulations will not apply to non-eagle raptor nests within the Converse County Project Area (CCPA) as delineated in the Record of Decision (ROD) for the Converse County Oil and Gas Project Environmental Impact Statement (CC EIS) dated XX/XX/XXXX.***
Option #3: Proposed by the OG	***For existing text in RMP Decision #4047, see Option 1 above.*** ***Proposed text to be appended at the end of Decision #4047:*** ***If the applicant applies the conservation measures set forth in the RMP Appendix XXX, these timing limit stipulations will not apply within the Converse County Project Area (CCPA), as delineated in the Record of Decision (ROD) for the Converse County Oil and Gas Project Environmental Impact Statement (CC EIS) dated XX/XX/XXXX.***
Option #4: Proposed by the BLM	***For existing text in RMP Decision #4047, see Option 1 above.*** ***Proposed text to be appended at the end of Decision #4047:*** ***If other management practices or plans agreed upon by the applicant/operator and BLM alleviate impacts to non-eagle raptors within the buffer distances defined above, these timing limit stipulations may be relieved within the Converse County Project Area (CCPA), as delineated in the Record of Decision (ROD) for the Converse County Oil and Gas Project Environmental Impact Statement (CC EIS) dated XX/XX/XXXX.***

Table 2.4-6 Land Use Plan Amendment Options

Option Number	***Proposed Text Changes for Land Use Plan Amendment Options***
Option #5: Proposed by the USFWS	***For existing text in RMP Decision #4047, see Option 1 above.*** ***Proposed text to be appended at the end of Decision #4047:*** ***If the applicant and/or operator works with the U.S. Fish and Wildlife Service to alleviate impacts to non-eagle raptors within the buffer distances defined above by developing a Migratory Bird Conservation Plan using the outline provided in the RMP Appendix XXX, these timing limit stipulations may be relieved in the Converse County Project Area (CCPA), as delineated in the Record of Decision (ROD) for the Converse County Oil and Gas Project Environmental Impact Statement (CC EIS) dated XX/XX/XXXX.***
Option #6: Proposed by the BLM	***For existing text in RMP Decision #4047, see Option 1 above.*** ***Proposed text to be appended at the end of Decision #4047:*** ***Within the Converse County Project Area (CCPA), as delineated in the Record of Decision (ROD) for the Converse County Oil and Gas Project Environmental Impact Statement (CC EIS) dated XX/XX/XXXX, if the operator commits to implement all of the measures contained in Section 1 of RMP Appendix XXX, one timing limitation stipulation relief request will be granted for a well pad for 1 year. The number of stipulation reliefs allowed for the CCPA through the 10-year development phase beginning on the signed date of the CCPA ROD will be 98. After 98 stipulation reliefs have been granted, additional reliefs will only be granted upon implementation of an adaptive management plan that has been approved by BLM. This adaptive management plan will follow the guidance set forth in: "Adaptive Management: The U.S. Department of the Interior Technical Guide."***

Options 3, 4, 5, and 6 consist of design features or a process and plan that would be required to avoid or reduce effects to non-eagle raptors. A summary of the process or plan is provided below.

- ***Option 3 – Under this non-eagle raptor amendment option, the timing limit stipulations would not apply within the CCPA if the applicant applies conservation measures set forth in Appendix G1. The OG-committed design features would reduce potential impacts to migratory birds by avoiding contact with development facilities such as reserve pits, ponds, containers, dehydrator tubs, and stacks. Two additional design feature options are proposed regarding operations and active/inactive nests. One of these design features would be followed after approval from the BLM and the USFWS.***

  Feature 1 – Commence oil and gas development within the spatial nest buffer either a) in advance of the season buffer period listed in Appendix G1 and maintain continuous operations (i.e., development activities that continue without a break of more than 72 contiguous hours) throughout the seasonal buffer period (or until such activities are completed); or b) following the conclusion of the applicable seasonal buffer period listed in Appendix G1. If a non-eagle raptor nest becomes active while continuous operations are occurring within a spatial nest buffer during a seasonal buffer period, it is assumed that the species is tolerant of the surrounding conditions.

  Feature 2 – During an appropriate seasonal buffer period as listed in Appendix G1, before oil and gas development activities can a) commence, or b) resume after a break of more than 72 hours of such activities, then the nest must first be determined to be inactive through the monitoring check that occurs seven days before oil and gas development activities commence or resume. If the monitoring check reveals the nest is active, oil and gas activities cannot commence or resume until the nest becomes inactive. To lessen the overall amount of time for disruption to non-eagle raptors, continuous operations would be pursued to the extent practicable.

- ***Option 4 – A Non-eagle Raptor Timing Stipulation Relief Process Framework must be followed for this option. An example of the process is provided in Appendix G2. The process includes specific prerequisite requirements associated with the APD application; appropriate planning/coordination between the applicant, the BLM; and other agencies; implementation of conservation measures to protect non-eagle raptor nesting; and adherence to a BLM Authorized Officer Decision Matrix, as identified in Appendix G2. The conservation measures would be identified in a raptor protection plan. Monitoring would be required for two consecutive years after well development to ensure that the conservation measures were effective in protecting the non-eagle raptor nesting activity. It is important to note that in order for development activities to be considered further, the information gathered from the prior two years must display that no eagle has utilized the nest. If a nest has ever been occupied by eagles, it will be considered an eagle nest regardless of being inactive, used by other species, or if eagle occupancy occurred greater than two years ago.***

- ***Option 5 – Under this option, the applicant would work with the BLM and USFWS to alleviate impacts to non-eagle raptors within buffers by developing a Migratory Bird Conservation Plan (MBCP). An outline for a MBCP is provided in Appendix G3. MBCP is a life-of-a-project framework for identifying and implementing actions to conserve migratory birds during oil and gas project planning, construction, operation, maintenance, and decommissioning. It is the responsibility of project developers and operators to effectively assess project-related impacts to migratory birds and their habitats, and to work to avoid and minimize those impacts. Key elements of the MBCP would include regulatory background and required bird permits; description of project activities, baseline characterization of non-eagle raptor species and habitats; identification of conservation***

measures for protection of raptors; evaluation of the applied conservation measures from monitoring surveys; adaptive management based on evaluation of the conservation measures; training; and resource contacts.

- ***Option 6 – Under this option which was added by the BLM following public review of the SDEIS, the timing limit stipulations would not apply within the CCPA if the applicant applies conservation measures set forth in Appendix G4. This option is similar to Option 3 with modification of terminology, inclusion of specific requirements, and the addition of a cap on the number of well pads for which timing limit stipulation relief would be granted.***

2.5 Alternative C

A summary of surface disturbance associated with implementation of Alternative C is presented in **Table 2.5-1**. The disturbance indicated in **Table 2.5-1** is new disturbance that would occur in addition to existing and new disturbance under the No Action Alternative (Section 2.3).

Table 2.5-1 Alternative C Summary of New Surface Disturbance

		Construction		Operational	
Facility	**Number or Length**	**Area or Width**	**Surface Disturbance**	**Area or Width**	**Surface Disturbance**
Pads	**(number)**	**(acres)**	**(acres)**	**(acres)**	**(acres)**
Well Pads	938[1]	12	11,256	6	5,628
Production Pads	236[2]	8	1,888	8	1,888
Water Source Well Pads	50	2	100	1	50
Disposal Well Pads	30	10	300	10	300
Well Pad Subtotal	**1,254**		**13,544**		**7,866**
Roads	**(miles)**	**(feet)**	**(acres)**	**(feet)**	**(acres)**
Well Pad Access Roads	1,018[3]	50	6,170	35	4,319
Primary Collector Roads	244[2]	75	2,218	50	1,479
Roads Subtotal	**1,262**		**8,388**		**5,798**
Construction/Production Facilities	**(number)**	**(acres)**	**(acres)**	**(acres)**	**(acres)**
Gas Plants	2	100	200	100	200
Oil/Condensate Storage	6	3	18	3	18
Central Processing Facilities	2	5	10	5	10
Compression Facilities	50	5	250	5	250
Equipment/Pipe Storage Yards	1	50	50	50	50
Electrical Substation	12	3	36	3	36
Workforce Facility	1	10	10	10	10
Fresh Water Make-up Ponds	30	8	240	8	240
Water Processing/Recycling Facility	4	15	60	15	60
Construction/Production Facilities Subtotal			**874**		**874**

Table 2.5-1 Alternative C Summary of New Surface Disturbance

Facility	Number or Length	Construction		Operational	
		Area or Width	Surface Disturbance	Area or Width	Surface Disturbance
Linear Facilities	**(miles)**	**(feet)**	**(acres)**	**(feet)**	**(acres)**
Gas Gathering Pipelines within Road Disturbance	469[2]	30	1,705	0	-
Gas Gathering Pipelines with New Cross-country Disturbance	469[2]	50	2,842	0	-
Oil Gathering Pipelines within Road Disturbance	188[4]	30	682	0	-
Oil Gathering Pipelines with New Cross-country Disturbance	188[4]	50	1,139	0	-
Oil and Gas – Main Trunk Pipelines	315	75	2,864	0	-
Water Supply/Disposal Pipelines within Road Disturbance	188[4]	30	682	0	-
Water Supply/Disposal Pipelines with New Cross-country Disturbance[5]	188[4]	50	1,136	0	-
Overhead Electrical Distribution along Road	844[2]	30	3,069	1	102
Overhead Electrical Distribution Cross-country	94[2]	30	342	1	11
Linear Facilities Subtotal	**2,943**		**14,461**		**113**
Total Alternative C New Surface Disturbance			**37,267**		**14,651**
New Disturbance Percent of CCPA			2.5 percent		1.0 percent
Alternative A Surface Disturbance			24,072		18,528
Total Surface Disturbance (Alternative A + Alternative C)			61,339		33,179
Total Disturbance Percent of CCPA			4.1 percent		2.2 percent

1 The number of well pads for this alternative would be reduced relative to the Proposed Action (Alternative B) based on the assumption that a greater number of wells would be drilled from each pad. Specifically, 55 percent of the CCPA would be developed on pads with 1 to 4 wells, 35 percent of the CCPA would be on pads with 5 to 8 wells, and 10 percent of the CCPA would be on pads with 9 to16 wells. This would provide for drilling of the same number of wells (5,000) as Alternative B.

2 Assumes a similar percentage reduction in number or length based on the reduction in the number of well pads.

3 Assumes a road length of one mile for each new pad, consistent with assumptions for other alternatives. Includes well pads, water source well pads, and disposal well pads. Production pads would be located close to well pads and would not have a separate access road.

4 Assumes 10 percent of pads would have buried pipelines in year 1, 20 percent in year 2, 30 percent in year 3, 40 percent in year 4, and 50 percent in years 5 through 10. This would result in 40 percent of the Project development using buried pipelines.

5 Water pipelines could be used as supply lines for drilling and then reversed to be used as disposal lines during production.

2.5.1 Development Overview

Alternative C would be similar to Alternative B, but would reduce the surface disturbance based on the assumption that a greater number of wells would be drilled from each pad. Specifically, based on the OG's submittal for the regional modeling scenarios for air quality, the BLM assumed that 4 wells would be drilled from 55 percent of the pads, 8 wells would be drilled from 35 percent of the pads, and 16 wells would be drilled from 10 percent of the pads. This would provide for drilling the same number of wells (5,000) at the same drilling rate (500 wells per year) as Alternative B. The number of wells drilled from each pad would vary from 4 to 16, with an average of 5 wells per pad. This would reduce the total number of well pads to 938 (approximately 37 percent reduction), which would proportionately reduce the number of access roads, gas gathering pipelines, temporary water pipelines, and overhead electrical lines.

This alternative would not include changes to any of the proposed construction/production facilities discussed under Alternative B except that under Alternative C there would be separate gathering pipelines for oil, and water supply/disposal pipelines would be buried. However, because there would be fewer well pads, the overall length of pipelines needed would be less than under Alternative B.

Construction and operational surface disturbances for Alternative C from the 938 multi-well pads and all associated infrastructure would be 37,267 acres and 14,651 acres, respectively. The total estimated construction and operational surface disturbance from Alternative C would be approximately 2.5 and 1.0 percent of the CCPA, respectively.

2.5.2 Alternative-specific Activities

2.5.2.1 Timing Stipulations

The BLM Casper RMP applies timing stipulations for the protection of mountain plover, raptors, sage-grouse, and sharp-tailed grouse. The USFS TBNG LRMP applies timing stipulations for the protection of these species as well as for black-footed ferrets and swift fox. Under Alternative C, timing stipulations would continue to be required as outlined in the BLM Casper RMP and USFS TBNG LRMP, only allowing for exceptions to timing stipulations as currently specified in the Casper Field Office for short-term uses for emergencies or to finish tasks. **Table 2.5-2** provides the details regarding the timing limit stipulations for raptors and greater sage-grouse on BLM- and USFS-managed lands.

A wildlife review of federal APDs for fiscal year 2016 conducted by the BLM determined that approximately 50 percent of federal applications were subject to timing limitation stipulations. Applying that 50 percent coverage to the approximately ***64*** percent of the CCPA under federal mineral ownership yields an estimated ***one-third*** of the CCPA that ***c***ould be subject to timing limitation stipulations.

Table 2.5-2 Timing Limit Stipulations

Species	BLM Casper RMP	USFS TBNG LRMP
Raptors	Avoid surface disturbance or occupancy within a 0.5-mile buffer of raptor nests, except for the following species: red-tailed hawk, Swainson's hawk, American kestrel, osprey, great horned owl, long-eared owl, northern saw-whet owl, barn owl, western screech owl. The seasonal restriction will occur from February 1 to July 31, or until young birds have fledged. Activities or surface use will not be allowed in special status raptor nesting habitats from February 1 through July 31 within certain areas, to be determined by the BLM authorized officer.	To help prevent abandonment, reproductive failure, or nest destruction, prohibit development of new facilities within the minimum distances (line of sight) of active raptor nests and winter roost sites as follows: • Bald eagle nest – 1-mile buffer from February 1 through July 31; • Bald eagle winter roost – 1-mile buffer from November 1 through March 31; • Golden eagle nest – 0.25-mile buffer from February 1 through July 31; • Merlin nest – 0.25-mile buffer from April 1 through August 15; • Ferruginous hawk nest – 0.25-mile buffer from March 1 through July 31; • Swainson's hawk nest – 0.25-mile buffer from March 1 through July 31; • Burrowing owl nest – 0.25-mile buffer from April 15 through August 31; and • Other raptors – 0.125-mile buffer from February 1 through July 31. To help reduce disturbances to nesting and wintering raptors, do not authorize construction (e.g., pipelines, utilities, fencing) or well workover operations for maintenance of oil and gas wells within the minimum distances (line of sight) of active raptor nests and winter roost areas as specified above.
Sage-grouse	Surface occupancy and surface disturbing activities will be prohibited on or within a 0.6-mile radius of the perimeter of occupied sage-grouse leks within Priority Habitat Management Areas (PHMAs). The Agreement Officer may grant an exception if an environmental record of review determines that the action, as proposed or conditioned, will not impair the function or utility of the site for the current or subsequent seasonal habitat, life-history, or behavioral needs of greater sage-grouse. 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 within GHMAs. The Agreement Officer may grant an exception if an environmental record of review	Do not authorize new surface disturbing and disruptive activities that create noise at 10 dB above ambient measured at the perimeter of an occupied lek during lekking (March 1 to May 15) from 6 p.m. to 8 a.m. Do not include noise resulting from human activities that have been authorized and initiated within the past 10 years in the ambient baseline measurement. In priority-core habitat management areas and sagebrush focal areas, do not authorize new surface disturbing or disruptive activities from March 15 through June 30. Where credible data, based upon field analysis; support different timeframes for the seasonal restriction, dates may be shifted by either 14 days before or subsequent to these dates, but not both.

Table 2.5-2 Timing Limit Stipulations

Species	BLM Casper RMP	USFS TBNG LRMP
	determines that the action, as proposed or conditioned, will not impair the function or utility of the site for the current or subsequent seasonal habitat, life-history, or behavioral needs of greater sage-grouse. Surface disturbing and/or disruptive activities will be prohibited from March 15 to June 30 to protect sage-grouse breeding, nesting, and early brood rearing habitat. This timing limitation will be applied throughout the PHMAs (core only). Activities in unsuitable habitats will be evaluated under the exception and modification criteria and shall be allowed on a case-by-case basis. Where credible data support different timeframes for this seasonal restriction, dates may be expanded by up to 14 days prior to or subsequent to these dates. Surface disturbing and/or disruptive activities will be prohibited within PHMAs (connectivity only) from March 15 to June 30 to protect breeding, nesting, and early brood-rearing habitats within 4 miles of the lek or lek perimeter of any occupied sage-grouse lek within identified PHMAs (connectivity only). This timing limitation will be applied throughout the PHMAs (connectivity only). Activities in unsuitable habitats will be evaluated under the exception and modification criteria and may be allowed on a case-by-case basis. Where credible data support different timeframes for this seasonal restriction, dates can be shifted by 14 days prior or subsequent to these dates. 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 PHMAs. Where credible data support different timeframes for this restriction, dates can be shifted by 14 days prior or subsequent to these dates. Surface disturbing and/or disruptive activities in sage-grouse winter concentration areas will be prohibited from December 1 to March	Within priority-connectivity habitat management areas, do not authorize new surface disturbing or disruptive activities from March 15 through June 30 within 4 miles of a lek perimeter. Where credible data, based upon field analysis, support different timeframes for this seasonal restriction, dates may be shifted by either 14 days before or after these dates, but not both. In GHMAs, do not authorize new surface disturbing or disruptive activities from March 15 to June 30 within 2 miles of the lek or lek perimeter of any occupied lek located inside general areas. Where credible data, based upon field analysis, support different timeframes for this restriction, dates may be shifted by either 14 days before or subsequent to these dates, but not both. Within mapped winter concentration areas in priority-core habitat management areas and sagebrush focal areas, do not authorize new surface disturbing or disruptive activities from December 1 through March 14 to protect priority-core and sagebrush focal area greater sage-grouse populations that use these winter concentration habitats. Within mapped winter concentration areas in priority connectivity and GHMAs, do not authorize new surface disturbing or disruptive activities from December 1 through March 14 where winter concentration areas are identified as supporting populations of greater sage-grouse that attend leks within priority-core habitat management areas and sagebrush focal areas.

Table 2.5-2 Timing Limit Stipulations

Species	BLM Casper RMP	USFS TBNG LRMP
	14. Activities in unsuitable habitats within PHMAs will be evaluated under the exception and modification criteria and may be allowed on a case-by-case basis. During lekking (March 1 to May 15) anthropogenic (i.e., human-caused) disturbances, including noise at 10 dB above ambient (not to exceed 20 to 24 dB) to lekking birds, should be restricted from 6 p.m. to 9 a.m. at a distance of 0.6 mile from the perimeter of an occupied lek.	

Source: BLM 2015b, 2007b; USFS 2002.

2.5.2.2 Historic and Culturally Sensitive Areas

Historic Trails

Segments of the Child's Cutoff of the Oregon-California National Historic Trail, the Bozeman Trail, and the Rock Creek to Fort Fetterman Stage Route occur within the CCPA. These historic trails have been identified in the BLM Casper RMP for special management because of their historic quality and the management challenges associated with them. The historic trails consist of a combination of braided linear trail remains and associated sites that form a complex corridor. The historic trail corridors shown on **Figure 2.5-1** include those areas that are known to or are likely to contain remnants of the historic trails and sites. Additionally, the setting, feeling, and association of the landscape surrounding the historic trail corridor are integral to the integrity of the trails. No all-encompassing surveys or evaluations have been completed for these trails; therefore, it is assumed for this alternative that the entire length of the trails are contributing trail segments and that no surface development would be permitted along any of these trails (see BLM Casper RMP Decision 7074 and 7078). Based on these decisions, controlled surface use would be extended from the viewshed foreground out to a maximum of 3 miles or the visual horizon (see BLM Casper RMP Decision 7072).

Pine Ridge

Pine Ridge, which partially intersects with the CCPA, includes a concentration of sites and features that are sensitive for the Native American Tribes (**Figure 2.5-1**). This area has been identified in the BLM Casper RMP for special management because of the sensitive nature of the resources in the area. BLM Casper RMP Decision 5010 establishes requirements for cultural resource inventories. To identify and evaluate properties of traditional cultural and religious significance at the landscape level, Tribal consultation would be required under this alterative for any undertaking within Pine Ridge ***in addition to the inventory requirements in the RMP***.

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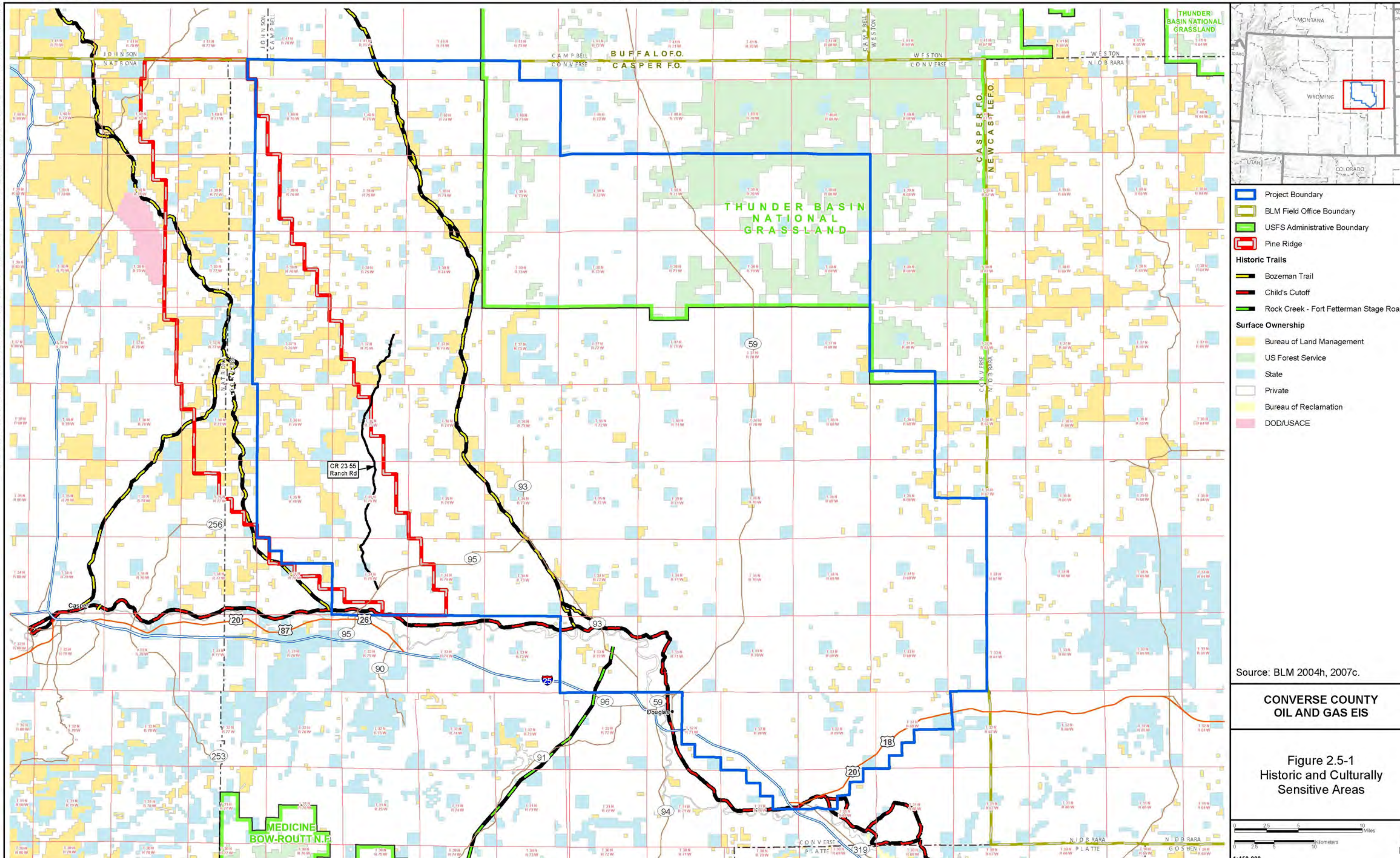

Figure 2.5-1
Historic and Culturally Sensitive Areas

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2.5.2.3 Greater Sage-grouse Priority Habitat Management Areas

As shown in **Figure 2.5-2**, five PHMAs are overlapped by the CCPA per the Approved Resource Management Plan Amendment sage-grouse mapping***, WGFD Core Area Version 4, and the USFS LRMP***. These include the Douglas, North Glenrock, Thunder Basin, Bill, and M Creek PHMAs, which constitute approximately 21.2 percent of the CCPA. Under the Approved Resource Management Plan Amendment, density and disturbance of a proposed action within a PHMA is evaluated using the Density Disturbance Calculation Tool (DDCT) process. New and existing disturbance is not to exceed 5 percent of the DDCT area. Existing disturbance within the Douglas, North Glenrock, and Thunder Basin PHMAs are calculated at approximately 26, 10, and 10 percent disturbance in their respective DDCT areas. The Bill and M Creek PHMAs are calculated at less than 1 percent disturbance within their respective DDCT areas. ***Under Alternative C, surface disturbance would be prohibited within PHMA.*** Further discussion on Greater sage-grouse PHMAs and calculations of the DDCT areas is provided in Section 4.18.

2.5.2.4 Access

Alternative C would result in the construction of 1,262 miles of new roads, which equates to approximately 1 mile of new road per well pad (1,018 miles) and 244 miles of additional primary collector roads. Estimated construction and operational reclamation surface disturbances from roads would be 8,388 and 5,798 acres, respectively.

2.5.2.5 Well Pad Layout and Construction

The entire CCPA would require strictly closed-loop drilling (i.e., no pits would be used and all fluids would be contained in tanks) on federal minerals. The use of pits of any kind including cuttings, hydraulic fracturing, or reserve pits or trenches would be prohibited. At the Notice of Staking/APD stage, the BLM would require all development over federal mineral estate to be located outside of a 0.25-mile setback from occupied dwellings and structures.

2.5.2.6 Pipelines and Mid-stream Facilities

As with Alternative B, the Proposed Action, approximately 50 percent of the oil and gas gathering pipelines would be installed, where feasible, adjacent to or in a common ROW with new or upgraded roads. The greater consolidation of wells onto fewer pads would reduce the need for gas gathering pipelines to 469 miles of gathering lines installed adjacent to existing roads (resulting in 1,705 acres of temporary disturbance) and 469 miles of gathering lines installed cross-country (resulting in 2,842 acres of temporary disturbance). There would still be a need for 315 miles of main trunk pipelines (resulting in 2,864 acres of temporary disturbance).

In addition, prorated installation of oil gathering pipelines would be required through the APD process for all completions and production activities on 50 percent of the well pads. Starting with the first year of development, 10 percent of well pads constructed would be required to install oil gathering pipelines. This would increase incrementally by 10 percent each subsequent year and would remain at 50 percent installation in years 5 through 10. This requirement is unique to Alternative C and would result in 40 percent of the Project development oil transportation infrastructure using buried pipelines.

2.5.2.7 Water Pipelines

Similar to oil gathering pipelines (Section 2.5.2.6), installation of water supply and disposal pipelines would be required through the APD process on 50 percent of the development. This requirement would be prorated the same as oil gathering pipelines, resulting in 40 percent of the Project development water pipelines being buried. A single line could be used for water supply, and the pumping direction would be reversed later to be used for water disposal. This requirement is unique to Alternative C. This assumes that all of the wells on a given pad would be drilled (and completed), and no wells on the pad would be producing until the last well is completed. At this time, the water line pumping direction would be reversed, and the water would be pumped back to the facilities for disposal.

2.5.2.8 Produced Water Management and Disposal

Water disposal volumes per well may range from 30 to 80 percent of completion water as flowback, with an assumed average of 60 percent. At maximum capacity over the life of the well, it is estimated that an average of 1.2 acre-feet (or approximately 9,125 barrels) per year per well would be produced. Actual rates of produced water would be the same as for the Proposed Action. Produced water volumes would decline as wells reach the end of their anticipated life and are plugged and abandoned.

Implementation of water recycling would be required for all completion and production activities on water operations for 50 percent of the well pads. This requirement would be established during the APD process. This requirement would be prorated the same as for oil gathering pipelines (Section 2.5.2.6) and water pipelines (Section 2.5.2.7); 10 percent of the well pads would implement this requirement in the first year, which would increase incrementally by 10 percent each subsequent year and would remain at 50 percent in years 5 through 10. ***Recycling would reduce the demand for freshwater by*** 40 percent. Recycling could be accomplished through the use of water from existing oil and gas wells as a water source for hydraulic fracturing at new wells. Such use could reduce the need for new freshwater from groundwater or surface water sources and could reduce the need to transport water to disposal wells or evaporation ponds. If conditions allow, the operators also may be able to recycle water remaining in the freshwater mud system for use during drilling of additional wells on a pad. Although recycling would reduce the demand for fresh water, water use would be ***up to 26.2*** acre-feet (***203,000*** barrels) per well.

2.5.2.9 Reclamation

Upon completion of construction activities, all disturbed areas not necessary for production would undergo interim reclamation to minimize environmental impacts. On federally managed lands and lands above federal minerals, interim and final reclamation would be required to comply with BLM or USFS policy and land use plan requirements for suitable wildlife habitat (i.e., pre-disturbance baseline conditions). This would equate to approximately 65 percent of the CCPA.

2.5.2.10 Transportation

Transportation-related activities under Alternative C would be the same as under Alternative B due to the same number of wells being drilled under both alternatives. One exception to this is that traffic would be reduced due to the construction of fewer well pads (938 for Alternative C versus to 1,500 for Alternative B). Another exception is that the number of rig moves would increase under Alternative C for those pads located within a non-eagle raptor timing limit stipulation buffer (see Section 2.5.2.1). For purposes of analysis the BLM assumed three rig moves would occur for each well pad located within a non-eagle raptor timing limit stipulation buffer. Since approximately 26 percent of the CCPA is covered by a non-eagle raptor timing limit stipulation buffer (see Section 3.18.2, Raptor subsection), the BLM estimates that there would be approximately 1,425 rig moves, or an average of 1.5 rig moves per pad, during the 10-year development phase.

2.6 Alternatives Considered but Eliminated from Detailed Analysis

Many alternatives or components of alternatives to the proposed Project were considered that were not carried forward for detailed analysis in subsequent chapters of this document. The following sections describe these alternatives or components of alternatives and provide the rationale for eliminating them from further detailed consideration.

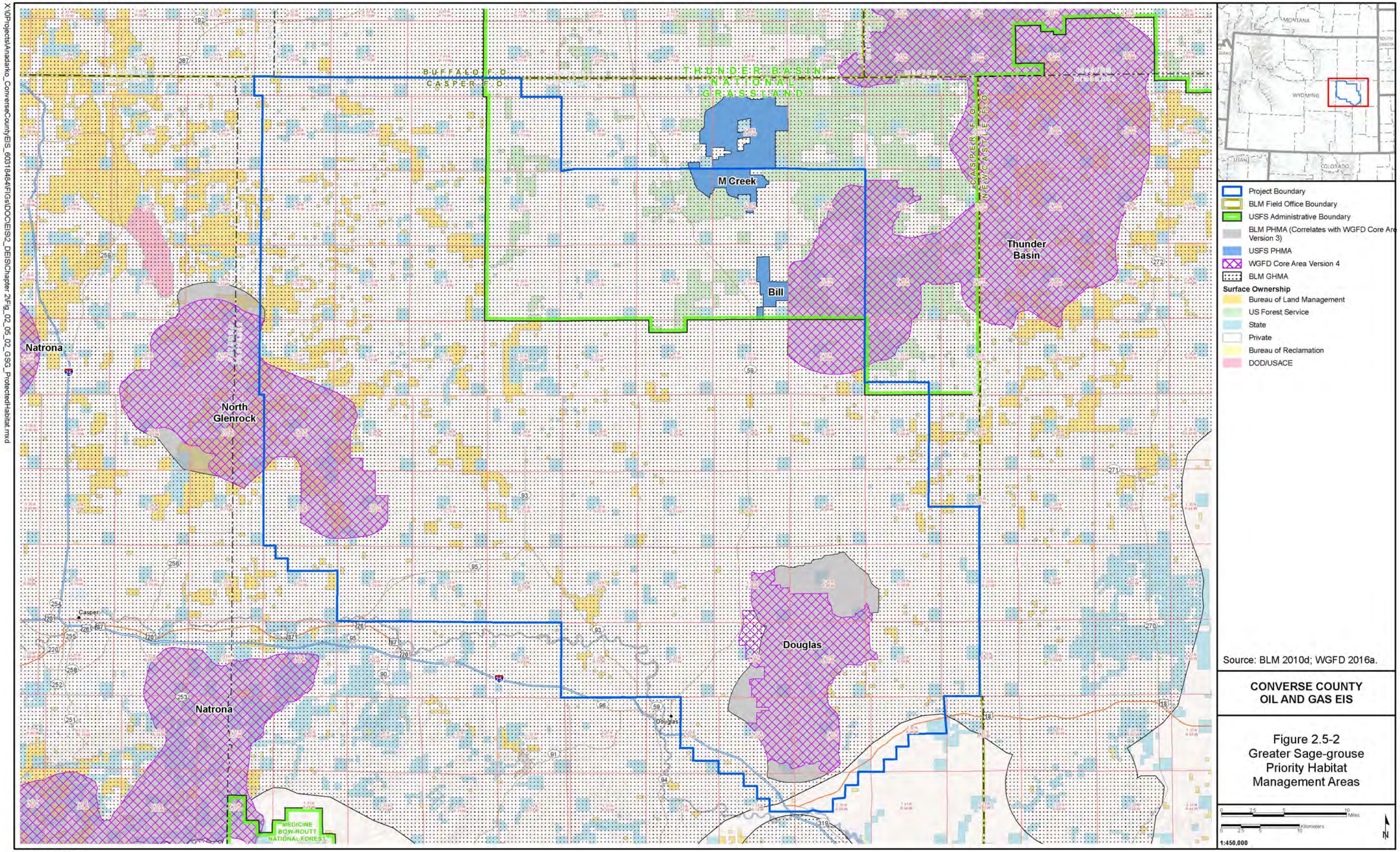

Figure 2.5-2
Greater Sage-grouse Priority Habitat Management Areas

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An action alternative may be eliminated from detailed analysis if:

- It is ineffective (it would not respond to the purpose and need);
- It is not technically or economically feasible (consider whether implementation of the alternative is likely given past and current practice and technology; this does not require cost-benefit analysis or speculation about an applicant's costs and profits);
- It is inconsistent with the basic policy objectives for the management of the area (such as, not in conformance with the land use plan;
- Its implementation is remote or speculative;
- It is substantially similar in design to an alternative that is analyzed; or
- It would have substantially similar effects to an alternative that is analyzed.

2.6.1 No Further Development

Under this alternative, no further development would be allowed in the CCPA. This alternative was eliminated from detailed analysis because it is inconsistent with the basic policy objectives for the management of the area as approved in the Casper RMP. Additionally, this alternative would not meet the purpose and need because it would not honor valid existing lease rights within the CCPA as disclosed under existing NEPA decision documents (Section 2.3.2). The decisions in the existing NEPA documents are not being revisited under this EIS. The No Further Development alternative is frequently mistaken for the No Action Alternative, which is required to be analyzed under NEPA. If the BLM were to deny the OG's proposal for this Project, the No Action Alternative would occur, and development would continue in the CCPA under existing NEPA disclosures. The No Action Alternative is fully analyzed in this document (Section 2.3 and analysis sections in Chapter 4.0).

2.6.2 Bury All Electrical Distribution Lines

Under this alternative, all new and existing overhead electric distribution lines would be buried throughout the CCPA. This alternative was eliminated from further detailed analysis because it is not technically or economically feasible.

Upgrading electric distribution lines as operators explore into unproven areas becomes more expensive and difficult when the electric lines are buried. In remote portions of the CCPA, terrain would make access difficult, increasing installation and continued repair costs. Additionally, upgrades to buried lines would result in additional surface disturbance as the oil and gas field may continue to develop and move into new areas. Finally, the BLM and USFS could enforce such restrictions only on the approximately 10 percent of the federal surface estate within the CCPA.

Although burying of all electrical lines would not be required, it should be noted that USFS Standard Special Uses #1 for the Broken Hills Geographic Area requires burial of all electric utility lines of 33 kV or less and telephone lines. On the remainder of the TBNG within the CCPA, this is a USFS Guideline that may be waived under certain conditions when scenic integrity objectives of the area can be met using an overhead line, burial is not feasible due to geologic hazard or unfavorable geologic conditions, it is not reasonable as determined by a cost-effectiveness analysis, greater long-term site disturbance would result, or it is not technically feasible. It should be noted that the need to bury electrical lines typically addresses a site-specific issue.

2.6.3 Use of Electrical Power for Production

Under this alternative, electrical power would be used exclusively for all proposed production facilities. This alternative was eliminated from further detailed analysis because it is not technically feasible.

Implementation of such an alternative would not be feasible due to the exploratory nature of the proposed development, resulting in uncertainty as to where development would take place.

2.6.4 Balanced Alternative

Under a Balanced Alternative, year-round development activity would be balanced with enhanced protection for important habitats and offer environmental protections while recognizing the rights provided by mineral leasing agreements with the federal government. This alternative was eliminated from further detailed analysis because it would have substantially similar effects as an alternative that is analyzed in detail (Alternative C); therefore, it does not warrant analysis in the EIS as a separate alternative.

2.6.5 Flareless Drilling, Completion, and Production

All flaring during the drilling, completion, and production phases of development would be precluded to manage the natural gas stream. This alternative was eliminated from further detailed analysis because it is not technically feasible, and it is inconsistent with the basic policy objectives for the management of the area. Implementation of this alternative would not be feasible as WOGCC rules allow for flaring during drilling and well construction due to safety concerns related to emergency situations such as over-pressurized equipment or piping. WOGCC rule (Chapter 3.0, Section 39) authorizes use of flaring for emergencies or upset conditions, well purging or evaluation tests, production tests, and low rate gas flow. In addition, in the operations phase of the Project, flaring is used during maintenance procedures and equipment repair. Eliminating flaring during operations would require installation of gas gathering pipelines to all wells prior to completion, which may not be feasible due to the remoteness of the CCPA and the low volumes of gas produced.

2.6.6 Full Resource Protection Alternative

Under a Full Resource Protection Alternative, full recovery of fluid minerals would be allowed with the greatest conservation of the human and natural environment. Surface disturbance would be minimized, development in sensitive habitats would be clustered, and all timing and distance stipulations would be enforced for wildlife. In addition, well pads would be spaced at 4 pads per square mile outside of greater sage-grouse PHMA and 1 pad per square mile inside PHMA, with all well field equipment concentrated at a maximum of 11 sites throughout the CCPA to minimize equipment, traffic, and human activity at well pads and facilitate earlier road reclamation. Development activities would be required to cease if violations of the CAA were to occur. This alternative was eliminated from further detailed analysis because it would be substantially similar to an alternative that was analyzed (Alternative C). Disturbance under Alternative C would be reduced relative to the Proposed Action (Alternative B). Additionally, actions taken to address future violations of the CAA are speculative in nature and do not warrant analysis of a stand-alone alternative.

2.6.7 Greenhouse Gas Reduction Alternative

A Greenhouse Gas (GHG) Reduction Alternative would require carbon-neutral processes (e.g., drilling, hydraulic fracturing, and production activities) and prevent the venting or flaring of methane or other products. It was suggested that this alternative would stipulate that drilling could only proceed if the operator eliminates potential carbon emissions or otherwise secures enforceable offsets that ensure no net increase in carbon emissions. Direct mitigation of methane emissions would be accomplished through a variety of efforts, including but not limited to centralizing liquid gathering systems and liquid transport pipelines, reducing emissions completions/recompletions (i.e., utilizing green completions), utilizing low-bleed/no-bleed pneumatic devices on all new wells, installing dehydrator emission controls, utilizing solar-powered electric pumps in lieu of pneumatic chemical injection pumps, using electric-powered glycol pumps at new production facilities where grid electricity is available (or solar-powered models), replacing high-bleed pneumatics with low-bleed/no-bleed or air-driven pneumatic devices on all existing wells, using electric compression, using plunger lifts or other deliquification technologies for liquids unloading, improving compressor wet seal maintenance/replacement with dry seals, placing vapor recovery units on storage vessels, using pipeline best management practices, mitigating emissions from storage vessels, and installing better leak detection and repair techniques. This alternative was eliminated from further detailed analysis because it is not technically feasible to conduct full carbon-neutral processes. Additionally, venting and flaring are conducted for safety reasons and cannot be fully avoided.

2.6.8 Limit Number of Wells Annually

Under this alternative, the pace of development would be regulated by placing a limit on the number of wells that could be developed in a given year. This alternative was eliminated from further detailed analysis because its implementation is remote or speculative, and it is inconsistent with the basic policy objectives for the management of the area. Although a reduction in the number of wells drilled in a year may result in a reduction in air emissions and a potential reduction in air quality impacts, implementation of such an alternative would be speculative for many reasons. A reduction in the number of wells drilled in a year may not reduce surface disturbance (i.e., the number of pads may not be reduced). Approximately 64 percent of the CCPA is underlain by federal fluid mineral estate; therefore, a limit on the number of wells drilled in a year could not be imposed on approximately one-third of the CCPA. Given the complexities of the number of operators, the number of leases, the number of surface owners, and the size of the CCPA, it is not reasonable to limit the pace of development by selecting which operator(s) can or cannot drill.

2.6.9 Limit Total Number of Wells per Operator

Under this alternative, a set of criterion would be established that would limit the allocation of wells each operator could develop within the CCPA. This alternative was eliminated from further analysis because it would not be consistent with the purpose of the agency action. A reduction in the total number of wells would not address a known resource conflict in the CCPA. Furthermore, the total number of wells proposed is an estimate and does not represent a limit. Approximately 64 percent of the CCPA is underlain by federal mineral estate; therefore, a limit on the total number of wells drilled could not be imposed on approximately one-third of the CCPA. The BLM and USFS do not have the authority to infringe upon existing lease rights by imposing limits on the pace of development or selecting which operator(s) are allowed to drill.

2.6.10 Maximum Development Alternative

Under this alternative, the same number of proposed well pads would be retained (1,500) while assuming operators would drill the maximum number of wells on each pad, resulting in an estimated total of 9,900 wells. This alternative was eliminated from further detailed analysis because implementation of this alternative would be remote or speculative because the rate of development would be roughly twice the rate (almost 1,000 wells per year) of the Proposed Action (Alternative B). The proposed number of wells would exceed the capacity of present and planned support facilities, increasing the speculation, complexity, and uncertainty in the analysis.

2.6.11 No Surface Disturbance on Federal Surface

Under this alternative, no surface development would be allowed on BLM- or USFS-administered surface. This alternative was eliminated from further detailed analysis because it does not address a specific issue or resource concern and would be ineffective because it would apply to only ten percent of CCPA that is federal surface estate.

2.6.12 Phased/Concentrated Development

Development under this alternative would be concentrated in one portion of the CCPA at a time and would advance to another portion of the CCPA once all development activities in the previous area are complete and reclamation has been initiated. Enforcement would be based on social and economic impact criteria and on reclamation goals and objectives. This alternative would minimize impacts to water, air, land, wildlife, and social and economic resources. This alternative was eliminated from further detailed analysis because it is not technically feasible, its implementation is remote or speculative, and it is inconsistent with the basic policy objectives for the management of the area. Due to the exploratory nature of the proposed Project, there is not sufficient information to identify concentrated areas for development, and concentrated development would be impractical given the diverse lease pattern and multiple operators in the CCPA. Phased or concentrated development would delay development of valid existing leases in portions of the CCPA. Additionally, phased or concentrated development could not be implemented on state and private lands that do not overlie federal mineral estate.

2.6.13 Surface Disturbance Cap

Under this alternative, a cap would be put in place to establish the maximum amount of surface disturbance that could occur within the CCPA at any one time. This would be monitored by the BLM to determine when the cap is reached and new development would be put on hold until disturbance areas are reclaimed and released from the cap, allowing new areas to be developed. This alternative was eliminated from further detailed analysis because it is not technically feasible and its implementation is remote or speculative. The size of the CCPA (1.5 million acres), multiple land ownership jurisdictions, and multiple operators and leasing entities make the management of a disturbance cap extremely complex and potentially unworkable. Establishing a clear, comprehensive process for approving and tracking reclamation success over such a large area of substantially varied surface and mineral ownerships would be difficult for the BLM to administer. A disturbance cap could not be implemented on approximately one third of the CCPA that are state lands or private lands that do not overlie federal minerals. Surface use agreements are negotiated between the surface owner and the operator, and the BLM would have no influence in what these agreements say or how they are established; therefore, the BLM would have less control over surface reclamation.

2.6.14 Vertical Development of the CCPA

This alternative was eliminated from further detailed analysis because it is not technically feasible, and it is inconsistent with the basic policy objectives for the management of the area. Under this alternative, all well development would use vertical wells (1 well per pad) for the proposed 5,000 wells. This alternative was eliminated primarily because advances in technology in the past decade have made the development of shale oil and gas using vertical wells much less efficient, and therefore potentially not economical, relative to horizontal wells. This is demonstrated using data from the WOGCC, which shows that the majority of current drilling activity is utilizing horizontal drilling. Additionally, the development of shale oil and gas using vertical wells has a much greater impact on surface disturbance and, similar to the maximum development alternative (Section 2.6.10), would be speculative, complex, and add uncertainty to the analysis.

2.7 Comparison of Alternatives

This section lists impacts of the six non-eagle raptor amendment options (designated as 1, 2, 3, 4, 5, and 6) to the existing raptor stipulations from the Casper RMP (Decision No. 4047) on applicable resources (i.e., migratory birds, and special status species.

Table 2.7-1 is included in the Draft EIS and is not being amended in this supplement. Impacts on raptors from alternatives and ***non-eagle*** raptor amendment options are provided in **Table 2.7-2**.

Table 2.7-1 Disturbance Comparison for All Alternatives (Excluding Existing Condition)

Facility	Size (ROW width [feet] or acres/ facility)	New Surface Disturbance by Alternative					
		Alternative A (No Action)		Alternative B (Proposed Action)		Alternative C	
		Multiplier (number or miles)	Disturbance (acres)	Multiplier (number or miles)	Disturbance (acres)	Multiplier (number or miles)	Disturbance (acres)
Pads							
Well Pads	12 acres	361	4,332	1,500	18,000	938	11,256
Production Pads[1]	5 or 8 acres	20	100	375	3,000	236	1,888
Water Source Well Pad	2 acres	0	0	50	100	50	100
Disposal Well Pads	10 acres	5	50	30	300	30	300
Well Pad Subtotal			4,482		21,400		13,544
Roads							
Well Pad Access Roads[2]	50 feet	386	2,339	1,580	9,576	1,018	6,170
Primary Collector Roads	75 feet	0	0	390	3,545	244	2,218
Roads Subtotal			2,339		13,121		8,388
Construction/Production Facilities							
Gas Plants	100 acres	2	200	2	200	2	200
Oil/Condensate Storage	3 acres	0	0	6	18	6	18
Central Processing Facilities	5 acres	0	0	2	10	2	10
Compression Facilities	5 acres	14	70	50	250	50	250
Equipment/Pipe Storage Yards	50 acres	0	0	1	50	1	50
Electrical Substation	3 acres	0	0	12	36	12	36
Workforce Facility	10 acres	2	20	1	10	1	10
Freshwater Make-up Ponds	8 acres	7	56	30	240	30	240
Water Processing/Recycling Facility	15 acres	1	15	4	60	4	60
Construction/Production Facilities Subtotal			361		874		874

Table 2.7-1 Disturbance Comparison for All Alternatives (Excluding Existing Condition)

Facility	Size (ROW width [feet] or acres/ facility)	New Surface Disturbance by Alternative					
		Alternative A (No Action)		Alternative B (Proposed Action)		Alternative C	
		Multiplier (number or miles)	Disturbance (acres)	Multiplier (number or miles)	Disturbance (acres)	Multiplier (number or miles)	Disturbance (acres)
Linear Facilities							
Gas Gathering Pipelines within Road Disturbance	30 feet	181	658	750	2,727	469	1,705
Gas Gathering Pipelines with New Cross-country Disturbance	50 feet	181	1,097	750	4,546	469	2,842
Oil Gathering Pipelines within Road Disturbance	30 feet	-	-	-	-	188	682
Oil Gathering Pipelines with New Cross-country Disturbance	50 feet	-	-	-	-	188	1,139
Oil and Gas - Main Trunk Pipelines	75 feet	0	0	500	4,545	315	2,864
Water – Temporary Surface Pipelines (aboveground)	0 feet	0	0	900	0	-	-
Water Supply/Disposal Pipelines within Road Disturbance	30 feet	-	-	-	-	188	682
Water Supply/Disposal Pipelines with New Cross-country Disturbance	50 feet	-	-	-	-	188	1,136
Overhead Electrical Distribution along Road	30 feet	181	658	1,350	4,909	844	3,069
Overhead Electrical Distribution Cross-country	30 feet	181	658	150	545	94	342
Linear Facilities Subtotal			3,071		17,272		14,461
Surface Disturbance Summary							
New Surface Disturbance (acres)			10,253		52,667		37,267
CCPA New Disturbance (percent)			0.7		3.5		2.5
Existing Surface Disturbance (acres)			13,819		13,819		13,819
Alternative A (No Action) New Disturbance (acres)			-		10,253		10,253

Table 2.7-1 Disturbance Comparison for All Alternatives (Excluding Existing Condition)

Facility	Size (ROW width [feet] or acres/ facility)	New Surface Disturbance by Alternative					
		Alternative A (No Action)		Alternative B (Proposed Action)		Alternative C	
		Multiplier (number or miles)	Disturbance (acres)	Multiplier (number or miles)	Disturbance (acres)	Multiplier (number or miles)	Disturbance (acres)
Total Surface Disturbance (acres)			24,072		76,739		61,339
Total CCPA Disturbance (percent)			1.6		5.1		4.1

[1] Alternative A (No Action) production pad size assumes 5 acres per pad; Alternatives B and C assume 8 acres/pad.

[2] Assume access road length of 1 mile per well pad.

Table 2.7-2 Impact Comparison by Resource for All Alternatives

Resource	Alternative A (No Action)	Alternative B (Proposed Action)	Alternative C	Additional Discussion
Air Quality and Climate				
Greenhouse Gas (GHG) Emissions (total 10^3 tonne carbon dioxide [CO_2] equivalents [CO_2e]/year in year 10)	11.88	50.44	50.44	Section 4.1; **Appendix A**
Air Quality (exceed NAAQS)	24-hour PM_{10} ***1-hour*** $\boldsymbol{NO_2}$	24-hour PM_{10} 24-hour $PM_{2.5}$ ***1-hour*** $\boldsymbol{NO_2}$	Similar or slightly less than Alternative B	Section 4.1; **Appendix A**
Near-field HAPs (exceed acceptable risk limits)	Yes within 2 km of Gas Plants and Compressor Stations	Yes within 2 km of Gas Plants and Compressor Stations	Yes within 2 km of Gas Plants and Compressor Stations	Section 4.1; **Appendix A**
Visibility (Class I)	N/A	Incremental impacts > 1.0 deciview (dv) at 1 of 15 areas	Similar or slightly less than Alternative B	Section 4.1; **Appendix A**
Visibility (Class II)	N/A	Incremental impacts > 1.0 dv at 3 of 23 areas	Similar or slightly less than Alternative B	Section 4.1; **Appendix A**
Acid Deposition (Class I threshold exceedances)	N/A	Nitrogen exceeded in 3 of 15 areas	Similar or slightly less than Alternative B	Section 4.1; **Appendix A**
Acid Deposition (Sensitive Class II threshold exceedances)	N/A	Nitrogen exceeded in 7 of 23 areas	Similar or slightly less than Alternative B	Section 4.1; **Appendix A**
Cultural Resources, Historic Trails, and Native American Concerns				
Sites potentially encountered (incremental due to new surface disturbance)	101	521	369	Section 4.2
Visual impacts to historic trails (incremental acres visible with structures 60 feet in height or less)	9,886	50,781	35,932	Section 4.2; **Appendix B**
Sites of Native American concern encountered (incremental due to new surface disturbance)	31	160	115	Section 4.2
Geology and Mineral Resources				
Recoverable Oil Resource over 30-year life of the wells (billion barrels)	0.29	1.4	1.4	Section 4.3

Table 2.7-2 Impact Comparison by Resource for All Alternatives

Resource	Alternative A (No Action)	Alternative B (Proposed Action)	Alternative C	Additional Discussion
Recoverable Gas Resources over 30-year life of the wells (trillion cubic feet [Tcf])	1.2	5.9	5.9	Section 4.3
Aggregate used (million tons per year)	0.33	1.7	1.1	Section 4.3
Land Use				
Disturbance to agricultural lands (incremental acres disturbed)	71	360	255	Section 4.5
Disturbance to grazing allotments (incremental acres disturbed)	4,954	33,447	22,689	Section 4.5
Disturbance to Class 3/4 wind potential areas (incremental acres disturbed)	6,562	33,707	23,851	Section 4.5
Disturbance to Class 5/6 wind potential areas (incremental acres disturbed)	3,486	17,907	12,670	Section 4.5
Lands and Realty				
Potential disturbance to federal surface estate potential impacted (acres)	1,025	5,267	3,727	Section 4.6
Range Resources				
Permitted AUMs Lost – BLM	***111***	***573***	***405***	Section 4.9
Permitted AUMs Lost – USFS	***100***	***511***	***362***	Section 4.9
Total Permitted AUMs Lost	***211***	***1,084***	***767***	Section 4.9
Socioeconomics				
Energy Resource Recovery				Section 4.11
Oil (million barrels)	533	1,370	1,370	
Natural Gas (Tcf)	2.4	5.79	5.79	
Employment – peak during development (number of direct, indirect, and induced jobs)	2,200	8,421	Similar to Alternative B but with greater annual variability due to enforcement of timing limitation stipulations.	Section 4.11
Population increase in 3 counties – peak during development (number of residents)	737	9,491	Same as Alternative B	Section 4.11

Table 2.7-2 Impact Comparison by Resource for All Alternatives

Resource	Alternative A (No Action)	Alternative B (Proposed Action)	Alternative C	Additional Discussion
Housing - temporary and permanent demand in Converse County during development (units)	455	5,640	Similar to Alternative B but with a greater need for temporary housing.	Section 4.11
Public School Enrollment - peak increase in 3 counties (number of students)	135	1,158	Same as Alternative B	Section 4.11
Public Sector Revenues for Total for Life of Project (40+ yrs) (millions of 2015 dollars)				Section 4.11
Severance Taxes	1,915	5,109	Same as Alternative B	-
Federal Mineral Royalties	3,114	8,307	Same as Alternative B	-
State Mineral Royalties	90	249	Same as Alternative B	-
Ad Valorem Taxes, counties	373	968	Same as Alternative B	-
Ad Valorem Taxes, schools	1,400	3,621	Same as Alternative B	-
Combined Public Sector Revenues	6,892	18,254	Same as Alternative B	-
Soils				
Water Erodible (incremental acres disturbed)	1,425	7,318	5,178	Section 4.12
Wind Erodible (incremental acres disturbed)	1,930	9,913	7,014	Section 4.12
Droughty Soils (incremental acres disturbed)	4,507	23,149	16,380	Section 4.12
Hydric Soils (incremental acres disturbed)	386	1,985	1,405	Section 4.12
Shallow Depth to Bedrock (incremental acres disturbed)	3	13	9	Section 4.12
Prime Farmland (incremental acres disturbed)	5	26	18	Section 4.12

Table 2.7-2 Impact Comparison by Resource for All Alternatives

Resource	Alternative A (No Action)	Alternative B (Proposed Action)	Alternative C	Additional Discussion
Compaction Prone (incremental acres disturbed)	3,050	15,665	11,084	Section 4.12
Limited Reclamation Potential (incremental acres disturbed)	29	147	104	Section 4.12
Transportation and Access				
New Access Roads (miles)	386	1,970	1,262	Section 4.13
Traffic Volume increase for well development (total number of annual round trips)	N/A	***383,337***	***409,069***	Section 4.13
Vegetation				
Vegetation Type (estimated incremental acres disturbed)				Section 4.14
Grassland	6,795	34,905	24,698	-
Sagebrush shrubland	2,255	11,585	8,197	-
Barren/sparsely vegetated	860	4,418	3,126	-
Conifer	77	394	279	-
Agriculture	70	360	255	-
Developed	70	362	256	-
Wetland/riparian	75	383	272	-
Mixed shrubland	51	260	184	-
Federally Listed Species Habitat (estimated incremental acres disturbed)				
Ute ladies' tresses orchid	41	211	149	Section 4.14; **Appendix E**
Visual Resources				
Visual Resource Management (VRM) Class II areas on BLM Lands (incremental acres disturbed)	49	254	180	Section 4.15
Scenic Integrity Objective (SIO) Moderate Class on USFS Lands (incremental acres disturbed)[1]	24	124	88	Section 4.15
Water Resources				
Total Water Use (acre-feet/year)	1,500	7,000	4,200	Section 4.16; **Appendix E**
Wastewater Disposal (acre-feet per year)				Section 4.16; **Appendix E**
Flowback	858	3,870	1,935	-

Table 2.7-2 Impact Comparison by Resource for All Alternatives

Resource	Alternative A (No Action)	Alternative B (Proposed Action)	Alternative C	Additional Discussion
Produced Water	1,980	5,880	2,940	-
Total Wastewater to be disposed	2,838	9,750	4,875	-
Wildlife Resources				
WGFD Strategic Habitat (estimated incremental acres disturbed)				Section 4.18
Douglas Crucial Habitat Area	177	910	644	-
Ormsby Crucial Habitat Area	1,441	7,402	5,238	-
Thunder Basin Crucial Habitat Area	2,213	11,366	8,043	-
Thunder Basin Enhancement Area	1,857	9,537	6,749	-
Big Game Ranges (estimated incremental acres disturbed)				Section 4.18
Pronghorn Year-long	7,329	37,648	26,640	-
Pronghorn Winter/Year-long	2,781	14,288	10,110	-
Pronghorn Severe Winter Relief	44	228	161	-
Mule Deer Year-long	7,661	39,354	27,847	-
Mule Deer Winter/Year-long	2,556	13,128	9,290	-
White-tailed Deer Winter/Year-long	13	67	48	-
Elk Year-long	269	1,380	976	-
Federally Listed Species Habitat (estimated incremental acres disturbed)				Section 4.18; **Appendix F**
Preble's meadow jumping mouse	31	158	112	-
Black-footed ferret	108	555	393	-
Greater Sage-grouse Habitat (estimated incremental acres disturbed)				Section 4.18; **Appendix F**
PHMA	2,176	11,177	***0***	-
2.0 Mile Lek Buffer	810	4,158	2,942	-
Sagebrush Shrubland Habitat	2,254	11,584	8,197	-

Table 2.7-2 Impact Comparison by Resource for All Alternatives

Resource	Alternative A (No Action)	Alternative B (Proposed Action)	Alternative C	Additional Discussion
Migratory Birds - Raptors				
Relative Effects from LUP Non-eagle Raptor Amendment Options		***Option 1: Lowest impact*** ***Option 2: Highest impact*** ***Options 3, 4, 5, and 6: Less than Option 2 but greater than Option 1*** ***Option 6: Cap of 98 well pads to receive TLS relief***		***Section 4.18.2.2***

[1] There are no lands classified as SIO High with***in*** the CCPA.

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3.0 Affected Environment

3.1 Air Quality and Climate

3.1.1 Overview

Air quality within the CCPA has the potential to be affected by such activities as emissions from the construction and operation of oil and gas well sites, facilities, access roads, and other elements of management activities. Regional air quality also is affected by natural events such as windstorms and wildfires. These natural events generally are short lived, lasting from several hours to several days or weeks. The effects during these events may impact human health and the environment, and generally are considered part of the natural and physical environment. This section describes the current air quality and climate trends of the region and the applicable regulations that would apply to the Project.

3.1.2 Regulatory Framework

The CAA of 1970 (42 USC 7401 et seq.), as amended in 1977 and 1990, is the primary federal statute that regulates air pollution. Provisions of the CAA potentially relevant to the Project include:

- National Ambient Air Quality Standards (NAAQS)
- New Source Review
- Federal Operating Permits Program
- New Source Performance Standards
- National Emission Standards for Hazardous Air Pollutants
- Conformity Requirements
- Greenhouse Gas (GHG) Tailoring Rule and Reporting Rule

In addition to federal regulations, the CAA provides states with the authority to regulate air quality within state boundaries. The State of Wyoming has enacted additional Wyoming Ambient Air Quality Standards (WAAQS) and air quality regulations that have permitting requirements for sources operating within the state.

3.1.2.1 National and State Ambient Air Quality Standards

The federal CAA requires all states to control air pollution emission sources so that NAAQS are met and maintained.

The NAAQS establishes maximum acceptable concentrations for criteria pollutants including nitrogen dioxide (NO_2), carbon monoxide (CO), sulfur dioxide (SO_2), particulate matter with an aerodynamic diameter of 10 microns or less (PM_{10}), particulate matter with an aerodynamic diameter of 2.5 microns or less ($PM_{2.5}$), ozone, and lead. The NAAQS are established by the USEPA and as outlined in 40 CFR 50. In addition to the federal criteria pollutants, WAAQS also establish maximum acceptable concentrations of hydrogen sulfide (H_2S), fluoride, and suspended sulfates. Given the extremely low levels of lead, H_2S, floride, and SO_2 emissions from potential Project sources, lead, H_2S, floride, and suspended sulfate standards are not addressed further in this analysis.

NAAQS and WAAQS represent the maximum allowable atmospheric concentrations that may occur to protect public health and welfare and include a reasonable margin of safety to protect the more sensitive individuals in the population. The objective for all areas is to meet the NAAQS, which are promulgated by the USEPA and apply nationwide. An area that does not meet the NAAQS is designated as a nonattainment area on a pollutant-by-pollutant basis. As of spring 2016, the areas potentially impacted by the Project currently are in attainment for all criteria pollutants. Applicable NAAQS and WAAQS are presented in **Table 3.1-1**.

Table 3.1-1 Applicable Ambient Air Quality Standards

Pollutant[1] (Units)	Averaging Period	Ambient Air Quality Standards	
		National[2]	Wyoming[3]
Ozone	8-hour[4]	0.070 parts per million (ppm)	0.070 ppm
NO_2	1-hour[5]	100 parts per billion (ppb) or 188 $\mu g/m^3$	100 ppb or 189 $\mu g/m^3$
	Annual[6]	53 ppb or 100 $\mu g/m^3$	53 ppb or 100 $\mu g/m^3$
CO	1-hour[7]	35 ppm or 40,000 $\mu g/m^3$	35 ppm or 40,000 $\mu g/m^3$
	8-hour[7]	9 ppm or 10,000 $\mu g/m^3$	9 ppm or 10,000 $\mu g/m^3$
SO_2	1-hour[8]	75 ppb or 196.5 $\mu g/m^3$	75 ppb or 196.5 $\mu g/m^3$
	3-hour[9]	0.5 ppm or 1,300 $\mu g/m^3$	0.5 ppm or 1,300 $\mu g/m^3$
PM_{10} (micrograms per cubic meter [$\mu g/m^3$])	24-hour[9]	150	150
	Annual[6]	--[10]	50
$PM_{2.5}$ ($\mu g/m^3$)	24-hour[11]	35	35
	Annual[12]	12	12

1 Due to the lack of an identified regional issue for lead, H_2S, floride, and suspended sulfate these standards will not be analyzed as part of this study.
2 Source: USEPA 2015a.
3 Source: WDEQ 2014e.
4 The 3-year average of the fourth-highest daily maximum 8-hour average measured at each monitor within an area over each year must not exceed this standard. This standard was updated from previous standard of 0.075 ppm on October 1, 2015 (USEPA 2015c,d).
5 The 3-year average of the 98th percentile of the daily maximum 1-hour average is not to exceed this standard.
6 Not to be exceeded.
7 Not to be exceeded more than once per year.
8 The 3-year average of the 99th percentile of the daily maximum 1-hour average must not exceed this standard.
9 Not to be exceeded more than once per year on average over 3 years.
10 The annual PM_{10} NAAQS of 50 $\mu g/m^3$ was revoked by USEPA on September 21, 2006; see FR Volume 71, Number 200, October 17, 2006.
11 Three-year average of the 98th percentile of the 24-hour concentrations at each population-oriented monitor within an area must not exceed this standard.
12 Three-year average of annual mean must not exceed this standard.

New Ozone Standard

On October 1, 2015, USEPA reduced the NAAQS for ozone from 0.075 ppm to 0.070 ppm based on extensive scientific evidence regarding ozone effects on public health and welfare (USEPA 2015c). As of spring 2016, attainment designations were based on the previous 0.075 ppm standard, but the lower standard could change some attainment area designations, especially those where attainment is based on ozone monitoring values above 0.070 ppm. According to USEPA (2015d), designating areas is typically is a 2-year process, and in some cases, it may take 3 years. Final designations will utilize future air quality data (i.e., 2014-2016 data), and USEPA plans to issue new guidance to facilitate the designation process in the near future. The statutory deadline for final area designations by USEPA is October 1, 2018 (USEPA 2017). Thus, the attainment designation of some counties may change in the near future due to the new ruling.

3.1.2.2 New Source Review

The New Source Review requires stationary sources of air pollution to obtain permits before construction. A source may have to meet one or more of the following permitting requirements:

- Prevention of Significant Deterioration (PSD) permits: required for new major sources or major sources making a major modification in an attainment area.
- Nonattainment New Source Review permits: required for new major sources or major sources making a major modification in a nonattainment area.
- Minor source permits.

New Source Review is pollutant-specific; therefore, it is important to note that a single stationary source may have requirements under all three programs for different pollutants. The Project is not expected to trigger major source permitting requirements under the PSD or Nonattainment New Source Review programs for any pollutant; however, it likely would require minor new source permits. Wyoming New Source Review policy is found in Chapter 6, Section 2 of the Wyoming Air Quality Standards and Regulations (WDEQ 2014e).

Prevention of Significant Deterioration Review

PSD regulations, which restrict the degree of ambient air quality deterioration allowed in areas that meet the NAAQS, apply to proposed new or modified major stationary sources located in an attainment area that have the potential to emit criteria pollutants in excess of predetermined de minimis values (40 CFR Part 51). As defined in 40 CFR 51, a source is a major stationary source if it:

- Can be classified in one of the 28 named source categories listed in Section 169 of the CAA, and it emits or has the potential to emit 100 tons per year (tpy) or more of any pollutant regulated by the CAA; or
- Is any other stationary source that emits or has the potential to emit 250 tpy or more of any pollutants regulated by the CAA (USEPA 1990).

Allowable deterioration to air quality can be expressed as the incremental increase to ambient concentrations of criteria pollutants, also referred to as a “PSD increment.” The PSD increments for criteria pollutants are based on the PSD classification of the area. Class I area status is assigned to federally protected wilderness areas and allows the lowest amount of permissible deterioration. Class I areas allow the lowest amount of air quality increment consumption, while Class II designations allow higher increment consumption. There are no designated Class III or heavy industrial use areas in the Project area.

A project’s PSD increment consumption typically is determined through the use of an air quality model. Atmospheric concentrations of NO_2, SO_2, PM_{10}, and $PM_{2.5}$ predicted by the air quality model are compared with allowable PSD increments. The allowable PSD increments for Class I and Class II areas are provided in **Table 3.1-2**. The CCPA is shown in **Figure 3.1-1** relative to designated Class I and Class II areas, as well as undesignated areas (which are evaluated relative to Class II increments) within the CAMx 4-kilometer (km) modeling domain. If conducted for a NEPA analysis, a comparison of project impacts to PSD increments does not represent an official regulatory PSD increment consumption analysis because:

- Increment consumption is not evaluated for regulatory purposes under NEPA; and
- An official increment consumption analysis requires a special set of emissions data not typically available as part of a NEPA analysis.

Table 3.1-2 USEPA Allowable PSD Increments for Class I and Class II Areas

PSD Class	Pollutant	Allowable Increment (µg/m³)		
		Annual Arithmetic Mean	24-hour Maximum	3-hour Maximum
Class I	NO_2	2.5	-	-
	SO_2	2	5	25
	PM_{10}	4	8	-
	$PM_{2.5}$	1	2	-
Class II	NO_2	25	-	-
	SO_2	20	91	512
	PM_{10}	17	30	-
	$PM_{2.5}$	4	9	-

Source: USEPA 1991.

Nonattainment New Source Review

Nonattainment New Source Review is required for new major sources or major modifications of existing sources in nonattainment areas. As of fall 2016, the areas potentially impacted by the Project currently are in attainment for all criteria pollutants; therefore, Nonattainment New Source Review does not apply.

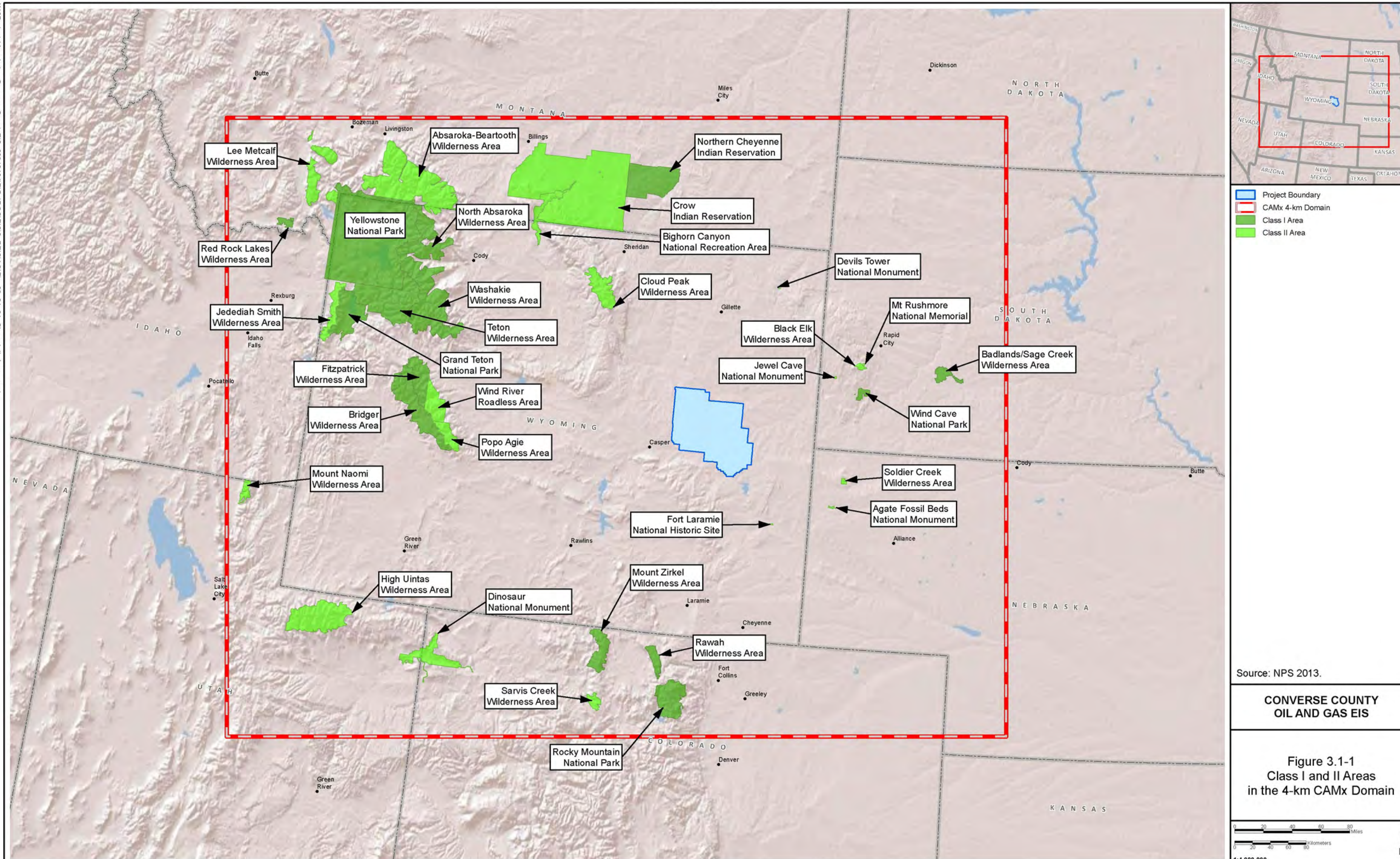
Minor New Source Review

The minor New Source Review permitting program regulates pollutants from sources that do not require PSD or Nonattainment New Source Review permits. The purpose of minor New Source Review permits is to prevent the construction of sources that would interfere with attainment or maintenance of a NAAQS or violate the control strategy in nonattainment areas. Also, minor New Source Review permits often contain permit conditions to limit the sources' emissions to avoid the need for PSD analysis or Nonattainment New Source Review. The Wyoming minor source permitting program does not include de minimis emission levels below which facilities or projects are exempted from permitting.

3.1.2.3 Federal Operating Permits Program

A Title V operating permit is required for all major stationary sources under the Federal Operating Permits Program outlined in 40 CFR Part 70 of the CAA. Whether a source meets the definition of "major" depends on the type and amount of air pollutants it emits and, to some degree, on the overall air quality in its vicinity. Generally, major sources are industrial facilities and large commercial operations, which include stationary facilities that emit 100 tpy or more of a regulated air pollutant including compounds such as oxides of nitrogen (NO_X), CO, SO_2, PM_{10}, $PM_{2.5}$, and volatile organics. Major sources of toxic air pollutants (i.e., any source that emits more than 10 tpy of an individual toxic air pollutant or more than 25 tpy of any combination of toxic air pollutants) also are covered under the Federal Operating Permits Program.

The proposed Project is not expected to be a major source with respect to the Federal Operating Permits Program; therefore, a Title V operating permit would not be required.



CONVERSE COUNTY OIL AND GAS EIS

Figure 3.1-1 Class I and II Areas in the 4-km CAMx Domain

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3.1.2.4 Wyoming Air Quality Standards and Regulations

The Project would be required to comply with applicable Wyoming Air Quality Standards and Regulations, including those pertaining to New Source Review outlined in Section 3.1.2.2 and those that specify fugitive dust control requirements. Specifically, Wyoming Air Quality Standards and Regulations Chapter 3, Section 2(f)(i)(A) requires that sources operating within the State of Wyoming control fugitive dust emissions. Approved control measures for minimizing fugitive dust from construction/demolition activities (i.e., clearing or leveling of land, earthmoving, excavation, or movement of trucks or construction equipment over access haul roads or cleared land) may include watering and/or chemical stabilization.

3.1.2.5 New Source Performance Standards

The regulation of new sources was an important step taken by the CAA. New Source Performance Standards apply to all new, modified, or reconstructed sources within a given category, regardless of geographic location or the existing ambient air quality. The standards define emission limitations that would be applicable to a particular source group. The New Source Performance Standards 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 IIII – Standards of Performance for Stationary Compression Ignition Internal Combustion Engines
- Subpart JJJJ – Standards of Performance for Stationary Spark-Ignition Internal Combustion Engines
- Subpart OOOO – Standards of Performance for Crude Oil and Natural Gas Production, Transmission, and Distribution

3.1.2.6 National Emission Standards for Hazardous Air Pollutants

Under the National Emission Standards for Hazardous Air Pollutants, the USEPA promulgated Maximum Achievable Control Technology (MACT) standards pursuant to Section 112 of the 1990 CAA Amendments, and these rules are provided in 40 CFR 63. The MACT standards potentially applicable to the Project include:

- Subpart A – General Provisions
- Subpart HH – Oil and Natural Gas Production Facilities
- Subpart HHH – Natural Gas Transmission and Storage Facilities

3.1.2.7 Conformity for General Federal Actions

Established under the CAA (Section 176(c)(4)), the General Conformity Rule plays an important role in helping states and tribes improve air quality in those areas that do not meet the NAAQS (i.e., nonattainment areas). Under the General Conformity Rule, federal agencies must work with state, tribal, and local governments in a nonattainment or maintenance area to ensure that federal actions conform to the air quality plans established in the applicable state or tribal implementation plan.

The CCPA is in an area that is in attainment for all pollutants; therefore, the Project would not be subject to General Conformity requirements.

3.1.2.8 Greenhouse Gas Reporting and Tailoring Rules

GHGs include carbon dioxide (CO_2), methane (CH_4), nitrous oxide, and several halogenated compounds. While GHGs are naturally occurring in the atmosphere, anthropomorphic (human-caused) activity is adding to the levels of GHGs. Their status as a pollutant is not related to toxicity, but to the long-term impacts they may have on climate due to increased levels in the earth's atmosphere. GHGs do not have applicable ambient standards or emission limits under the major environmental regulatory programs described above because they are non-toxic and non-hazardous at normal ambient concentrations.

On October 30, 2009, the USEPA issued the reporting rule for major sources of GHG emissions (40 CFR Part 98). The rule requires a wide range of sources and source groups to record and report selected GHG emissions. Various oil and gas operations are required to monitor and report GHG emissions under this regulation.

On June 3, 2010, the USEPA issued the *Prevention of Significant Deterioration and Title V Greenhouse Gas Tailoring Rule*. The rule provides criteria to determine which stationary sources become subject to permitting requirements for GHG emissions under the PSD and Title V programs of the CAA. The rule is based on calculation of carbon dioxide equivalents (CO_2e), which factors into the global warming potential of each GHG and normalizes this to an equivalent of CO_2 emissions. Under the rule, facilities are required to obtain PSD permits if they are new facilities with GHG emissions of at least 100,000 tpy CO_2e or existing facilities with at least 100,000 tpy CO_2e that are making changes resulting in increased GHG emissions by at least 75,000 tpy CO_2e. Facilities seeking to obtain a PSD permit for other regulated pollutants also must address GHG emissions increases of 75,000 tpy CO_2e or more. New and existing sources with GHG emissions above 100,000 tpy CO_2e also must obtain operating permits.

On June 23, 2014, the Supreme Court ruled that the USEPA lacked the authority to require PSD and Title V Permits based on the CO_2e emissions thresholds for sources that would not otherwise require such a permit. This ruling will prompt regulatory changes that will impact future permitting actions; interim guidance is available to provide direction with regard to current permitting actions (USEPA 2014b), and a proposed rule has been provided for public comment (USEPA 2016a).

The USEPA rules do not require any controls or establish any standards related to GHG emissions for minor sources.

3.1.3 Criteria and Hazardous Air Pollutants

Many air quality regulations consider both existing (i.e., background) air quality conditions, recent trends, and the impact of a development on those conditions. An understanding of the current conditions and trends also provides a baseline for comparison of potential future impacts. Recent trends in air quality (e.g., frequency and length of periods of elevated concentrations) are important to consider when evaluating potential future changes, independent of an individual project.

The following discussion describes current conditions and trends for criteria air pollutants as well as Hazardous Air Pollutants (HAPs), and it concludes with a discussion of the current attainment status in the vicinity of the CCPA.

3.1.3.1 Criteria Air Pollutants

To determine existing air quality conditions within the CCPA, recent measurements of criteria pollutants were analyzed using data obtained from the USEPA Air Quality System (USEPA 2014c) for six WDEQ monitoring stations as identified in **Table 3.1-3**. The locations of these monitoring stations are shown relative to the CCPA in **Figure 3.1-2**.

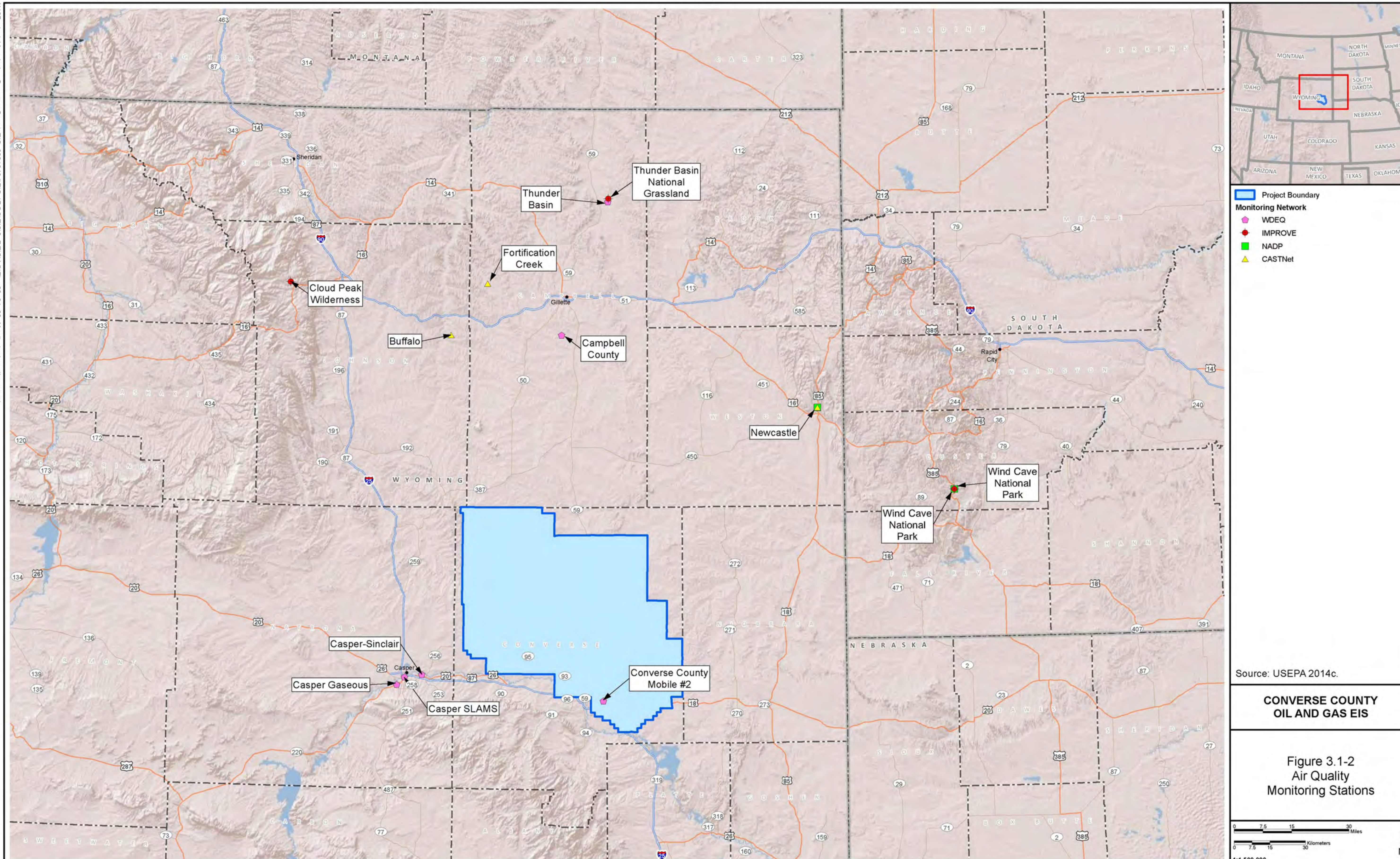

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Figure 3.1-2
Air Quality
Monitoring Stations

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Table 3.1-3 Criteria Pollutant Monitoring Stations

Station Name	Station ID	Wyoming County	Pollutants Analyzed	Latitude (degrees)	Longitude (degrees)	Distance to Center of CCPA (km)
Thunder Basin[1]	56-005-0123	Campbell	NO_2, $PM_{2.5}$, ozone	44.652	-105.29	173
Campbell County	56-005-0456	Campbell	NO_2, PM_{10}, ozone	44.147	-105.53	116
Casper-Sinclair	56-025-2601	Natrona	NO_2, SO_2, ozone	42.861	-106.236	66
Casper SLAMS	56-025-0001	Natrona	PM_{10}, $PM_{2.5}$	42.851	-106.325	73
Converse County Mobile #2	56-009-0801	Converse	NO_2, ozone	42.767	-105.304	40
Casper Gaseous	56-025-0100	Natrona	NO_2, ozone	42.822	-106.365	78

1 The $PM_{2.5}$ data at this monitor likely did not use Federal Reference Method/Federal Equivalent Method. It is considered by Air Quality System to be “valid data that does reasonably match the FRM with or without correction, but not to be used in NAAQS decisions” (USEPA 2014d).

Existing conditions and air quality trends are discussed in more detail for each criteria pollutant in the following subsections. The monitoring data obtained from the Air Quality System are not necessarily in the statistical form required for comparison to the NAAQS or WAAQS (e.g., Air Quality System gives the 98th or 99th percentile for each year rather than the 3-year average required for NAAQS or WAAQS). Therefore, the analyses presented below are not directly comparable to the NAAQS or WAAQS but show recent air quality and indicate whether background values in the vicinity of the CCPA are near NAAQS or WAAQS thresholds. Air quality data provided in the statistical form of the NAAQS or WAAQS are referred to as design concentrations.

Ozone

Ozone monitors chosen for the analysis include data collected at five monitoring stations. **Figure 3.1-3** shows the fourth highest 8-hour average ozone concentration for each reporting year at each station. The Thunder Basin and Campbell County stations reported occasional values above the 0.070 ppm standard over the past 10 years. The 3-year average of the fourth-highest daily maximum 8-hour concentration (the form of the standard) for Thunder Basin during 2006, 2007, and 2008 is exactly 0.070 ppm, but the concentrations appear to be lower during subsequent years. As discussed in Section 3.1.2.1, current attainment designations are based on the previous 0.075 ppm standard, and the exceedance occurred while this previous standard was in effect. According to USEPA (2015d), designating areas is typically a 2-year process (and in some cases 3). Final designations would utilize future air quality data (i.e., 2014 to 2016 data), and the USEPA plans to issue new guidance to facilitate the designation process in the near future. There does not appear to be any discernable trends over the past decade.

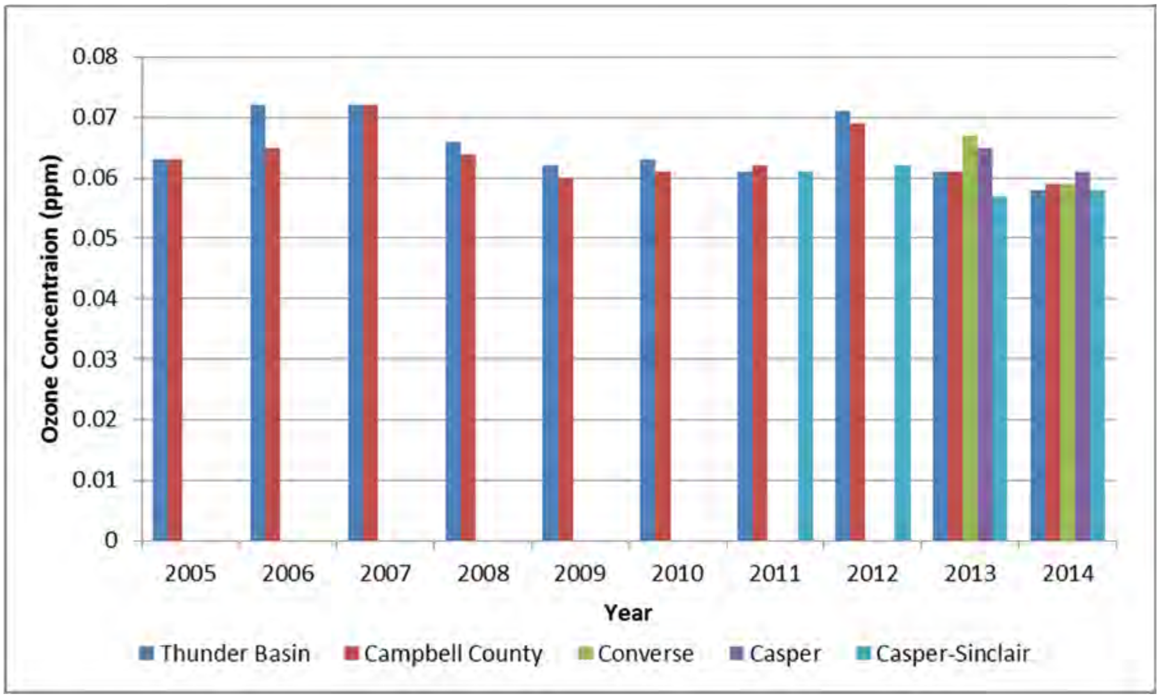


Figure 3.1-3 Fourth Highest 8-hour Average Ozone Levels

<u>NO_2</u>

Figure 3.1-4 shows the maximum 98th percentile 1-hour NO_2 concentration in a given year at five monitoring stations in the vicinity of the CCPA. All sites analyzed have concentrations well below the 1-hour and annual NO_2 standard (**Table 3.1-1**). There are no discernable trends in NO_2 concentrations.

<u>CO</u>

No air quality monitoring stations within the region routinely monitor CO and it is not expected to be an air quality concern in the region.

<u>SO_2</u>

The Casper-Sinclair station began collecting data in July 2011, and during the period from July through December 2011 only 55 percent of the collected data was valid. However, high data capture was achieved in 2012, 2013, and 2014.

Figure 3.1-5 shows the 1-hour annual maximum SO_2 concentrations for 2011 through 2014 and indicates upward trend in SO_2 concentrations. These maximum monitored concentrations are well below the NAAQS and WAAQS thresholds of 75 ppb and 500 ppb (**Table 3.1-1**).

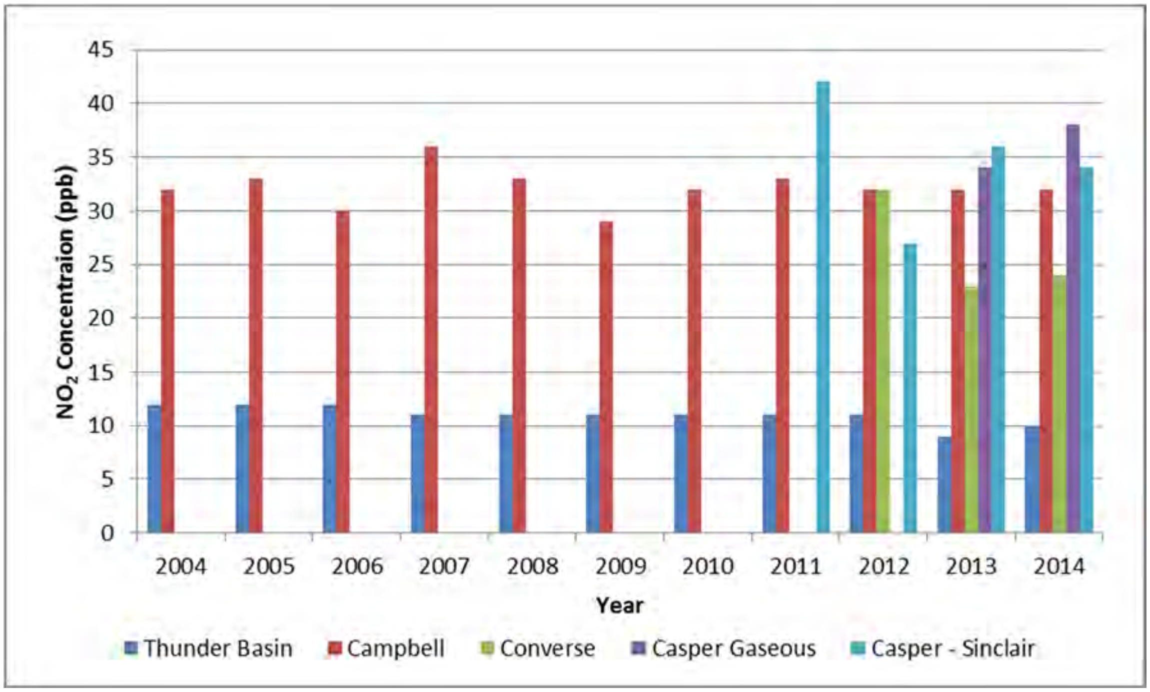


Figure 3.1-4 98th Percentile of the Daily Max 1-hour NO_2 Values

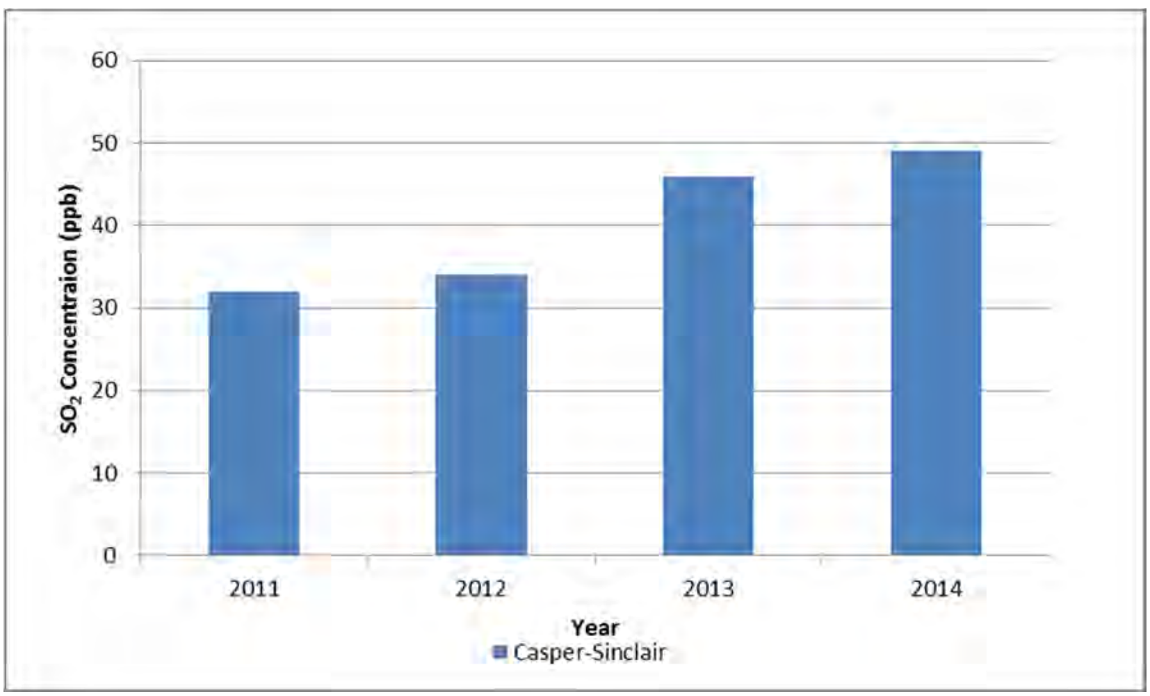


Figure 3.1-5 Maximum Daily 1-hour SO_2 Values at Casper-Sinclair Station

<u>PM_{10}</u>

While there are several PM_{10} monitoring stations in the vicinity of the CCPA, most of these stations are industrial in nature and are not intended for regional background purposes. Three stations were chosen for this analysis. **Figure 3.1-6** shows the maximum 24-hour average PM_{10} concentrations for each year since 2003, which are all below the 150 µg/m^3 NAAQS and WAAQS threshold (**Table 3.1-1**). **Figure 3.1-7** shows annual mean concentrations of PM_{10}, which are all below the 50 µg/m^3 threshold. No trends are discernible.

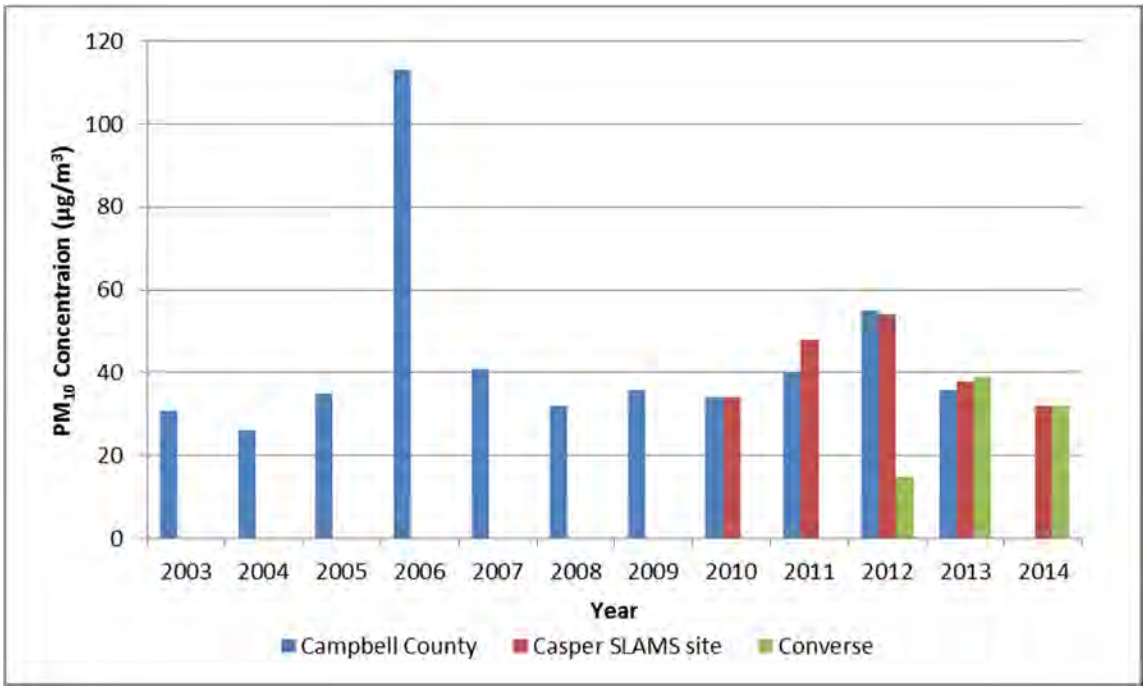


Figure 3.1-6 Second Maximum 24-hour PM_{10} Values

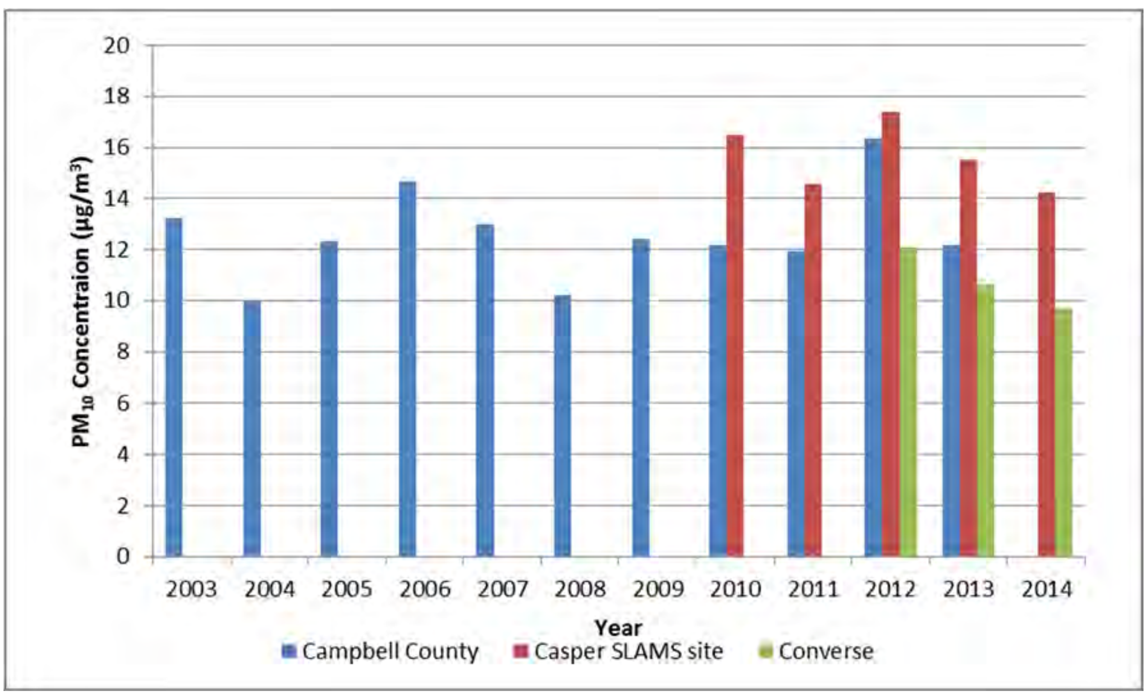


Figure 3.1-7 Annual PM_{10} Arithmetic Average Concentrations

PM2.5

Figure 3.1-8 shows the 98th percentile 24-hour concentration for each year at the Thunder Basin and Casper SLAMS monitoring stations. All values are below the 35 µg/m³ NAAQS and WAAQS threshold (**Table 3.1-1**). **Figure 3.1-9** shows the annual average $PM_{2.5}$ concentration for each year of the record. All of these values are well below the 12 µg/m³ standard. There are no discernable trends in the $PM_{2.5}$ concentrations.

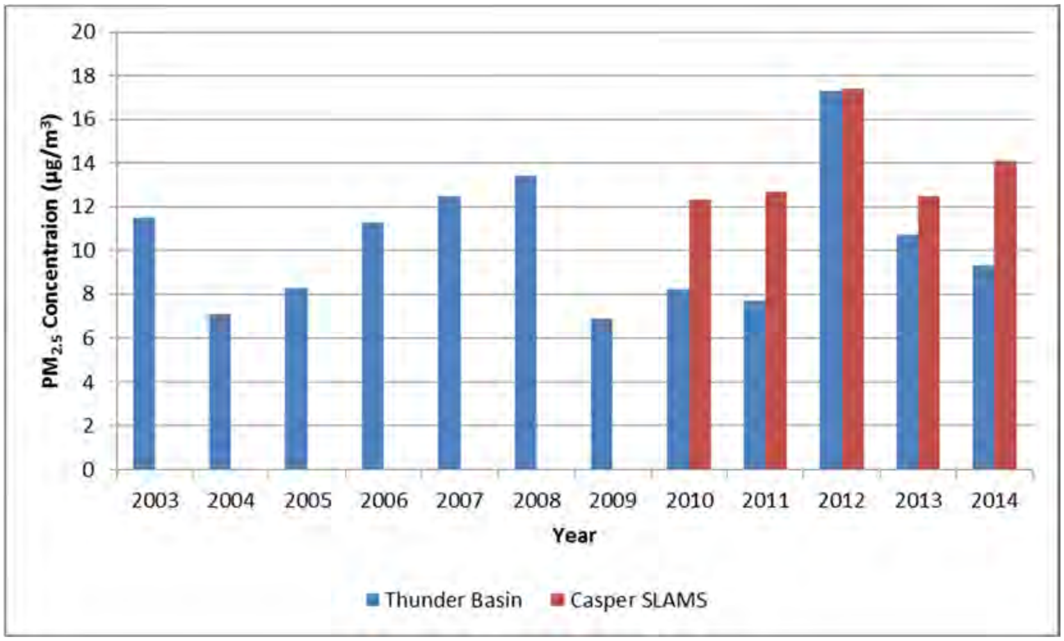


Figure 3.1-8 98th Percentile 24-hour $PM_{2.5}$ Values

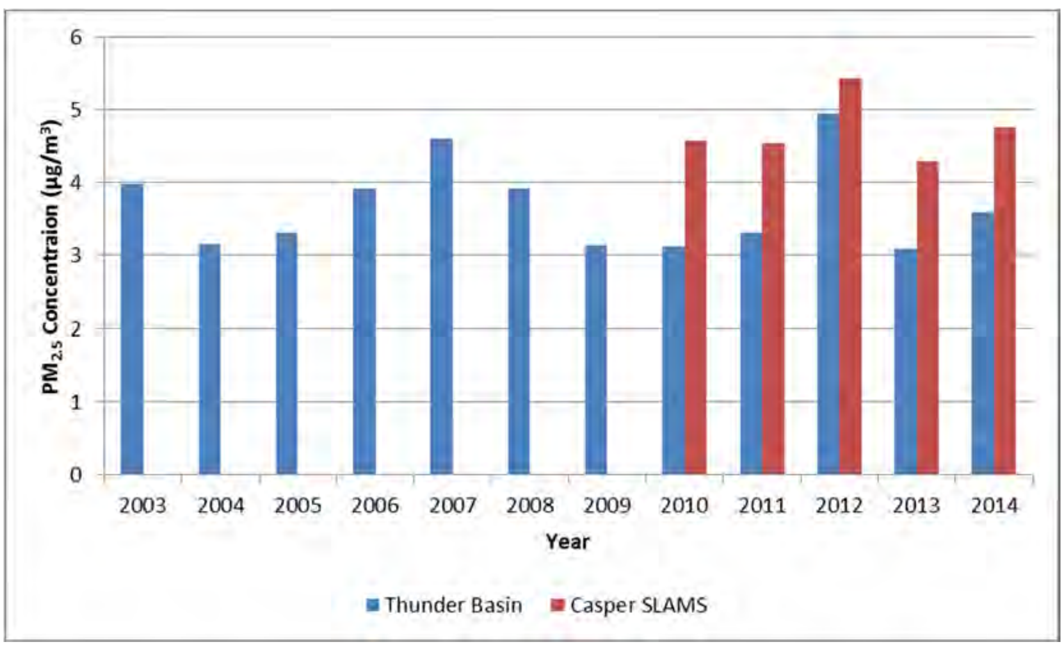


Figure 3.1-9 Annual Average $PM_{2.5}$ Concentrations

3.1.3.2 Hazardous Air Pollutants

In addition to criteria pollutants, HAPs can cause serious health effects or adverse environmental or ecological effects. While there are many types of HAPs, those commonly emitted from similar projects include benzene, toluene, ethyl-benzenes, xylene, n-hexane, and formaldehyde. Although these HAPs are associated with anthropogenic (human-caused) emissions sources, concentrations of HAPs are not measured in the region and there is no data available to assess the current concentrations or trends.

3.1.3.3 Air Quality Attainment Status

USEPA has designated the area surrounding the CCPA as in attainment for all criteria pollutants. The data shown in Section 3.1.3.1 are consistent with attainment designations. The closest nonattainment area is for PM_{10} in Sheridan, Wyoming, which is greater than 200 miles north of the CCPA. The nearest nonattainment areas for ozone include Upper Green River Basin, Wyoming (approximately 330 miles from the CCPA) and the Fort Collins-Denver-Boulder-Greeley-Loveland, Colorado area (greater than 220 miles from the CCPA).

3.1.4 Air Quality Related Values

Air quality related values (AQRVs) are a metric used to assess impacts to other resources sensitive to air quality, including vegetation, soils, water, fish, wildlife, and visibility. Federal Land Managers (FLMs) such as the NPS, BLM, and USFS track and manage AQRVs. The New Source Review permitting program (described in Section 3.1.2.2) includes an analysis of impacts to AQRVs as a component of all PSD permit applications. Impacts to AQRVs can include changes in visibility or atmospheric deposition of pollutants to soil and bodies of water. For example, to assess atmospheric deposition impacts to sensitive waterbodies, the change in the acid neutralizing capacity (ANC) of sensitive lakes is evaluated as an AQRV assessment.

Under the PSD program, areas are classified as three categories: Class I, Class II, and Class III. Special protection via the Class I designation is given to those areas Congress has designated as special national or regional areas of natural, scenic, recreational, or historic value. PSD Class I designation allows the lowest amount of permissible deterioration. Class II designations allow a higher level of increment consumption relative to Class I areas, and Class III applies to heavy industrial use areas. There are no designated Class III areas in the U.S. Any areas not classified as Class I or Class II are treated as Class II for evaluation purposes.

PSD Class I and other sensitive Class II areas are located within the vicinity of the CCPA (**Figure 3.1-1**). The closest PSD Class I area is Wind Cave National Park, which is approximately 100 miles northwest of the CCPA.

FLMs review the issuance of any PSD permits required under the New Source Review program to evaluate any impacts that exceed established thresholds for AQRVs. Similarly, the potential impacts on AQRVs would be assessed and disclosed for this Project as part of the NEPA process regardless of the applicability of the New Source Review rule. The monitoring stations within the vicinity of the CCPA that collect data useful for assessment of AQRVs are listed in **Table 3.1-4** and shown in **Figure 3.1-2**.

Table 3.1-4 AQRV Monitoring Station Information

Network/Station Name	Station ID	County	Values Analyzed	Latitude (degrees)	Longitude (degrees)	Distance to Center of CCPA (km)
IMPROVE						
Thunder Basin National Grassland	THBA1	Campbell, Wyoming	Speciated $PM_{2.5}$, Visibility	44.663	-105.287	175
Cloud Peak Wilderness Area	CLPE1	Johnson, Wyoming	Speciated $PM_{2.5}$, Visibility	44.334	-106.956	175
Wind Cave National Park	WICA1	Custer, South Dakota	Speciated $PM_{2.5}$, Visibility	43.558	-103.484	179
National Atmospheric Deposition Program						
Wind Cave National Park	WNC429	Custer, South Dakota	Wet deposition	43.558	-103.484	179
Newcastle	WY99	Weston, Wyoming	Wet deposition	43.873	-104.192	142
CASTNet						
Newcastle	NEC602	Weston, Wyoming	Dry deposition	43.873	-104.192	142

Source: IMPROVE 2014a,b,c; National Atmospheric Deposition Program 2015a,b; USEPA 2015b.

3.1.4.1 Visibility

Regional haze is visibility impairment caused by the cumulative air pollutant emissions from numerous sources over a wide geographic area. Visibility impairment is caused by particles and gases in the atmosphere that scatter, distort, or absorb light. The primary cause of regional haze in many parts of the country is light scattering resulting from fine particles (i.e., $PM_{2.5}$) in the atmosphere. Additionally, coarse particles between 2.5 and 10 microns in diameter can contribute to light extinction. Coarse particles and $PM_{2.5}$ can be naturally occurring or the result of human activity. The natural levels of these species result in some level of visibility impairment, in the absence of any human influences and vary with season, daily meteorology, and geography (Malm 1999).

The USEPA and other agencies have been monitoring visibility in national parks and wilderness areas since 1988. Observations have shown that visibility is impaired relative to natural background conditions. In 1999, the USEPA issued a Regional Haze Rule to protect visibility in over 150 national parks and wilderness areas. The Regional Haze Rule requires states to establish Reasonable Progress Goals for improving visibility, with the overall goal of attaining natural background visibility conditions by 2064.

Visibility impacts are expressed in deciviews (dv), a numeric value describing perceived changes in visibility. Deciview values are calculated from either measured or estimated light extinction values in units of inverse megameters. A small dv value indicates a pristine atmosphere.

Visibility near the CCPA was assessed using the three closest visibility monitoring stations operated by the IMPROVE program as listed on **Table 3.1-4**. Visibility (in dv) for the 20 percent best days, 20 percent worst days, and annual average visibility are shown in **Figure 3.1-10** for these three IMPROVE stations over the period from 2003 to 2013. Thunder Basin National Grassland does not have data for 2003 and from 2006 through 2011.

FLMs have estimated natural background visibility conditions for Wind Cave National Park; a federally designated Class I area. Natural background visibility conditions are not available for Thunder Basin

National Grassland and Cloud Peak Wilderness Area because they are not federally designated Class I areas. The three IMPROVE monitoring stations are all located in similar geographic regions away from large population centers; therefore, it is expected that Thunder Basin National Grassland and Cloud Peak Wilderness Area have similar natural background visibility conditions as Wind Cave National Park. For Wind Cave National Park, the estimated natural background visibility conditions for the 20 percent best and 20 percent worst days are 2.1 dv and 7.2 dv, respectively.

As shown in **Figure 3.1-10**, the most recent 20 percent best days generally have visibility values less than 6 dv, while the 20 percent worst days typically have visibility values greater than 8 dv. When comparing the visibility measured at Wind Cave National Park over the period 2002 to 2013 to the estimated natural background conditions, both the 20 percent worst and 20 percent best days are higher than natural background conditions.

3.1.4.2 Deposition

The effects of atmospheric deposition of nitrogen and sulfur compounds on terrestrial and aquatic ecosystems are well documented and have been 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. The effects of acidification are not as wide spread in the western U.S. relative to the eastern U.S. because sulfur deposition tends to be lower in the western U.S. In areas of lower deposition, nitrogen enrichment effects are often observed prior to the onset of acidification effects. However, high elevation aquatic ecosystems in the west, including those in Wyoming, can still be sensitive to acidification, to which both nitrogen and sulfur deposition contribute.

The Federal Land Manager's Air Quality Guidance (FLAG) (2010) recommends that applicable sources assess impacts of nitrogen and sulfur deposition at Class I areas. To address this guidance, nitrogen and sulfur deposition impacts attributable to this Project were assessed at Class I areas and sensitive Class II areas. Project-specific and cumulative modeled results were compared to critical load thresholds to assess total deposition impacts. The National Park Service (NPS) has developed critical load values for its Class I areas, as shown in **Table 3.1-5**. In addition, **Table 3.1-5** presents the critical loads for potential ecoregions within the other Class I areas and sensitive Class II areas.

Background total nitrogen and sulfur deposition data are collected at the National Atmospheric Deposition Program National Trends Network (wet deposition) and CASTNet (dry deposition) monitoring locations near Wind Cave National Park in South Dakota and Newcastle, Wyoming. The most recent available background nitrogen and sulfur deposition data for monitoring year 2013 are shown in **Table 3.1-6**. The average annual wet deposition values from these stations for nitrate, sulfate, and ammonium are shown in **Figure 3.1-11** for the period from 2003 through 2013.

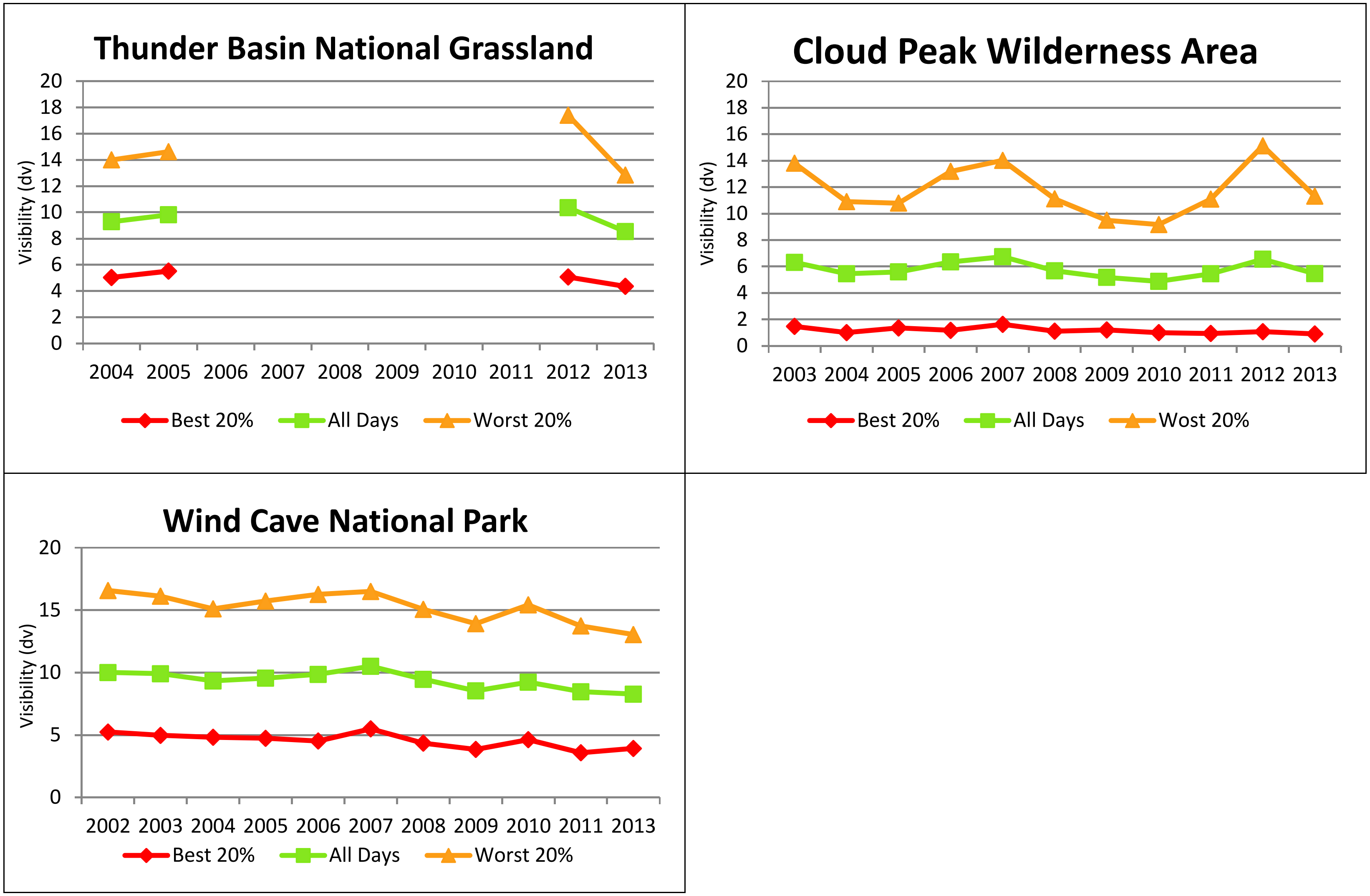


Figure 3.1-10 Visibility for the 20 percent Best Days, 20 percent Worst Days, and All Days

Table 3.1-5 Critical Load Values for NPS Class I areas and Ecoregions near CCPA

NPS Unit	Ecoregion	Critical Load (kilograms per hectare per year)											
		Maximum Total Nitrogen Deposition	Forest		Herbaceous Plants		Lichen		Mycorrhizal Fungi		Nitrate Leaching	
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Grand Teton National Park	Northwestern Forested Mountains	7.8	4	17	4	10	2.5	7.1	5	10	4	17
Rocky Mountain National Park	Northwestern Forested Mountains	12	4	17	4	10	2.5	7.1	5	10	4	17
Wind Cave National Park	Northwestern Forested Mountains	5.3	4	17	4	10	2.5	7.1	5	10	4	17
Yellowstone National Park	Northwestern Forested Mountains	6.8	4	17	4	10	2.5	7.1	5	10	4	17
	North American Deserts	2.7	NA	NA	3	8.4	3	3	NA	NA	NA	NA
	Northwestern Forested Mountains	6.8	4	17	4	10	2.5	7.1	5	10	4	17
	Great Plains	5.1	NA	NA	5	25	NA	NA	12	12	10	25
	Temperate Sierras	4.2	NA	NA	NA	NA	4	7	NA	NA	NA	NA

NA = Not available.

Source: NPS 2014.

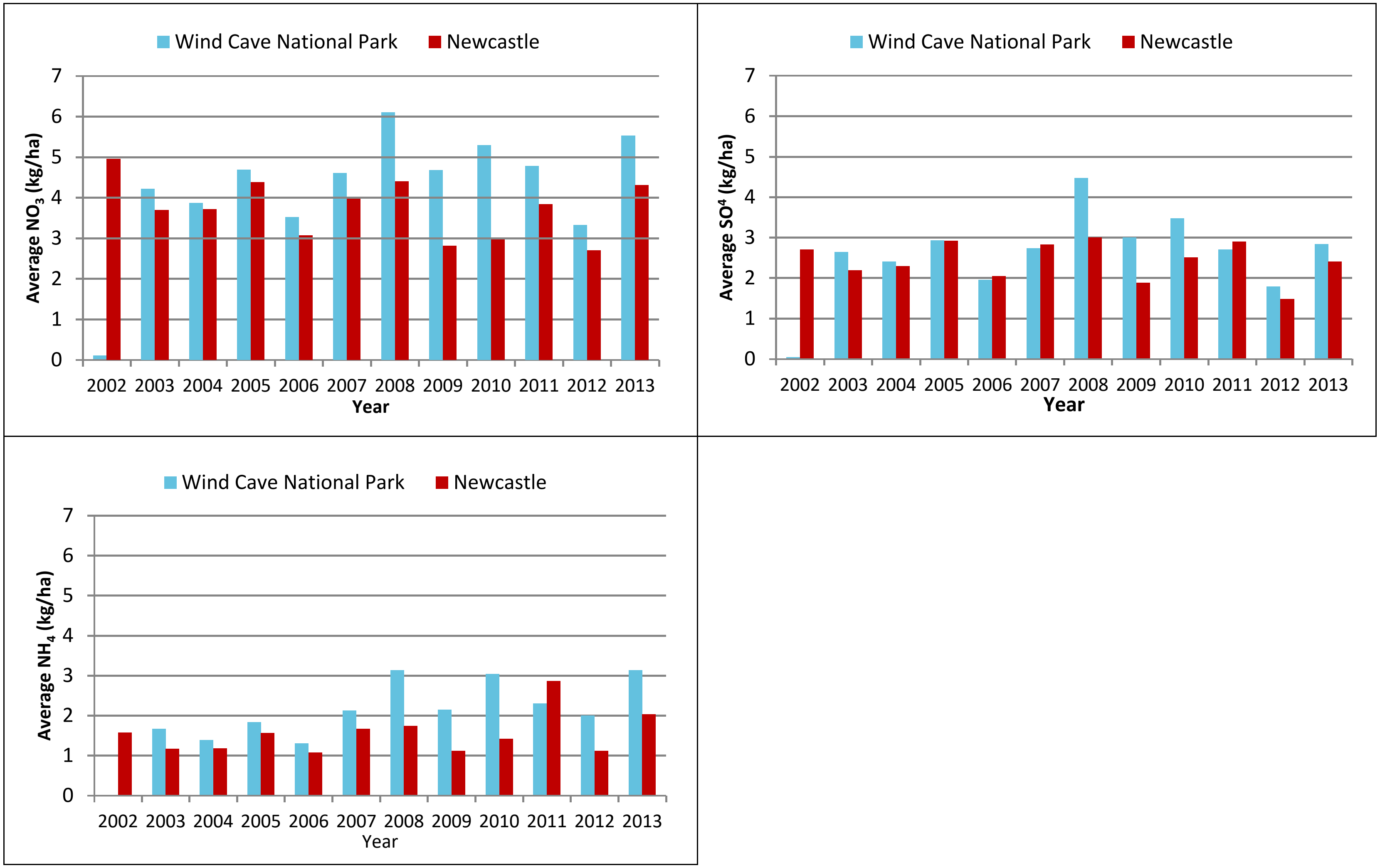


Figure 3.1-11 Annual Average Wet Deposition of Nitrate, Sulfate, and Ammonium for National Atmospheric Deposition Program Stations

Table 3.1-6 Background Nitrogen and Sulfur Deposition Values for 2013

Station Location	Deposition (kilograms per hectare per year)			
	Nitrogen		Sulfur	
	Wet[1]	Dry[2]	Wet[1]	Dry[2]
Wind Cave National Park, South Dakota	5.53	0.906	2.84	0.195
Newcastle, Wyoming	4.31	-	2.41	-

[1] National Atmospheric Deposition Program 2015a, 2015b.

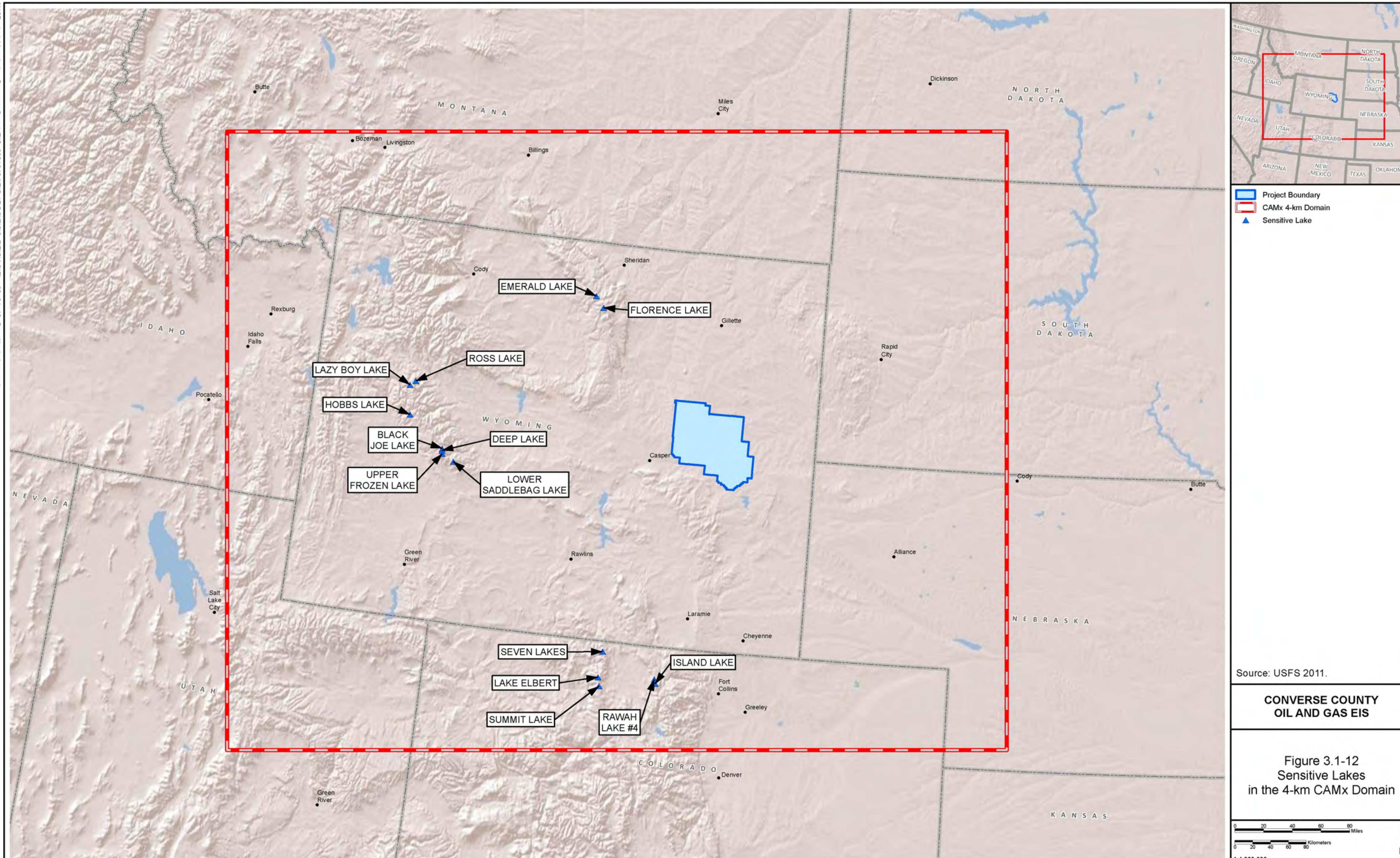
[2] USEPA 2015b.

The most recent ANC values available (as of November 2014) and the number of samples used in the calculation of the lowest 10th percentile ANC values are provided in **Table 3.1-7**. **Figure 3.1-12** shows the location of the lakes relative to the 4-km CAMx domain. Of the 14 lakes analyzed, only Upper Frozen Lake is considered to be extremely sensitive to atmospheric deposition by the USFS because the background ANC is less than 25 microequivalent/liters (µeq/L).

Table 3.1-7 Background ANC Values for Acid Sensitive Lakes

Wilderness Area	Lake	Latitude (Deg-Min-Sec)	Longitude (Deg-Min-Sec)	10th Percentile Lowest ANC Value Reported (µeq/l)	Number of Samples
Bridger	Black Joe	42º44'22”	109º10'16”	70.6	72
Bridger	Deep	42º43'10”	109º10'15”	61.1	62
Bridger	Hobbs	43º02'08”	109º40'20”	69.8	76
Bridger	Lazy Boy	43º19'57”	109º43'47”	27.8	1
Bridger	Upper Frozen	42º41'13”	109º09'39”	13.2	3
Cloud Peak	Florence Lake	44º20'53”	107º10'50”	70.0	40
Cloud Peak	Emerald Lake	44º27'26”	107º18'11”	34.4	42
Fitzpatrick	Ross	43º22'41”	109º39'30”	54.0	55
Mount Zirkel	Lake Elbert	40º38'3”	106º42'25”	52.0	61
Mount Zirkel	Seven Lakes	40º53'45”	106º40'55”	39.9	18
Mount Zirkel	Summit Lake	40º32'43”	106º40'55”	48.0	102
Popo Agie	Lower Saddlebag	42º37'24”	108º59'38”	55.5	54
Rawah	Island	40º37'38"	105º56'28"	71.9	25
Rawah	Rawah Lake #4	40º37'38"	105º56'28"	41.5	24

Source: USFS 2011.



Source: USFS 2011.

CONVERSE COUNTY OIL AND GAS EIS

Figure 3.1-12
Sensitive Lakes
in the 4-km CAMx Domain

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3.1.5 Current Climate and Trends

Current climate data for the CCPA is disclosed in Section 3.1.5.1. While a climate data analysis is an indicator of current and near future meteorology in a particular region, it does not provide an indication of anticipated future changes in climate due to outside phenomenon (i.e., anthropogenic forcing or natural long-term climate cycles). Future potential climatic changes are addressed in Section 3.1.5.2.

3.1.5.1 Regional Climate

The climate in the region is characterized as arid, with cold winters and moderate summers. The Cooperative weather station in Douglas, Wyoming (COOP ID 482685) provides representative current climate conditions in the CCPA. Common climatological measurements for this station were obtained from the ***Western Regional Climate Center (***WRCC***)***. Monthly typical temperatures are provided on **Table 3.1-8** and precipitation and snow data are provided on **Table 3.1-9.** Wind data for this station was not available, so a wind rose showing typical wind conditions was developed using data from the National Weather Service Automated Surface Observing System station at Douglas, Wyoming (**Figure 3.1-13**). Primary wind flow is from the northwest and southeast.

Note that the timeframe for the temperature/precipitation record only extends as far back as 1996 as data were not available before then. Generally, climate "normals" are determined from the most recent 30 years of a meteorology station data record. While both datasets contain enough information to assess current climate and weather behaviors (i.e., typical wind patterns, precipitation, etc.), this short timeframe must be considered when applying these values to potential future weather conditions. The earth has had episodes of extreme drought, cold, and warmth not captured in this brief record, and climate models indicate that climate is rapidly changing due to anthropogenic activity.

3.1.5.2 Climate Change and Greenhouse Gases

The following sections summarize the existing climatic conditions, anticipated regional climate trends, climate change effects, as well as local, regional and national GHG emissions. Effects of the Project on climate change and GHG gases are addressed in Sections 4.1 and 5.3.1.

<u>Current and Future Climate Trends</u>

The Intergovernmental Panel on Climate Change (IPCC) reports that since 1750, the largest contribution to total radiative forcing is caused by the increase in atmospheric concentration of CO_2 (IPCC 2018). In addition, "the atmospheric concentrations of CO_2, CH_4, and nitrous oxide have increased to levels unprecedented in at least the last 800,000 years. CO_2 concentrations have increased by 40 percent since pre-industrial times, primarily from fossil fuel emissions and secondarily from net land use change emissions" (IPCC 2018). While the earth has experienced many episodes of warming and cooling in the past, the IPCC recently concluded that the recent warming of the climate system is very unique when compared to those past episodes. Additionally, most of the observed increases in global average temperatures since the mid-20th Century are due to the observed increase in anthropogenic GHG concentrations (IPCC 2018). Anthropogenic activities can influence climate; therefore, it is important to understand the potential impact of those activities.

Table 3.1-8 Monthly Typical Temperature for Douglas, Wyoming

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean Temperature (degrees Fahrenheit [°F])	24.8	26.5	35.0	43.3	53.1	63.1	70.6	68.7	57.4	45.1	33.4	24.2	45.5
Average Maximum Temperature. (°F)	39.0	40.5	48.2	57.3	67.5	78.3	86.7	85.2	73.5	60.2	47.3	37.5	60.2
Average Minimum Temperature (°F)	10.5	12.6	21.9	29.4	38.6	47.9	54.6	52.2	41.4	29.9	19.4	10.9	30.9

Source: WRCC 2014***a***.

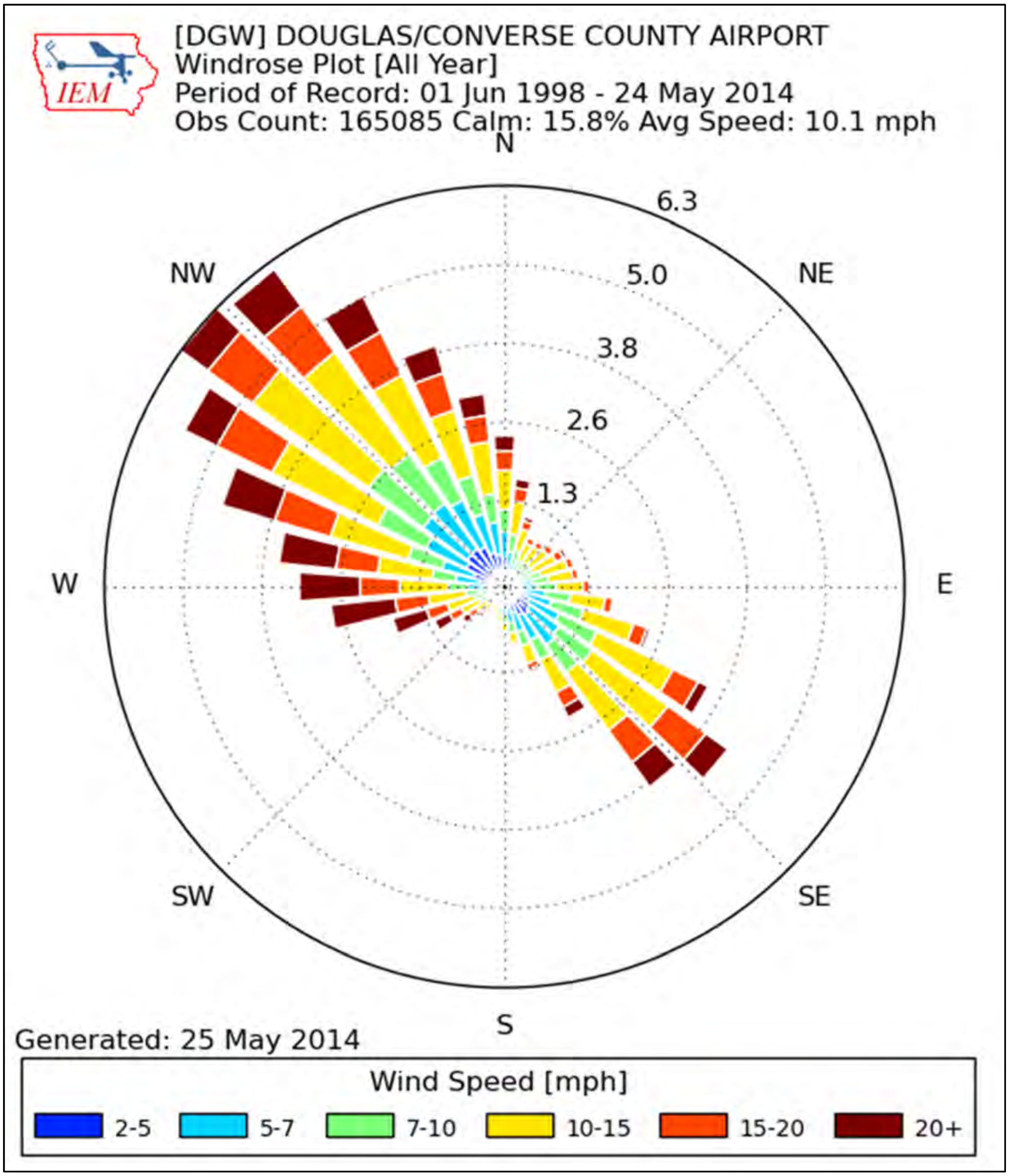
Note: Period of record: 1996 through 2010. Data were not collected for 1981-1996.

Table 3.1-9 Precipitation and Snow Statistics for Douglas, Wyoming

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Precipitation (inches)	0.5	0.6	0.9	1.8	2.4	1.8	1.3	1.1	1.2	1.3	0.6	0.5	13.9
Average Total Snowfall (inches)	6.6	7.9	8.7	8.8	1.7	0.2	0	0	0.6	3.2	6.1	7.6	51.3
Average Snow Depth (inches)	2	2	1	0	0	0	0	0	0	0	1	2	1

Source: WRCC 2014***c***.

Note: Period of Record: 4/1/1909 to 3/31/2013. Percent of possible observations for period of record: 53.7 percent for snowfall and 15.3 percent for snow depth



Source: Iowa Environmental Mesonet 2014.

Figure 3.1-13 Wind Rose from Douglas, Wyoming

Climate assessments are often performed by comparing recent meteorological conditions to past meteorological conditions. There are numerous indications that the climate is changing. According to the National Climate Assessment (Melillo et al. 2014), U.S. average temperatures have increased by 1.3 degrees Fahrenheit (°F) to 1.9°F since record keeping began in 1895 with most of this increase occurring after 1970. Additionally, according to the National Oceanic and Atmospheric Administration Climate Prediction Center (NOAA 2018), from 1890 to 2006, global mean surface temperatures increased nearly 1.8°F across land and ocean surface areas. The 2017 average global temperature was 1.51°F (0.84°C) higher than the twentieth-century average of 57.0°F (13.9°C). This makes it the third-warmest year on record behind 2016 (warmest) and 2015 (second warmest) (NOAA 2018). Average temperature changes are likely to be greater in the Northern Hemisphere according to the climate models. Since 1900, Northern latitudes (above 24°N) temperatures have increased by nearly 2.1° F since 1900, and 1.8°F since 1970 alone.

In addition, the American Meteorological Society (AMS) also produces annual State of the Climate Reports (Bissoli et al. 2018). According the 2017 AMS report, the annual average temperature in 2017 for the contiguous United States (CONUS) was 12.5°C , which is 1.0°C above the 1981–2010 average and is the third warmest year since records began in 1895. The annual CONUS temperature over the 123-year period of record is increasing at an average rate of 0.1°C per decade, with the trend increasing since 1970 to 0.3°C per decade (Bissoli et al. 2018). For the CONUS, 10 months of 2017 were warmer than their respective 1981–2010 average. Additionally, the annual CONUS precipitation total is increasing at an average rate of 4.3 mm decade (Bissoli et al. 2018).

The Northwestern Plains Rapid Ecoregional Assessment (SAIC 2012) performed a higher resolution future climate change analysis for the Northwestern Plains Ecoregion, which encompasses the CCPA. This analysis utilized a high CO_2 emission global climate model scenario in conjunction with a regional climate model to obtain more spatially refined climate change model projections than what can be obtained directly from a global climate model. This assessment projected a 1.9 to 2.3 °F temperature increase across most of the northeastern quadrant of Wyoming by the year 2060. Precipitation and snow water equivalent are expected to increase moderately in spring, decrease moderately in summer, and remain relatively unchanged annually by mid-century.

For Wyoming, temperatures in western Wyoming are expected to increase by 0.25 to 0.40°F per decade, while temperatures in surrounding locations in Utah, Wyoming, and Colorado are expected to increase by 0.40 to 1.2°F per decade (Bissoli et al. 2018). Precipitation across western Wyoming is expected to decrease by 0.1 to 0.6 inch per decade with the largest decrease expected in southwestern Wyoming. In general, the eastern portions of the state are expected to get warmer and wetter (Bissoli et al. 2018). The National Climate Assessment (Shafer et al. 2014) suggests that impacts across Wyoming will include at least a 5°F to 6°F temperature increase over the next century, and an increase in the maximum number of dry days and extreme events, such as exacerbated flooding and extended droughts.

Similar to the Northwestern Plains Rapid Ecoregional Assessment, the USGS in cooperation with the BLM, also produced the report entitled the Wyoming Basin Rapid Ecological Assessment (Carr and Melcher 2017). This report provides projections of future climatic changes, while cautioning that there are uncertainties about future greenhouse gases and global climate models in general. Based on the analysis, the USGS analysis generally agrees with the IPCC determination that global temperatures are expected to increase, although the magnitude and consequences of warming are uncertain. Summers are projected to warm more than the rest of year. No statistically significant changes in precipitation are predicted in the Wyoming Basin, but winters may be wetter and summers likely drier.

<u>Environmental and Ecological Changes Due to Climate Changes</u>

The climate changes outlined in the previous section will affect all aspects of Wyoming ecosystems (URS 2010). For example, the changes in the timing and quantity of snowmelt would affect both aquatic species and agricultural needs (USEPA 2016). An earlier snowmelt means that peak stream flow would be earlier and weeks before the peak needs of ranchers, farmers, recreationalists, and others. Plus, in late summer, rivers, lakes, and reservoirs would be drier (USEPA 2016). More frequent, more severe, and possibly longer-lasting droughts are expected to occur, which would increase particulate matter in the air as drier, less vegetated soils experience wind erosion. Additionally, drier conditions would reduce the range and health of ponderosa and lodge pole pine forests and increase the susceptibility to fire. Shifts in vegetative communities could threaten plant and wildlife species. Grasslands and rangelands could expand into previously forested areas (USEPA 2016).

Projected and documented broad-scale changes within ecosystems of the U.S. are summarized in the Climate Change Supplemental Information Report (URS 2010). The report states that the large-scale changes in climate have already occurred. These changes will likely continue to impact a wide range of species along with the timing of the seasons and animal migrations (URS 2010). For example, multiple bird species now migrate north earlier in the year as the arrival of spring is an average of 10 days to 2 weeks earlier through much of the U.S. compared to 20 years ago. Fires, insect epidemics, disease pathogens, and invasive weed species have increased, and these trends are likely to continue. Changes in timing of precipitation and earlier runoff are contributing to increased fire risks. Insect epidemics and the amount of damage that they may inflict have also been on the rise. The combination of higher temperatures and dry conditions have contributed to increased insect populations such as pine beetles, which have killed trees on millions of acres in western U.S. and Canada. Warmer winters allow beetles to survive the cold season, while drought weakens trees, making them more susceptible to mortality due to insect attack (URS 2010).

<u>Climate Change Effects on Air Quality</u>

Increased temperatures due to climate change can have an impact on air quality as well. While research has been conducted regarding how meteorological conditions affect air quality, the relationship is complex because pollutants chemically interact with each other and pollution is highly dependent on local conditions such as local topography, wind conditions, and the vertical structure of the lower atmosphere.

According to the National Climate Assessment (Melillo et al. 2014), there is high confidence that climate warming has the potential to decrease background surface ozone on a global scale. However, high CH_4 ***levels can offset this decrease, raising background surface ozone. It is estimated that by year 2100, background surface ozone would increase by approximately 8 ppb (which would be 25 percent of current background levels) relative to scenarios with small*** CH_4 ***changes. Increases in surface ozone have been documented during heat wave episodes (Peterson et al. 2014). Research also has shown ozone concentrations are strongly dependent on temperature (Weaver et al. 2009). As drought and duration of heat waves increase, ozone concentrations are likely to increase in the region.***

Additional air pollution challenges include PM emissions from forest fires, which are likely to increase due to a longer fire season and higher temperatures that allow for drying out of vegetation (Peterson et al. 2014). Windblown dust from lack of vegetation also may occur. Such events will lead to more common exceptional air quality events and overall decreased air quality in the region. While such events may increase PM emissions by altering natural sources (i.e., forest fires and vegetation), PM is removed from the air through precipitation. Precipitation

patterns also are expected to change; therefore, the confidence behind overall future PM impacts is still relatively low.

In addition to air quality impacts, a variety of other environmental and ecological impacts are likely as well. Examples include alterations in snowmelt affecting streamflow, decreases in soil moisture, alterations in vegetation species and animal migrations, insect epidemics and overall increased stress on ecosystems. These are outlined in Section 5.3.1.6.

It also is important to note that many of the projected changes associated with climate change may not be measurably discernible within the reasonably foreseeable future. Existing climate prediction models are global and regional in nature; therefore, they are not at the appropriate scale to identify exact climate changes at the scale of the CCPA. However, such regional predictions do provide clues to potential impacts, and such predictions should be taken into consideration. Evidence suggests that ozone concentrations may increase (all else being equal) due to climate change (Wise 2009), making compliance with the NAAQS less attainable.

<u>GHG Emissions</u>

To assess the potential contributions towards climate change effects of a particular organization or entity, the standard approach is to measure and predict emissions of GHGs. As discussed in Section 3.1.2.8, GHGs do not have applicable ambient standards or emission limits under the major environmental regulatory programs. As climate change is a result of greenhouse gas emissions collectively contributing to the global net greenhouse gas total, the following sections discuss existing local, state and nationwide GHG emissions. Since proposed development is an oil and gas project, the GHG emissions are mostly attributable to oil and gas direct GHG emissions associated with installing and producing new wells, and indirect emissions associated with downstream use of the produced oil and gas.

Local GHG Emission Totals

Direct GHG emissions were calculated for natural gas, CBNG, oil, horizontal natural gas, and horizontal oil wells for the majority of BLM Wyoming field offices as part of the Wyoming Greater Sage-grouse RMP (BLM 2015). These emissions were calculated using USEPA and State of Wyoming approved emission factors and an estimate of the number oil and gas wells that were reasonably foreseeable based on known reserves potential, information from operators, drilling technology and economics. According to the Greater Sage-grouse RMP up to 1,292 new oil and gas wells could be installed within the Casper Field Office (CFO) over the life of the plan. Based on the analysis within the Greater Sage-grouse RMP (BLM 2015), these newly constructed wells are projected to produce roughly 2.6 million barrels of oil and 6.1 MMCF of gas for their first production year. Using these production estimates, the BLM calculated indirect GHG emissions using the USEPA GHG equivalency calculator. In sum, the total direct and indirect CO_2e emissions for the CFO were calculated to be 0.387 MMT CO_2e per year and 1.5 MMT CO_2e per year, respectively (BLM 2015, 2019).

It must be noted, as well, that a large number of the horizontal wells proposed in the Converse County project will produce from multiple mineral estates including state and private minerals. The production of state and private minerals was not included in BLM's production projections included in the Greater Sage-grouse RMP (BLM 2015) and not included in the indirect GHG emission calculations. As well, most of the surface infrastructure will likely occur on lands that are not administered by the BLM. Therefore, the calculated indirect GHG emissions for the CFO represent only the well production of federal minerals and represent a subset of possible GHG emissions due to oil and gas development.

In addition to the Greater Sage-grouse RMP, GHG emissions were calculated for the BLM CFO using the total wells and production obtained from the Wyoming Oil & Gas Conservation

Commission (WOGCC) for 2014. Based on the WOGCC data there were 3,407 active oil and gas wells within the CFO boundary. The well count includes all wells that occur within the CFO boundary regardless of well type and mineral ownership. It was estimated that these wells produced roughly 44 million barrels of oil and 156,016 MMCF of gas for 2014. Using the estimated production and number of active wells, the total direct and indirect CO_2e emissions for the CFO were calculated to be 3.03 MMT CO_2e per year and 27.62 MMT CO_2e per year, respectively.

Statewide GHG Emission Totals

The Center for Climate Strategies (CCS) prepared the Wyoming Greenhouse Gas Inventory and Reference Case Projection 1990-2020 (referred to as CCS report) (CCS 2007) for the WDEQ through an effort of the Western Regional Air Partnership. The CCS report presents a draft GHG emissions inventory and a 1990 to 2020 forecast for all Federal and non-Federal emission-generating activities in Wyoming. The information presented provided an estimate of Wyoming's current and possible future CO2e emissions. According to the CCS report, Wyoming's gross GHG emissions increased 25 percent from 1990 to 2005, while national emissions rose by only 16 percent from 1990 to 2004. The Wyoming GHG emissions increase is primarily due to increased activity in the fossil fuel industry. The emissions from the fossil fuel sector grew 101 percent from 1990 to 2005, largely attributable to the tight sand gas play in Western Wyoming, and the CBNG boom that occurred in the Powder River Basin. The CCS report projected that these emissions would increase by a further 10 percent between 2005 and 2020 (if economic incentives remain).

In 2018, the U.S. Geological Survey (USGS) produced a Scientific Investigations Report (SIR) at the request of BLM analyzing and estimating the GHG emissions and sequestration on Federal lands (Merrill et al. 2019), hereby referred to as the USGS SIR. The USGS SIR presents gross GHG emission estimates for all Federal mineral estates (e.g., oil, gas, coal, etc.) in the U.S. and for each of the states which contain Federal minerals. For Wyoming in 2014, the USGS SIR estimated the total direct GHG emission from extraction and combustion of fossil fuels (which includes natural gas, petroleum products, and coal) on Wyoming Federal lands to be approximately 744.2 MMT CO_2e (USGS 2019). Of that total, 9.089 MMT CO_2e are direct GHG emissions due to the extraction of oil and natural gas products. Coal mining in Wyoming, by comparison, contributed approximately 3.8 MMT CO_2e in 2014. According to the USGS SIR data, 84.55 MMT CO_2e is due to combustion of natural gas and petroleum products at stationary and mobile sources, which can be viewed as the indirect GHG emissions from oil and gas production in Wyoming (USGS 2019).

Using 2018 production information from the Wyoming Oil and Gas Commission (WOGCC 2019), BLM estimated indirect GHG emissions from all (Federal, state, private) oil and gas production in Wyoming. The indirect GHG emissions are calculated using USEPA's Greenhouse Gas Equivalency Calculator (USEPA 2016b), which assumes all oil and gas produced is combusted as either crude oil or natural gas. Because crude oil is typically refined into various petroleum products (e.g. jet fuel, propane, motor gasoline, etc.) resulting in different GHG emissions, it is assumed for this analysis that all oil would be combusted as crude oil. In 2018, the total oil and natural gas produced was 83,538,577 BBLs and 1,803,004,880 Mcf, respectively (WOGCC 2019). Based on total production, the total indirect GHG for Wyoming in 2018 was 135.3 MMT CO_2e. It should be noted that the indirect GHG emissions based on the WOGCC 2018 production is almost two times higher than the indirect GHG emissions based on the USGS SIR 2014 data. The USGS SIR data are only for production on Federal Lands as the WOGCC data are for all lands including state and private. Essentially, the USGS SIR data represent a subset of the total oil and gas produced in the state.

National GHG Emissions

According to USEPA's Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2017 (USEPA 2019), the total direct U.S. GHG emissions in 2017 was 6,456.7 MMT CO_2e. Relative to 1990, the baseline for the EPA Inventory, total emissions in 2017 are higher by 1.3 percent, down from a high of 15.7 percent above 1990 levels in 2007. For the energy sector (which includes oil, gas, and coal extraction and combustion), between 1990 and 2017, the total GHG emissions increased from 5,339.8 MMT CO_2e. to 5,424.8 MMT CO_2e - a 1.5 percent total increase over the twenty-eight-year period. Of the total, 4,968.5 MMT CO_2e (or 91 percent) is from the combustion of fossil fuels (e.g. coal, oil, gas, etc.). In 2016, the U.S. accounted for approximately 15 percent of the global CO_2 emissions (32,310 MMT) added to the atmosphere through the combustion of fossil fuels (USEPA 2019).

Looking specifically at petroleum and natural gas production, the direct GHG emissions from the petroleum and natural gas system were 252.9 MMT CO_2e, while the indirect GHG emissions from petroleum and natural gas combustions were 3,679.2 MMT CO_2e. According to an Energy Information Administration (EIA) report (EIA 2019a), in 2015 GHG emissions from the combustion of natural gas surpassed GHG emissions from coal combustion. It is expected that GHG emissions from natural gas combustion will continue to increase as natural gas becomes a main fuel source for electric generation.

For Federal lands in 2014, the USGS SIR reports estimates that the nationwide GHG emissions from all fossil fuels produced were 1,332 MMT of CO_2e, which is lower than the 2005 total. Over the 10 year estimate, emissions from fossil fuels produced on Federal lands represent, on average, 23.7 percent of national emissions for CO_2e. The trends and relative magnitudes of the emissions estimated are roughly parallel to the Federal lands production volumes (USEIA 2015). States that produced the most fuel from Federal lands are associated with the highest GHG emissions.

<u>Global Considerations</u>

According to the 2018 IPCC Report (Blanco et al. 2018), there are several drivers to greenhouse gas emissions globally, such as per capita production, consumption behaviors, population, as well as technological innovation and changes to economic structures. Many of these are linked to policy changes. In general, these drivers are "interconnected and influence each other and, many times, the effects of an individual driver on past GHG emissions are difficult to quantify. Yet historic trends reveal some clear correlations. Historically, population growth and per capita income growth have been associated with increasing energy use and emissions. Technological change is capable to substantially reduce emissions, but historically, labour productivity has increased more compared to resource productivity leading to increased emissions. Regulations and prices are established as directing technological change towards lower emission intensities. Behavioral change is also established as a potentially powerful underlying driver, but not tested at the macro level. Policies and measures can be designed and implemented to affect drivers but at the same time these drivers influence the type of policies and measures finally adopted. Historic policies and measures have proved insufficient to curb the upward GHG emissions trends in most countries" (Blanco et al. 2018). If the goal is to reduce future greenhouse gas emissions, "future policies need to provide more support for emission reductions compared to policies over the period 1970–2010," However, implementing these types of measures and policy changes are beyond BLM's decision authority.

In 2016, the U.S. accounted for 15 percent of the global fossil fuel CO_2 emissions on an annual basis (USEPA 2019). According to the EIA, in 2017 domestic energy production accounts for about 90 percent of all U.S. energy consumption (EIA 2018). The three major fossil fuels — petroleum (28 percent), natural gas (31.8 percent), and coal (17.8 percent) — combined accounted for about 77.6 percent of this production, while renewable energy sources

(12.7 percent) and nuclear electric power (9.6 percent) provide the remainder. The EIA's Annual Energy Outlook (AEO) report provides modeled projections of domestic energy markets through 2050 (EIA 2019b). The AEO report includes cases with different assumptions regarding macroeconomic growth, world oil prices, technological progress, and energy policies. In general, the last few years of baseline reference case data has shown strong domestic production coupled with relatively flat energy demand. The reference case estimates that natural gas consumption and nonhydroelectric renewables will grow the most. Coal annual growth is projected to be negative over the projection period, while crude oil is expected to increase until the 2030s when it is expected to plateau and begin to slowly decline mid-century. The outlook suggests that the U.S. could become a net energy exporter over the projection period in most cases (EIA 2019b).

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3.2 Cultural Resources, Historic Trails, and Native American Concerns

The term cultural resources generally refers to any and all resources 50 years old or older that are created or given special meaning ***by people****,* without reference to the eligibility ***of the resources*** for the National Register of Historic Places (NRHP). The term encompasses archaeological sites, historical buildings, structures, objects, and districts, ***trails that date to the Historic period (i.e., historic trails), and specific resources and locations on*** the landscape that are important to Native American tribes ***(e.g., Indian sacred sites) and/***or other culturally recognizable groups ***(e.g., traditional cultural properties [TCPs])***. Sites are the locations of events, human occupations, or activities (NPS 2017). Buildings (e.g., courthouses, barns, houses) primarily are constructions used to shelter any form of human activity*.* ***S***tructures (e.g., trails, bridges, trolley cars, canals) are functional constructions made for other purposes. Objects (e.g., monuments, boundary markers) are items that are not classified as buildings or structures. Districts include multiple sites, buildings, and/or objects. ***For the purposes of this analysis, the broad category of cultural resources are divided into three groups in this document: general cultural resources, historic trails and resources of interest to Native American tribes (including TCPs, sacred sites, and other cultural resources that potentially could be identified as such). This is because they require different analysis areas, as detailed below.***

Section 102 (42 USC 4332) of the NEPA mandates that federal agencies assess the direct and indirect environmental impacts of their proposed actions on the quality of the human environment, and Section 101 (42 USC 4331) charges federal agencies to "preserve important historic, cultural, and natural aspects of our national heritage." Accordingly, federal agencies must consider the impacts of their proposed actions on cultural resources and cultural uses of the natural environment (e.g., traditional plant gathering). When a proposed action has the potential to impact cultural resources that are eligible for or listed in the NRHP (i.e., historic properties), federal agencies also must comply with the NHPA. Section 106 of the NHPA requires agencies to make a reasonable and good faith effort to identify historic properties that could be adversely affected by a federal agency's proposed undertaking. While NEPA takes all cultural resources into consideration, regardless of their eligibility for the NRHP, the NHPA is concerned only with historic properties. Agencies must consider potential impacts on cultural resources and potential adverse effects on historic properties regardless of land ownership; however, resources located on private surface land belong to the private landowner. The NHPA and other authorities also charge federal agencies with conducting meaningful, on-going consultation with Indian tribes and other interested parties regarding their concerns about adverse effects to historic properties. This consultation helps to provide additional information for NEPA so that agencies may consider the impacts to cultural resources that are important to those ***Nations and*** groups.

Section 106 of the NHPA applies to ***all*** three categories of cultural resources analyzed (i.e., ***general*** cultural resources, historic trails, and resources of Native American ***interest***)***, but only those that are eligible for listing in the NRHP as discussed above. Section 106 helps define their impact analysis through the area of potential effects (APE).*** Section 106 defines an APE as "the geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of historic properties, if any such properties exist. The area of potential effect***s*** is influenced by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking" (36 CFR 800.16[d]).

Similarly, the size of the impact area around a cultural resource within which an undertaking can cause negative changes to that cultural resource varies according to the kind of cultural resource involved. For ***P***rehistoric and ***Historic period*** historic properties for which integrity of setting, feeling, and association are not ***vital for their*** NRHP eligibility, the ***impact area*** generally represents the resource itself plus a small buffer to account for potential additional site elements. For linear historic properties such as roads and trails and for other ***Prehistoric and Historic period*** properties for which setting, feeling, and association ***are necessary for*** their NRHP eligibility, the ***impact area*** generally is the physical resource itself plus its ***setting*** and other directly associated features and sites. A ***setting***

can be determined using ***a*** Geographic Information System (GIS), with ***the setting*** size dependent on surrounding topography.

The three categories of cultural resources discussed in this document have overlapping yet different ***impact*** analysis areas; the minimum area is the CCPA but each category requires an additional analysis area beyond the CCPA. Accordingly, each specific analysis area is defined within its appropriate section.

To understand the kinds of cultural resources, historic trails, and resources of Native American concern that could be impacted by the Project, the first step was to conduct a literature review of existing information as set forth in BLM Manual 8110 (BLM 2004b). The literature was assembled from a review of previously recorded sites documented in State Historic Preservation Office (SHPO), BLM, USFS, and other databases (e.g., the Wyoming Cultural Records Office [WYCRO] database) as well as from current published and unpublished literature, chronologies, cultural and historical contexts, and information provided by the BLM, USFS, consulting Native American tribes, and special-interest groups (e.g., historic trails organizations). ***No new cultural resource surveys were conducted for this analysis.***

3.2.1 Cultural Resources

Cultural resources are specific, definable locations of human activity and/or meaning, including objects, features, structures, sites, landscapes, and topographic elements whose locations are identifiable through field inventory, historical documentation, and/or oral tradition. The term includes prehistoric and historic archaeological sites and constructed resources (e.g., buildings and structures), as well as specific places on the landscape that have special meaning for groups of people traditionally associated with them ***(e.g., cultural landscapes)***.

Cultural resources identified archaeologically generally are called either sites or isolates. While sites indicate relatively substantial human activity, isolates suggest ephemeral or uninterpretable use. In 2005 ***and 2012***, the definitions of sites and isolates were changed in the SHPO reporting standards . As a result, some sites recorded before 2005 would be considered isolated resources if they were recorded today. However, for purposes of this analysis, any cultural resource having a Smithsonian number was treated as a site.

3.2.1.1 Analysis Area

The analysis area for cultural resources is the CCPA, which represents the area in which direct effects and most or all indirect effects to those resources would occur. Different information is provided by each type of cultural resource and each type ***can be determined*** eligible ***for listing in the*** NHPA for different reasons; however, ***some types of general cultural resources do not have setting as an aspect of integrity like*** historic trails and resources of Native American ***interest***. As such, the analysis area for ***the more general group of*** cultural resources is ***generally*** smaller than those for historic trails and resources of Native American ***interest***. Prehistoric and historic archaeological sites can provide information about past activities and lifeways, and they may be ***determined*** eligible ***for listing in the*** NHPA for their data potential. ***Intact, buried prehistoric sites often contain the most potential to yield intact archaeological data, in the form of preserved plant and animal materials and minimally disturbed artifact and feature distributions****.* Information potential from an archaeological site generally is affected only by direct impacts and is not affected by visual intrusions. Historic sites and prehistoric sites that contain buildings and/or structures can provide information about construction techniques and architectural forms and styles, and they may be eligible under ***the*** NHPA for their association with important events, people, and/or architecture. The integrity of these sites generally is dependent on the preservation of relatively small ***settings*** (e.g., up to 1 mile or less). The aforementioned types of cultural resources located outside the boundary of the CCPA are unlikely to be indirectly affected by development within the CCPA.

3.2.1.2 Eligibility Criteria for Listing Cultural Resources in the NRHP

The NPS maintains the official list of the Nation's cultural resources that are worthy of preservation, based on an evaluation of three qualities: age, integrity, and significance. A resource generally must be at least 50 years old and must possess at least some integrity of location, design, setting, materials, workmanship, feeling, and/or association (36 CFR 60.4). A resource's significance is evaluated by meeting one or more of the following criteria.

- Criterion A: Are associated with events that have made a significant contribution to the broad patterns of U.S. history.
- Criterion B: Are associated with the lives of persons significant in U.S. history.
- Criterion C: Embody the distinctive characteristics of a type, period, or method of construction, or represent the work of a master, or possess high artistic values, or represent a significant and distinguishable entity whose components may lack individual distinction.
- Criterion D: Have yielded, or may be likely to yield, information important in prehistory or history (Criterion D).

3.2.1.3 Regulatory Framework

The primary federal laws related to the protection and management of cultural resources on federal lands include Section 101(d)(6), Section 106 (36 CFR part 800), and Section 110 of the NHPA of 1966 (16 USC 470), and the FLPMA (43 USC 35). Although the BLM is the lead federal agency for this EIS, the CCPA also contains surface and subsurface acreage under the purview of the USFS, the State of Wyoming, and private owners. Accordingly, the responsibilities and guidance of federal agencies, as well as the State and other appropriate entities, also are applicable. In addition to those noted above, the following federal, state, and/or county laws, ordinances, regulations, and standards apply to cultural resource protection within the analysis area:

- Antiquities Act of 1906 (16 USC 432, 433)
- Archeological and Historic Preservation Act of 1974 (16 USC 469)
- Archaeological Resources Protection Act of 1979 (16 USC 470aa)
- EO 11593 of 1971, Protection and Enhancement of the Cultural Environment (36 FR 8921)
- EO 13287 Preserve America (68 FR 43)
- Historic Sites Act of 1935 (16 USC 461)
- NEPA of 1969 as amended (42 USC 4321)
- Recreation and Public Purposes Act of 1926 (43 USC 869)
- Approved RMP/ROD for the BLM CFO (BLM 2007b)
- USFS TBNG LRMP (USFS 2001)
- Programmatic Agreement among the BLM, Advisory Council on Historic Preservation (ACHP), and the National Conference of SHPOs Regarding the Manner in which BLM will meet its responsibilities under the NHPA (***State Protocol;*** BLM and SHPO 2014)
- Programmatic Agreement among the USFS, Wyoming Forests, Wyoming SHPO, and ACHP Regarding Compliance with the NHPA on the National Forests and Grasslands of Wyoming (USFS, SHPO, and ACHP 2008).
- Wyoming Antiquities Act of 1935

- Historic Preservation in the Cowboy State Wyoming Comprehensive Statewide Historic Preservation Plan 2016-2026 (Wyoming Department of State Parks and Cultural Resources 2016)
- Wyoming Environmental Quality Act of 1973
- Converse County Land Use Plan (Converse County 2015a)

In addition, the following BLM handbooks and manuals provide policies and guidance for the management of various types of cultural resources:

- MS-8100, The Foundations for Managing Cultural Resources (BLM 2004a)
- MS-8110, Identifying and Evaluating Cultural Resources (BLM 2004b)
- MS-8130, Planning for Uses of Cultural Resources (BLM 2004c)
- MS-8140, Protecting Cultural Resources (BLM 2004d)
- MS-8150, Permitting Uses of Cultural Resources (BLM 2004e)
- MS-8170, Interpreting Cultural Resources for the Public (BLM 2004f)

Federal historic preservation legislation mandates the documentation, evaluation, and consideration of cultural resources that potentially could be affected by federal undertakings, including private undertakings that operate under federal license or on federally managed lands. Specifically, Section 106 of ***the*** NHPA requires that federal agencies consider the effects of their undertakings on historic properties. Effect is defined at 36 CFR Part 800.16(i) as "alteration to the characteristics of a historic property qualifying it for inclusion in or eligibility for the National Register." Section 106 also charges federal agencies with affording the ACHP a reasonable opportunity to comment on their undertakings. The federal Programmatic Agreements the Wyoming BLM and USFS have with ACHP and the National Conference of SHPOs (BLM and SHPO 2014; USFS, SHPO, and ACHP 2008) outline the manner in which the federal agencies should meet their responsibilities under ***the*** NHPA. The State Protocol between the BLM and Wyoming SHPO defines how those bodies should interact and cooperate under ***the*** NHPA and provides direction for implementing ***the*** NHPA. Additionally, BLM Manual 8140 provides direction for protecting cultural resources from natural and human-caused deterioration and for recovering cultural resource data to mitigate adverse effects of proposed undertakings in accordance with the State Protocol. Furthermore, although Section 106 of the NHPA does not specify how federal agencies should consider the effects of their undertakings on historic properties, the ACHP provides guidance for how to do so (ACHP 2013). In addition, the White House CEQ and the ACHP jointly published a handbook for integrating ***the*** NEPA and NHPA (CEQ and ACHP 2013).

3.2.1.4 Cultural Overview

The CCPA is situated in the Powder River Basin within the larger Northwestern Plains region. The Northwest Plains is an area of approximately 200,000 square miles that generally includes all of Wyoming, southern Montana, eastern Idaho, western South Dakota and Nebraska, the extreme southwestern corner of North Dakota, and the northern border of Colorado. Despite the presence of topographic and resource diversity, archaeological sites ***previously*** found in the region exhibit overall cultural homogeneity or similarity (Frison 1991; Kornfeld et al. 2010). The Powder River Basin is a wide, moderately deep, and asymmetrical basin bounded by the Black Hills to the east; Casper Arch, Laramie Range, and Hartville Uplift to the south; the Big Horn Mountains to the west***; and the Yellowstone River to the north***.

Cultural chronologies of the Northwestern Plains have been provided largely by Mulloy (1958), Wedel (1961), Frison (1991), and Kornfeld et al. (2010). Based on a combination of projectile point forms, tool assemblages, feature types, faunal remains, stratigraphy, and radiocarbon dates, cultural periods defined in this region are the Pre-Clovis (pre-11,500 years before present [B.P.]), Paleoindian (11,500–8000 B.P.), Plains Archaic (8000–1450 B.P.), Late Prehistoric (1450–ca. 250 B.P./anno Domini [A.D.] 1700), and Protohistoric (ca. 250 B.P./A.D. 1700–1800). Each is summarized below.

Pre-Clovis Period

No pre-Clovis sites have previously been recorded within the region or the analysis area. However, there is a growing body of evidence from sites in Colorado (e.g., Dutton, Selby, and Lamb Springs), in other parts of North America (e.g., Cactus Hill in Virginia, Paisley Caves in Oregon, the Topper site in South Carolina, and Meadowcroft Rockshelter in Pennsylvania), and in South America (e.g., Cueva Fell and Monteverde in Chile, Pedra Furada in Brazil, and Piedra Museo in Argentina [Meltzer 2009; Stanford and Bradley 2012]) that people were on those continents prior to 11,500 B.P.

Paleoindian Period

Many Paleoindian sites and isolated projectile points have been identified in the Northwestern Plains region, dating to between about 11,500 and 8000 B.P. Traditions defined by specific projectile point forms and tool assemblages include Clovis (ca. 11,500–11,000), Folsom (11,000–10,200 B.P.), the Agate Basin Complex (10,500–10,000 B.P.), the Hell Gap Complex (10,000–9500 B.P.), the Alberta/Alberta-Cody Complex (9800–9000 B.P.), the Frederick and/or James Allen Cultural Complex (8400–8000), and the Lusk Complex (8400–7900 B.P.). Highly nomadic Paleoindian hunter-gatherers relied to a great extent on large Pleistocene megafauna, including mammoth, giant sloth, camels, bison, and horses (Frison 1991; Kornfeld et al. 2010). Most activities were of small magnitude and short duration; therefore, Paleoindians mostly left small archaeological assemblages representing short-term lithic reduction locales, camps, and animal kill and processing sites (Frison 1991). A small number of sites, such as Lindenmeier (a Folsom site in north-central Colorado) and Hell Gap (a site in southeastern Wyoming containing Clovis, Folsom, Agate Basin, and Hell Gap assemblages), provide much more extensive evidence for large-scale and/or repeated use. In general, Paleoindian tool assemblages are characterized by large lanceolate and stemmed projectile points, spurred end scrapers, gravers, borers, crescents, and mammoth bone tools (Frison 1991; Kornfeld et al. 2010; Wood 1998).

Clovis sites are widespread on the Northwestern Plains and in the Rocky Mountains. They are identified by the presence of large, fluted and unfluted lanceolate projectile points, planoconvex scrapers, retouch flakes, pressure retouch flakes, and core choppers (Frison 1991; Kornfeld et al. 2010). Clovis bifaces and blade technologies are distinctive and their efficiency of material use allowed for high mobility and successful exploitation of a wide range of ecological settings and subsistence practices. No Clovis sites have been recorded previously within the analysis area; however, the Casper site is a well-documented *Bison antiquus* kill site located west of the CCPA. Clovis sites include artifact scatters, open camps, animal kill locations, and caches.

At least some Folsom sites likely were contemporaneous with Clovis sites (Kornfeld et al. 2010). Folsom sites are identified by smaller but deeply fluted projectile points and a wide range of tool types (Frison 1991; Wood 1998). Many Folsom sites are bison kill sites and appear to demonstrate Paleoindian adaptations to changing environmental conditions between the Pleistocene and Holocene that coincided with the decline of Pleistocene megafauna in the Northwestern Plains region. Folsom sites, including the Brewster and Hell Gap sites, are known outside but not far from the analysis area, in eastern and southeastern Wyoming, respectively (Kornfeld et al. 2010).

Goshen Complex sites (ca. 10,400–10,200 B.P.) also may overlap with Clovis and Folsom sites. The first recorded Goshen site is located in southeastern Wyoming (Larson et al. 2009). Goshen sites are identified through the presence of lanceolate projectile points that have slightly concave bases and parallel pressure flaking patterns, with thinned rather than fluted bases, as well as bifaces and blade tools (Kornfeld et al. 2010). Goshen sites typically are bison bone beds (Frison 1991). Many Goshen projectile points have been found on the Northwestern Plains and in the Rocky Mountains (Kornfeld et al.

2010). Sites known outside the CCPA include the Hell Gap site in southeastern Wyoming and the Carter/Kerr-McGee site in the Powder River Basin (Kornfeld et al. 2010).

The Agate Basin Complex, Hell Gap Complex, and Alberta/Alberta-Cody Complex follow Clovis, Folsom, and Goshen. Each is typified by large, often stemmed projectile points designed for big game hunting (Frison 1991). The Hell Gap site in southeastern Wyoming contains all three complexes. Other notable sites include Sister's Hill, the Casper site, Jones-Miller, and Horner in north-central and northeastern Wyoming (Kornfeld et al. 2010).

Approximately 10,000 B.P., two distinct and concurrent Paleoindian traditions appeared. Known as Plains Paleoindian and Foothill/mountains Paleoindian, they were characterized by the use of some shared lithic technologies but likely represent specific adaptations to different geographic areas. While the Plains Paleoindian tradition was oriented toward a part-time bison hunting subsistence strategy, the Foothill/mountains complexes used more generalized hunting and gathering because of the more limited availability of large game in that ecozone. Foothill/mountains groups also appear to have placed a greater emphasis on plant foods, foreshadowing Plains Archaic adaptations (Frison 1991). Several unique projectile point types, including Lovell Constricted, Alder Complex, Haskett, Pryor Stemmed, and Deception Creek points, are associated only with the Foothill/mountains Paleoindian tradition (Kornfeld et al. 2010).

The Frederick and/or James Allen Cultural Complex and the Lusk Complex follow the Alberta/Alberta Cody Complex. Both are characterized by variation in tool forms, including large, unfluted lanceolate projectile points, scrapers, notched flakes, utilized flakes, retouched flakes, bifacial knives, end scrapers, spur perforators, and bone needles (Kornfeld et al. 2010). Assemblages sometimes also contain grinding slabs and informal manos. Projectile points of the Frederick Complex are lanceolate with parallel oblique flaking. Lusk projectile points are similar but tend to be narrower and thicker and usually are made from flakes, resulting in a triangular or plano-convex cross section (Kornfeld et al. 2010). These complexes suggest the use of a greater diversity of resources and more sophisticated hunting techniques, such as utilizing topographic features or snow drifts, which resulted in a larger number of animals killed at one time (Kornfeld et al. 2010; Wood 1998). Sites known from outside the analysis area include the Hell Gap site in southeastern Wyoming, the James Allen site in southern Wyoming, the Agate Basin site in east-central Wyoming, and the Betty Greene site near the Wyoming, Nebraska, and South Dakota border (Kornfeld et al. 2010).

Plains Archaic Period

Changes in global climate occurred between the Pleistocene and Holocene (7900 7200 B.P.) as the Pleistocene glaciers finally melted. Based in part on major climatic shifts from generally cooler and wetter conditions to warmer and drier ones, Archaic hunter-gatherers were less mobile and used a broader resource base than their Paleoindian predecessors. Exploiting both small and large game, including bison, as well as diverse plant resources, they used mostly smaller, more diversified side- and corner-notched projectile points and more formal ground stone tools, as well as some large corner-notched and un-notched points (Frison 1991; Kornfeld et al. 2010). Chronological relationships among the different projectile point styles is not well understood, and the periods of use of many types appear to substantially overlap (Kornfeld et al. 2010). Typical Archaic archaeological assemblages also include a variety of unifacial and bifacial stone tools and numerous grinding implements (Frison 1991). Features at Archaic sites often include hearths and architectural elements such as stone circles and alignments, indicating somewhat reduced mobility. By the later Archaic, ceramics also were in use. The Archaic typically is divided into three sub-periods: Early Plains Archaic (8000–5000 B.P.), Middle Plains Archaic (5000–3000 B.P.), and Late Plains Archaic (3000–1450 B.P.).

The Early Plains Archaic roughly coincided with a dramatically drier climatic period, termed the Altithermal. During this time, people seem to have primarily occupied mountain and foothill areas; perhaps as a response to drought conditions at lower elevations. Habitation sites are found in rockshelters and caves, as well as in open areas near springs along mountain slopes (Frison 1991). Artifact assemblages demonstrate substantial technological changes in projectile point hafting and an emphasis on high quality lithic materials. For example, the Big Horn Mountains in north-central Wyoming contain evidence for concentrated quarrying (Frison 1991; Wood 1998). Other sites, such as the Hawken Site (a late fall/early winter arroyo trap bison kill locality in northeastern Wyoming) can be assigned to specific seasons and suggest that people regularly aggregated and dispersed at different times of the year (Kornfeld et al. 2010; Wood 1998). The Hawken site also contains the earliest side-notched point typology associated with a bison kill in the Northwestern Plains. Other notable Early Plains Archaic sites in the region include the Dunlap-McMurry burial in Natrona County east of the Town of Douglas, and the China Wall site in Albany County (Kornfeld et al. 2010).

The Middle Plains Archaic began approximately 5000 B.P. as moisture levels increased, creating environmental conditions similar to today (Kornfeld et al. 2010). At that time, human populations in the Northwestern Plains region increased due either to an influx of people or increased population growth within the region. The Middle Plains Archaic represented a continuing trend toward increased use of small game and plant resources; while evidence continues for small-scale bison hunting, most Middle Plains Archaic sites do not provide evidence for the kind of large-scale bison hunting seen in some Early Plains Archaic sites. One exception would be the Scoggin site in south-central Wyoming. Other site types include open and sheltered camps, many of which contain complex features such as stone-lined and stone-filled baking or roasting pits. Stone circle sites also are known, although they are less prevalent than in subsequent periods (Frison 1991). Middle Plains Archaic artifact assemblages include diverse projectile point types (Frison 1991) and flaked stone debitage, cores, unifacial flakes, worked flakes, and bifaces, as well as abundant manos and grinding slabs/mutates, atlatl points, bone tools, and occasional bone beads. The presence of rock-lined hearths at many sites indicates that baking plant foods became more common.

During the Late Plains Archaic, climatic conditions continued to be conducive to population growth, and sites dating to this period are more common and widespread than those of the Early and Middle Plains Archaic. A relatively intensive occupation of the Big Horn Mountains and Basin areas is suggested by many cave and rockshelter sites in those areas. Although the Late Plains Archaic is characterized by further changes in projectile point types, subsistence strategies, other tool types, and features such as stone circles, stone-lined and stone-filled hearths that first appear in the Middle Plains Archaic continue into this period (Frison 1991).

Other elements of artifact assemblages include a variety of flaked stone tools such as scrapers, drills, and perforators as well as bone awls, tabular bone beads, bone gaming pieces, and pendants. The diversified tool kits and larger variety of faunal and macrofloral remains recovered from Late Plains Archaic sites suggest a great variety of hunting and gathering activities. Notable sites in the region include the Muddy Creek site in Carbon County and the North Platte River and Patten Creek sites in Platte County (Kornfeld et al. 2010).

Two main cultural traditions are defined for the Late Plains Archaic based on projectile point forms. The Pelican Lake tradition, defined by wide, open, corner-notched projectile points, is widespread in the Northern and Northwestern Plains. The Yonkee tradition defined by extensive and sophisticated arroyo trap bison kill sites and associated projectile points, is less widespread and is found in the Powder River Basin of Montana and Wyoming (Kornfeld et al. 2010). In addition, a new side- or corner-notched projectile point type (termed Besant) appeared on the Northwestern Plains around 2000 B.P. They appear to have been used with atlatls (spearthrowers) and are associated with highly sophisticated bison kill sites (termed bison corrals or pounds) comprised of logs and deep-set posts (Kornfeld et al. 2010). Besant projectile points demonstrate that people in Wyoming had connections to the Northwestern Plains and to cultures affiliated with the Great Basin who made similar corner-notched projectile points and basketry (Frison 1991; Kornfeld et al. 2010).

Furthermore, two ceramic traditions appear in the archaeological record in small numbers near the end of the Late Plains Archaic (Frison 1991). The Intermountain Pottery Tradition appears to have been indigenous to the Rocky Mountains and Northwestern Plains and may have been created by Numic-speaking Shoshonean groups (Kornfeld et al. 2010). These low-fired ceramics are utilitarian wares with thick sides and flat bottoms that have minimal decoration on minimally smoothed surfaces (Frison 1991). In contrast, Plains-derived Woodland ceramics are found in association with some Besant sites; predominantly along the Wyoming-Nebraska border and in northeastern Colorado (Kornfeld et al. 2010). Made using a paddle and anvil technique, their shape is described as conoidal, or sometimes globular with a signature cord-marked pattern on their exterior. They, too, were fired under low and inconsistent conditions, resulting in irregular surface colors that range from black to brown to red (Ellwood 2002). Both of these ceramic traditions are far more abundant during the subsequent Late Prehistoric period than during the Late Plains Archaic.

Late Prehistoric Period

Similar to the Late Plains Archaic, the Late Prehistoric saw people's continued reliance on a combination of wild game and plant resources, but with an even greater variety of fauna. Overall, the increasing use of ceramics (Frison 1991) and plant resources coincided with a gradual change from a nomadic way of life to a more settled one. This trend also is suggested by Late Prehistoric site and feature types, which include semi-permanent house pit depressions, large slab-lined food preparation pits, extensive middens, and storage features. Artifact assemblages include the newly invented bow and arrow, as well as cord-marked Woodland type ceramic vessels, small corner-notched arrow points, and more specialized and formal tool types. In addition, a large variety of projectile point forms continued from earlier periods or were introduced. For example, Besant projectile points introduced during the Late Plains Archaic continued in use during the Late Prehistoric. At the same time, small corner- and side-notched projectile points were made for use on arrows. For example, delicate Avonlea arrow points with u-shaped side notches located close to their bases are known from this period. Sites in which Avonlea projectile points are found contain large slab-lined hearths, flaked stone and bone tools, ground stone implements, and bone and shell decorative items (Kornfeld et al. 2010). Sites containing other small corner- and side-notched projectile points are easily distinguished from Avonlea sites by their lack of abundant debitage, weaponry, tools, decorative items, and faunal materials (Kornfeld et al. 2010). Side-notched points with basal notches, known as tri-notched arrow points, appeared near the end of the Late Prehistoric and continued to be used by the Crow and Shoshone during Protohistoric times (Frison 1991; Kornfeld et al. 2010). Examples of Shoshonean occupation during the Late Prehistoric period occur at the Bugas-Holding site in northern Wyoming. This site yielded several types of hearth features surrounded by a bone bed containing predominantly bighorn sheep and bison, as well as many tri-notched points, bone and stone tools, ornaments, and ceramics (Kornfeld et al. 2010).

Many Late Prehistoric sites demonstrate a continued reliance on hunting. For example, the Vore site in the Black Hills of Wyoming is a bison jump that contains as many as 22 components, each of which includes a variety of side-notched arrow points.

Protohistoric Period

The Protohistoric period begins with the initial contact between indigenous Native Americans and Euro-Americans through the permanent, widespread settlement of the latter. In addition to bringing new trade goods such as cloth and seed beads as well as metal technologies such as guns, pots, and knives, Euro-Americans brought new diseases that decimated many Native American populations. In addition to the resulting changes in population sizes, perhaps the most profound change for indigenous peoples was the Euro-American re-introduction of the horse to North America (Frison 1991; Kornfeld et al. 2010). Many plains groups rapidly acquired large numbers of horses by the late 1600s. As a result, they could move farther faster and many tribes became known as highly skilled horse people and mounted bison hunters. For example, Shoshonean groups probably obtained large numbers of horses during the first quarter of the 17th Century, and the Crow obtained the horse shortly thereafter (Cowdrey et al. 2012).

Many Euro-American trade goods, including glass and shell beads, small metal objects, and horse trappings, became prized items that often appear in burials from this time (Kornfeld et al. 2010).

Site types known from the Protohistoric period include open camps, open lithic scatters, stone circle sites, sheltered camps, sheltered lithic scatters, rock art, battlefields, trails, and culturally modified trees. Artifact assemblages may include hand-hammered iron points and metal lance points. Native people created the latter themselves by cold-hammering other iron objects obtained through trade or raiding (Frison 1991). At least one metal point has been identified within the analysis area.

History

The Wyoming SHPO has identified eight Historic Periods of Significance within the Powder River Basin: Early Historic (A.D. 1801–1842), Pre-Territorial (A.D. 1843–1867), Territorial (A.D. 1868–1889), Expansion (A.D. 1890–1919), Depression (A.D. 1920–1939), World War II Era (A.D. 1940–1946), Post-World War II (A.D. 1947–1955), and Modern (A.D. 1956–present). Major events or trends for each period are summarized below.

Early Historic Period

The Early Historic period was characterized by initial Euro-American exploration, establishment of the Rocky Mountain fur trade, and dispersed trading posts. Euro-Americans arrived relatively late in Wyoming, with the only evidence for an early Spanish presence or trade item coming in the form of a likely 17th Century Spanish rapier blade found near Tongue River in Dayton, Wyoming. The earliest confirmed European presence in Wyoming were French traders in the early 1800s (Larson et al. 2009; Homsher 1965). By the early 1830s, as many as 200 fur trappers were in eastern Wyoming, but that industry died down by the end of the decade. The first official government exploration of the region was made in 1842. These explorers, trappers, traders, and settlers followed previously established Native American trails along the North Platte River and across the landscape that became the Oregon, California, and Mormon Pioneer emigrant trails, the Pony Express route, and the first transcontinental telegraph line (Reckner 1988).

Pre-Territorial Period

The Pre-Territorial period saw the development and use of emigrant trails and wagon trails fueled by discoveries of gold and the passing of the Homestead Act of 1862. As Euro-Americans journeyed through the Powder River Basin and adjacent regions in increasingly large numbers, their interactions with Native Americans generally deteriorated. The 1840s through 1870s were characterized largely by conflict as Euro-Americans began to claim transportation routes and longstanding tribal lands for themselves (Larson 1978). Increasing traffic on emigrant trails and the perceived need to maintain U.S. territories, especially against Native Americans, led to the establishment of many military forts across the Rocky Mountain West. Those included Fort Caspar on the west side of modern-day Casper and Fort Fetterman, established in 1867, on a plateau above the North Platte River where the Bozeman Trail bisected the Oregon Trail. Many of the first settlements, including Reno Junction and Douglas, also were established along trails and railroad corridors. A combination of the creation of the reservation system through the 1851 Treaty of Fort Laramie, the California Gold Rush, and the Homestead Act of 1862 brought travelers and settlers to the Powder River Basin. Mining during the Montana gold boom specifically spurred the development of the Bozeman and Bridger Trails which were used for traveling to northern Wyoming (Miller 2011; Wyoming State Historic Preservation Office 2014).

Territorial Period

The completion of the Transcontinental Railroad in 1868 and the expansion of the Union Pacific Railroad in Wyoming between 1867 and 1890 facilitated Euro-American development of the region. After years of battles and skirmishes between Native American groups and Euro-American settlers, particularly along trails (Barrett 2011), the 1868 Treaty of Fort Laramie brought a brief, but only partial, respite to the conflicts. It also established Indian agencies on reservations, through which Euro-Americans attempted to force tribal people to settle down for farming and ranching. The Wyoming Territory was created in 1869, which added to further land use and occupancy conflicts. In 1877 the Desert Land Act encouraged further economic development of arid and semi-arid public land in western states, including Wyoming. The Desert Land Act offered 640 acres to individuals who would reclaim, irrigate, and cultivate the land for agriculture and ranching (Larson 1978). The large-scale ranching industry initially followed the Texas model of open range practices, with railroad expansion supporting increased stock herding in the Casper area and in the Big Horn Mountains. However, the success of open range ranching was short-lived due, in part, to environmental conditions; the extremely harsh winter of 1886–1887 caused the deaths of hundreds of thousands of cattle (Larson 1978).The railroad also led to the growth of coal mining in Wyoming not only because trains required coal for power but also enabled the large-scale delivery of it. As a result of all of these factors, an increasing number of homesteaders and ranchers came to the region, and by the 1880s, Euro-Americans had largely relegated Native American tribes to reservations and claimed the region. Converse County was established in March 1888 (Converse County 2015a).

Expansion Period

Due to trends in other parts of the country, the sheep-raising industry in Wyoming expanded greatly during this period, eventually surpassing the cattle industry. Many sheep herders and ranch hands originated in Mexico, introducing a new cultural dynamic to the region (Cassity 2007). The different requirements of sheep and cattle for water, food, and herding often led to fierce disputes between ranchers. Range wars such as the Johnson County War, which occurred partly in Converse County in 1892, are well known in Wyoming (Larson 1978; Smith 1966). Troubles with competitors, rustling, diseases, and bad weather led many cattlemen to install barbed-wire fencing on their lands (Larson 1978). As a result, by the late 1800s the large-scale open range ranching system was replaced by small farms and ranches. Homestead Acts of 1909 and 1912 encouraged continued settlement in Converse County and technological advances initially led to an expansion in farm and ranch size, but World War I (1914–1918) represented a new economic impact that strained Wyoming's resources and population. In partial reaction to these impacts, the Stock-Raising Homestead Act of 1916 offered settlers 640 acres to encourage expansion of the ranching industry (Cassity 2007). Mineral prospecting in the region expanded even more due to improved delivery via railroads followed by an increase in fuel oil consumption as a result of the invention of the combustion engine and increased demand due to World War I. The Powder River Basin experienced some of the heaviest development in coal mining by the 1920s. In some cases company towns were built at the mines. In addition, railroads aggressively recruited immigrants to work coal mines, which resulted in distinctive cultural, economic, and social patterns (Cassity 2013).

Depression Era

The 1920s are sometimes called the New Deal era because of rapid social and economic changes, including a dramatic rise in the stock market, proliferation of automobiles, and growing settlement in cities. However, Wyoming's economy and population distribution in the 1920s remained relatively similar to previous decades: dependent on agriculture and mining and dispersed across the land. Although farms and ranches increased in size and became more specialized (e.g., beets or dairy), Wyoming experienced an agricultural depression before the stock market crash of 1929 due to droughts and dependence on national trends in consumption. Furthermore, increased mechanization of the mining industry led to decreased employment of miners. Conversely, increased demand for oil in the 1920s caused a steady expansion of the oil and gas industry that generally has continued into modern times. Following the stock market crash, the Hoover administration put people to work on a variety of construction projects. In Wyoming those projects included public buildings such as courthouses, federal buildings, and post offices, as well as parks and highways. When President Roosevelt took office in 1933 he continued an emphasis on community building projects, but with different approaches. His Civilian Conservation Corps formed military-style camps that completed numerous projects for water and erosion control, vegetation planting and maintenance, and other landscape-level endeavors. In the Powder River Basin, Civilian Conservation Corps workers also expended considerable effort fighting naturally ignited fires in exposed coal seams. The Civil Works Administration program also was particularly important across Wyoming; however, it only lasted from November 1933 to April 1934. In 5 months, this program completed 402 projects primarily focused on road improvements (Cassity 2013). Additionally, the government also sought to provide assistance to the agricultural industry in 1937 through the Bankhead-Jones Farm Tenant Act, which authorized a credit program to help tenant farmers purchase land and authorized the federal government to acquire damaged lands to rehabilitate them.

World War II Era

Although World War II re-energized the nation's economy as a whole, it marked the end of public relief programs and led to social changes in Wyoming. Manufacturing employment in the state during the war increased by only a few hundred people; although, over time thousands of people left to serve in the war. Approximately 5,560 men from Wyoming were enlisted in the armed forces as of 1941, but 23,611 men and 515 women were in service by 1945. At the same time, hundreds of foreigners were brought into Wyoming via Japanese detainment camps and prisoner of war camps. The Heart Mountain Relocation Center for Japanese detainees was constructed between Cody and Powell in 1942. Prisoner of war camps, including one near Douglas, held people from various European countries during the second half of the war. Unlike most other parts of the country, Wyoming generally did not experience the benefits of increased industrial production surrounding the war. Most money went toward expansions of facilities and activities for various branches of the military such as the Casper Army Air Base and the Wyoming National Guard (TolTest and TEC 2009), and industrialization was more centralized rather than distributed among different communities (Cassity 2013).

Post-World War II Era

After World War II, Wyoming continued to be a primary producer of raw materials, but the population increased more slowly than that of most other states. Post-World War II modernization gradually led to the modern intensification of agriculture and grazing (Cassity 2011), with farming and ranching remaining important industries in the Powder River Basin. However, immediately following World War II the industries were fraught with challenges, including unsuccessful irrigation projects and a lack of available labor. To fill the labor gap, an increasing number of laborers and ranch hands immigrated to Wyoming. Some military facilities also expanded after World War II during the Cold War era (TolTest and TEC 2009). In addition, energy exploration increased to support military activities and lifestyles that were increasingly dependent on automobiles and mechanization.

Modern Era

With initial federal financial support the post-World War II economy of Wyoming has become fairly prosperous. Beginning in the mid-1950s, inventions such as better farm equipment, fertilizer, and science-based livestock breeding have supported much more intensive and successful agricultural production that feeds into the national economy (Cassity 2011), although the state experienced an economic slump in the 1960s. Extraction of oil, gas, and other minerals also has continued to be a vital part of the Powder River Basin economy.

3.2.1.5 Background

Official WYCRO file searches initially were conducted on November 6, 2013 and May 1, 2014. Files in the BLM CFO were examined on March 5 through 7, 2014 (Williamson et al. 2014a). Before 1983 there were no federal standards for archaeological inventory. Accordingly, most inventories conducted before 1983 are considered inadequate by modern standards. In 1983, the NPS published the Secretary of the Interior's Standards and Guidelines for Archaeology and Historic Preservation (48 FR 44716) with the goal of creating more consistent, systematic, and accurate methods of archaeological data collection. The publication precipitated the establishment of methods that were somewhat more consistent, at least within agencies or regions.

The initial file search showed that, of the 1.5 million-acre CCPA, 209,222 acres (approximately 14 percent) were inventoried previously for cultural resources; although not all of the inventories were conducted to current standards. In the analysis area (i.e., within and up to a 1-mile radius beyond the CCPA), 1,716 projects were conducted between 1974 and 2013, most of which were for oil and gas-related projects including exploration and construction of well pads, access roads, and pipelines. Of the 1,716 projects, 1,662 (97 percent) were inventories, and the remaining 54 projects (3 percent) were a combination of data recovery/mitigation, historic overview and evaluation, monitoring, site testing, snow monitoring, and other unassigned projects (Williamson et al. 2014a).

A supplemental file search of WYCRO records was conducted on June 8, 2017, to obtain information about projects conducted and cultural resources recorded within and up to 1 mile beyond the CCPA since the initial 2013 file search. This supplemental file search showed that an additional 639 projects were conducted between November 2013 and June 2017. Most of the projects were related to oil and gas development, including seismic exploration and construction of well pads, access roads, pipelines, and other facilities. Other projects were conducted for waste management, cellular communication towers, electrical transmission lines, railroads, range and wildlife development, research, roads, and water storage and conveyance. Of the 639 projects, 635 (99 percent) were Class III inventories. The remaining four projects (1 percent) were monitoring (n=2) and site testing and evaluation (n=2). The total number of acres covered by those 639 projects is unknown; WYCRO does not have information about the acres covered by more than half of the projects. An unsubstantiated estimate is that the post-2013 projects covered approximately 24,000 acres.

Table 3.2-1 summarizes the types and numbers of sites recorded previously within the analysis area, based on a combination of the pre-2013 and post-2013 file searches. Within the file search area, the WYCRO database lists 2,123 previously recorded sites. Two of the ***cultural resources*** (both rock cairns) included in the 2017 file search results are of unknown temporal affiliation. For purposes of this analysis, they were considered to be historic. Eight additional sites were identified by the 2013 BLM file search. No sites were added by the USFS file search. Of the 2,131 total sites, 1,426 are prehistoric, 568 are historic, and 137 are multicomponent (pre-2013 data from Williamson et al. 2014a). For purposes of further analysis, the multicomponent sites were split into their prehistoric and historic components, resulting in a total of 2,268 sites/components, and tallied according to those categories. Prehistoric sites were broken into nine categories: cairns/caches, alignments/hunting blinds, stone circles, lithic scatters, open camps, bison kills/bone beds, lithic quarries, burials, and other (e.g., unspecified). Lithic scatters are the most common site type within the analysis area. Historic sites were broken into 15 categories: cairns/alignments, homesteads/structures/ foundations, telegraph/telephone lines, trails/roads, bridges, dams/canals, dugouts, inscriptions, mines, railroads, military sites, debris scatters/camps/dumps, corrals, cemeteries/graves, and other. Homesteads/structures/foundations are the most common type within the analysis area (Williamson et al. 2014a).

Although a somewhat larger number of sites have been recorded in the south-central, southwestern, and northern portions of the analysis area, the distribution of ***previously*** recorded sites is spread across the analysis area. The southwestern portion of the analysis area, within the Pine Ridge area and adjacent drainages, contains a relatively higher number of previously recorded sites. In much of Wyoming, prehistoric sites tend to be more frequently located along drainages. Areas lacking available water are less likely to contain sites than areas near water sources (Williamson et al. 2014a).

Most NRHP eligibility evaluations were made using information from surface surveys; very few were based on site testing and/or excavation. Only six sites have been excavated, and all of those have been recommended or determined eligible for the NRHP. As shown on **Table 3.2-1**, most of the previously recorded sites either were not eligible for the NRHP or remain unevaluated for eligibility. The most commonly eligible types of prehistoric sites were open camps and stone circles. Open camps generally retain the potential for dating, and stone circles may yield artifacts and additional information or are connected with specific kinds of activities. The most commonly eligible types of historic sites were debris scatters that can yield additional information; homesteads that are connected with early settlement, important people, or representative architecture; and trails/roads that are associated with early transportation and settlement (Williamson et al. 2014a).

Table 3.2-1 Site Types Previously Recorded in the Analysis Area

Site/Component Type	Total Number	Eligible	Not Eligible	Unevaluated
Prehistoric				
Cairns / caches	121	7	53	61
Alignments / hunting blinds	37	4	6	27
Stone circles	326	53	70	203
Lithic scatters	608	17	498	93
Open camps	453	100	227	126
Bison kills / bone beds	7	2	1	4
Lithic quarries	8	0	7	1
Burials	1	0	0	1
Other	2	0	0	2
Total Prehistoric Sites	***1,563***	***183 (12 percent)***	***862 (55 percent)***	***518 (33 percent)***
Historic				
Cairns / alignments	174	3	89	82
Homesteads / structures / foundations	217	9	131	77
Telegraph / telephone lines	3	2	1	0
Trails / roads	18	7	11	0
Bridges	12	0	11	1
Dams / canals	16	4	12	0
Dugouts	11	0	9	2
Inscriptions	11	1	8	2
Mines	12	0	9	3
Railroads	3	2	1	0
Military sites	9	2	6	1
Debris scatters / camps / dumps	194	15	142	37
Corrals	9	0	6	2
Cemeteries / graves	3	0	0	3
Other	13	2	10	1
Total Historic Sites	***705***	***47 (7 percent)***	***447 (63percent)***	***211 (30percent)***

Source: Williamson et al. 2014a; WYCRO 2017 updated files search.

3.2.2 Historic Trails

Historic trails are routes of travel used during the Protohistoric and/or Historic periods, but often with earlier origins. NHTs are “extended trails that closely follow a historic trail or route of travel of national significance” (BLM 2014g). The National Trails System Act of 1968, as amended, states that NHTs “shall have as their purpose the identification and protection of the historic route and its historic remnants and artifacts for public use and enjoyment” (NPS 2009). BLM Manual 6280 identifies requirements of NEPA processes for proposed actions that potentially could impact NHTs and/or trails that are undergoing feasibility studies to become NHTs.

3.2.2.1 Analysis Area

As with cultural resources in general (see Section 3.2.1.1), the core analysis area for historic trails is the CCPA. However, for historic trails, the consideration of indirect effects (e.g., visual, auditory, and olfactory) is as important as the consideration of direct effects (i.e., physical) because integrity of setting, feeling, and association usually are vital for the determination of significance of a historic trail. Historic trails often run long distances across relatively open landscapes; therefore, indirect effects can arise throughout extensive areas. Accordingly, the analysis area for direct and indirect effects to historic trails within and adjacent to the CCPA included both the physical routes of the trails and the ***setting***s of the trails. Direct effects were considered within historic travel corridors, which ranged within and between trails from approximately 0.5 to 2.5 miles wide. The specific widths of the corridors were determined by the geographic spread of trail braiding and the distances between trail and trail-associated sites (Williamson et al. 2014b). Visual effects resulting from oil and gas infrastructure of different heights were considered within a 3-mile-wide corridor as measured from the outer edges of the historic travel corridors (**Appendix B**). Historic trails that could be directly and indirectly affected by the proposed undertaking were identified through a combination of approaches, including records searches, field inventory, historical research, and consultation (Williamson et al. 2014b).

3.2.2.2 Eligibility Criteria for Listing Historic Trails in the NRHP

The basic eligibility criteria for listing historic trails in the NRHP are the same as those for cultural resources in general. Historic trails are most often determined to be eligible under Criteria A and B for their association with events that have made a significant contribution to the broad patterns of our history (Criterion A) and as sites that are associated with the lives of persons significant in our past (Criterion B). As a result, historic trails derive a large part of their significance from their settings, so high degrees of integrity of setting, feeling, and association are important factors for evaluating the eligibility of trails. Integrity of setting refers to whether the character of the location is similar to its historic use, and focuses on the relationship between the site and its surroundings. Integrity of feeling is linked to the integrity of setting, and is an expression of the aesthetic or historic sense of the time period associated with the site. Integrity of association is closely related to both setting and feeling and is the historic link between an important historic event and a historic property (NPS 2002). Accordingly, maintenance of a trail’s surroundings in a manner similar to those during the trail’s period of significance is vital for a trail’s eligibility. For trails that were created through an unsettled and undeveloped landscape, this means an area that is largely free of human construction.

3.2.2.3 Regulatory Framework

In addition to the laws, ordinances, regulations, and standards listed in Section 3.2.1.3, the following also apply to the protection of historic trails within the analysis area:

- Land and Water Conservation Fund Act of 1965, as amended (16 USC 4601-4 through 4601-11)
- U.S. Department of Transportation Act of 1966, as amended (49 USC 1653(f))
- National Trails System Act of 1968, as amended (16 USC 1242)
- Federal Advisory Committee Act of 1972, as amended (5 USC Appendix 2 1–16)
- Omnibus Public Land Management Act of 2009 (16 USC 7201–7203)
- Management and Use Plan Update Final Environmental Impact Statement: Oregon National Historic Trail (NPS 1999)
- NRHP Multiple Property Documentation Form: Historic Resources of the Bozeman Trail in Wyoming (Wyoming SHPO 1989)

- Oregon, California, Mormon Pioneer, and Pony Express National Historic Trail Final Environmental Impact Statement (NPS 1999)
- Visual Resource Inventory for the CFO (4072)

Furthermore, the following BLM manuals provide policies and guidance for the management of various kinds of historic trails:

- MS-6250, National Scenic and Historic Trail Administration (BLM 2012e)
- MS-6280, Management of National Scenic and Historic Trails and Trails under Study or Recommended as Suitable for Congressional Designation (BLM 2012h)

3.2.2.4 Cultural Overview

The CCPA includes rolling plains, broad tablelands, wide valleys, upland ridges, buttes, and a portion of the North Platte River that largely funneled prehistoric and historic travelers through the same parts of the landscape. Beginning in prehistoric times, people selected travel corridors based on their ease of use and proximity to water. As a result, prehistoric trails often followed major drainages and crossed low passes. Historic trails largely followed these earlier routes, although the use of wagons and the movement of large numbers of livestock and people sometimes necessitated travel across more open ground. Modern paved routes have destroyed portions of these historic trails where they followed the easiest paths across the landscape. Other linear constructions, including railroads as well as telegraph and electrical lines, also often followed the same routes already established by historic trails. Trails were used for millennia and Euro-Americans subsequently used them to cross through long-standing Native American territories; therefore, they were often the locations of conflict between those two populations.

This section summarizes the historical context in which people created and used the historic trails that cross the CCPA: Child’s Cutoff of the Oregon Trail, the Bozeman Trail, and the Rock Creek to Fort Fetterman Route (**Figure 3.2-1**). The Oregon-California-Mormon Pioneer-Pony Express NHTs run close to, but south of, the CCPA, although possible segments may occur in the very southwest portion of the CCPA. These trails were directly related to the historical themes of transportation, expansion, settlement, and land use, as they stimulated the construction of stage routes, local roads, stage stations, and railroads that helped to develop the American West. The railroad came to eastern Wyoming in 1869, spurring the construction of new transportation routes between railheads and more remote areas. Settlement and economic growth went hand-in-hand with the ability to transport products and people. As a result, cattle and sheep ranching and settlement-based businesses such as stores and post offices developed in the region (BLM 1986a).

By the 1830s, the fur trade in the region had dwindled, but scientific exploration, westward expansion, mining, ranching, homesteading, and other endeavors drew an increasing number of people to Wyoming (Larson 1978). Explorers, trappers, traders, and settlers followed the North Platte River and other land-based routes that together became the Oregon, California, and Mormon Pioneer emigrant trails and the Pony Express route, and the first transcontinental telegraph line.

Mining exploration of the gold and silver deposits in the Laramie Range on the southern edge of the Powder River Basin also began in the mid-1800s. The copper, tungsten, chromium, iron, and vermiculite deposits in the Powder River Basin also began to draw more miners to the area (Lane et al. 1972). With increased Euro-American travel through and interest in the region, interactions with Native American tribes between the 1850s and 1870s were characterized largely by conflicts that manifested in wars, raids, massacres, treaties, retributions, and recriminations (Larson 1978). As a result, the U.S. government constructed military forts along the emigrant and mining trails to protect people engaged in westward expansion and economic development.

Child's Cutoff

In the early 1800s fur trappers followed well-worn Native American trails and identified South Pass (west of the CCPA) as the best mountain pass for wagon travel due to its comparatively gentle topography. Between 1841 and 1869, more than 200,000 Americans traveled the shared route of the Oregon-California-Mormon Pioneer-Pony Express NHTs to escape persecution or economic hardship, seek their fortunes in gold, and/or obtain more and better land (Dary 2004). In 1850, these emigrant trails experienced their peak use as approximately 45,000 to 65,000 people traveled these routes (BLM 1986a). Over time, people identified alternate and better routes, and travel became somewhat more predictable with more clearly marked trails, particularly along the North Platte River (Hafen 1982; Unruh 1979).

Child's Cutoff of the Oregon Trail was pioneered as an alternate, safer route by Andrew Child in 1850. He had been a member of one of the first emigrant groups to veer off the main travel corridor and follow the northern side of the North Platte River. The cutoff left the main trail near Fort Laramie and followed the north bank of the river until it rejoined the Oregon Trail near present-day Casper. The main route crossed the river and traveled west to a second crossing near Casper. While earlier explorers had found the northern route difficult and many turned back, Child and a few others found a route that avoided a dangerous river crossing at Fort Laramie and reduced the journey by 2 days. Starting in 1850, the route following the northern side of the North Platte became the standard travel corridor. Child documented the route in an 1852 guidebook. Once emigrants were regularly using Child's Cutoff, entrepreneurs established toll bridges and ferries at several locations near Casper, allowing travelers to weave back and forth across the river to avoid difficult portions of the trail.

The emigrant trails continued to serve as transportation arteries even after the transcontinental railroad was constructed in 1869. Into the early 20th Century, people traveled them in both directions for local and regional movement as well as for transportation of cattle, sheep, and horses. Users of the trails represented diverse cultures, ethnic groups, religious denominations, educational backgrounds, and economic interests. Collectively they influenced statehood, national politics, international relations and boundaries, and U.S. policy toward American Indians.

Child's Cutoff has been designated as a segment of the California NHT. Authorized by the Omnibus Public Land Management Act of 2009, the NPS is conducting a feasibility study to determine if Child's Cutoff and six other routes also should be designated as segments of the Oregon NHT. Accordingly, in compliance with BLM Manual 6280, any proposed action must be evaluated to determine impacts to the values, characteristics, and settings of Child's Cutoff and if it substantially interferes with or is incompatible with the trail's nature and purposes.

Bozeman Trail

Blazed in 1863 and used most intensively between 1864 and 1868, the Bozeman Trail was a regionally important trail that left the Oregon Trail just north of present-day Douglas. Its southern end had three variants. John Bozeman established the original route of the Bozeman Trail in 1863 to take people from the Oregon Trail to the gold fields around Alder Gulch and Emigrant Gulch in western Montana. His original route followed the Salt Creek River and crossed the hunting grounds of the Northern Cheyenne and Sioux. It was most likely not a new trail, but an ancient route that was well known by tribes (Fraser Design 2006). The use of this trail, in combination with the dramatically increasing numbers of Euro-Americans who were moving into the region, led to battles between the tribes and U.S. troops.

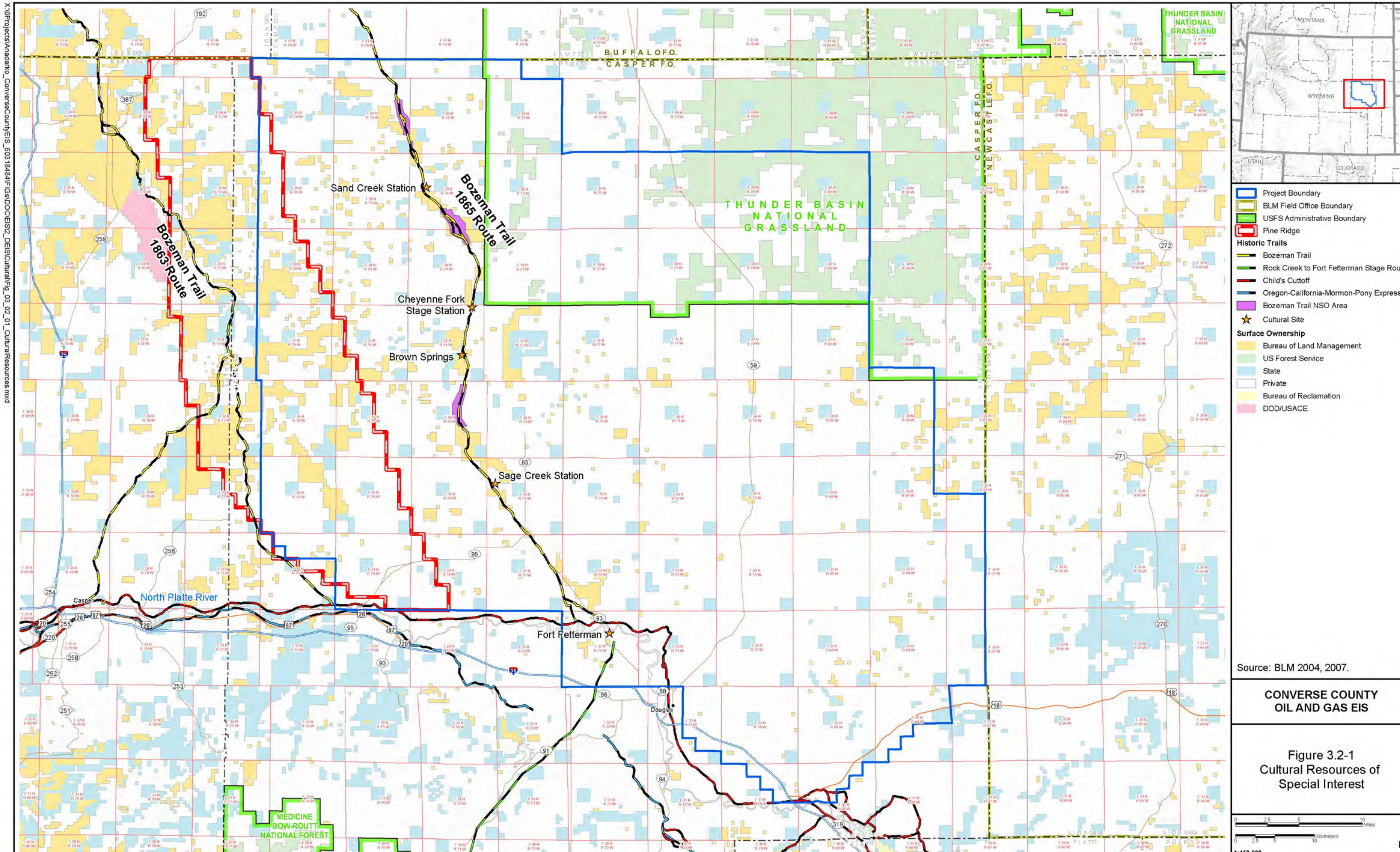

Figure 3.2-1
Cultural Resources of Special Interest

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As the trail became increasingly militarized, members of the military adjusted its path from Bozeman's original route. In 1865 General Patrick Edward Connor took a more easterly route along the Dry Fork River during the Powder River campaign against the Sioux, Cheyenne, and Arapaho who were attacking Bozeman Trail travelers. Connor built Fort Connor, which later become Fort Reno, at the convergence of the Powder and Dry Fork rivers. Connor's route became the main route of the Bozeman Trail for transporting supplies and deploying troops during the Plains Indian wars of the 1860s and 1870s. The military adjusted the trail's route a third time by implementing a cutoff that connected two other forts along the trail—Fort Phil Kearny and Fort C.F. Smith.

Numerous battles and skirmishes were fought along the Bozeman Trail between Native Americans and Euro-Americans, primarily led by Red Cloud, a prominent Oglala Sioux chief. One of these, sometimes called the Fetterman Massacre, was one of the worst military defeats suffered by the U.S. on the plains. It and two subsequent battles during Red Cloud's War served to effectively close down the Bozeman Trail and catalyze the 1868 Treaty of Fort Laramie (Larson 2011). As soon as Fort Phil Kearney was built, Red Cloud and his warriors kept the fort under near-constant siege. In late 1866, Captain William Fetterman and 81 men were sent to rescue what was believed to be a wood cutting detail under attack. However, tribal decoys drew Fetterman and his men over Lodge Trail Ridge and into a trap. Red Cloud and reportedly 1,000 warriors killed all of Fetterman's troops. Fetterman committed suicide rather than face capture and torture by the united Sioux and Arapaho warriors. Not all battles were so one-sided though, and the Sioux, Cheyenne, and Arapaho lost many of their own along the trail between 1866 and 1868, during Red Cloud's War (also referred to as the Bozeman War and the Powder River War). After the Treaty of Fort Laramie was signed, the U.S. agreed to abandon the forts. Shortly thereafter, Fort Kearney was burned to the ground, likely by the Cheyenne (Northern Plains Reservation Aid [NPRA] 2014). Native American control of the Powder River Basin lasted only 8 years, when the U.S. made a concerted military effort to force the Sioux back onto their reservation (Barrett 2011).

The Wyoming SHPO has determined that the Bozeman Trail is eligible overall for the NRHP, and some segments of it are listed in the NRHP.

<u>Rock Creek to Fort Fetterman Stage Route</u>

Fort Fetterman was one of the three forts built along the Bozeman Trail to protect miners and army members from raiding tribes. It was established in 1867 on a plateau above the North Platte River, approximately 11 miles north of present-day Douglas where the Bozeman Trail bisected the Oregon Trail (i.e., at the southwest corner of the CCPA). The Rock Creek to Fort Fetterman Stage Route connected the Rock Creek Stage Station on the Overland Trail, near present-day Interstate 80 southwest of Rock River ***and the CCPA***, with Fort Fetterman. Soldiers created the 83-mile-long, heavily traveled route in 1877 for transporting supplies to the fort (Thybony et al. 1985).

3.2.2.5 Background

WYCRO file searches were conducted on November 6, 2013, May 1, 2014, and June 8, 2017. Portions of the three historic trails (i.e., Child's Cutoff of the Oregon Trail, the Bozeman Trail, and the Rock Creek to Fort Fetterman Stage Route) run through the CCPA (**Figure 3.2-1** and **Table 3.2-2**). As summarized in **Table 3.2-1**, up to 15 other linear resources within the CCPA are historic roads, including four unnamed wagon or local roads, five county roads (Converse County Road 1-17, Highland Loop Road, Esau Road, Ogalala Road, and Irvine Road), two segments or off-shoots of the Bozeman Trail (Antelope Creek Crossing and Smith's Cutoff), and one segment of the Yellowstone Highway. Several buildings associated with the trails and roads also have been recorded previously within the CCPA. Those of note include Fort Fetterman, Cheyenne Fork Stage Station, Brown Springs, Sand Creek Station, and Sage Creek Station. All four of the stage stations are located along or near the Bozeman Trail. Fort Fetterman is located near the confluence of the Bozeman Trail, Child's Cutoff, and the projected location of the Oregon Trail.

The Oregon-California-Mormon Pioneer-Pony Express NHTs roughly parallel the south side of the North Platte River. Two possible segments of these emigrant trails have been recorded on the north side of the river in the very southwestern portion of the CCPA, but almost no data are available for them. Based on their location north of the river, it is possible that these segments were misidentified and are actually segments of Child's Cutoff, which runs across the south-central portion of the CCPA, roughly following the north bank of the North Platte River. The location of Child's Cutoff has been plotted based on depictions from General Land Office maps. The General Land Office-mapped length of the trail through the CCPA is 21 miles, but only 2 segments totaling 0.7 mile have been verified and recorded.

Table 3.2-2 Historic Trails Recorded Previously within the CCPA

Trail/Road	Documented Length within CCPA (miles)		Associated Site(s) in CCPA	Designation Level
	Total	Verified Segments		
National Historic Trail				
Child's Cutoff of Oregon Trail	21	0.7	N/A	National
Other Trails/Roads				
Bozeman Trail	76	30	Cheyenne Fork Stage Station, Brown Springs, Sand Creek Station, Sage Creek Station	Regional
Rock Creek to Fort Fetterman Stage Route	4	0	Fort Fetterman	Local

The easternmost variant of the Bozeman trail runs north-northwest through the CCPA, beginning just north of present-day Douglas where it met the Oregon Trail. The entire length of the trail within the CCPA has been plotted from General Land Office maps. The General Land Office-mapped length of the trail through the CCPA is approximately 76 miles. Of that length, 41 segments totaling approximately 30 miles have been verified and recorded. Most of the northern portion of the trail has been well recorded within the CCPA, including a nearly continuous 19-mile section.

The Rock Creek to Fort Fetterman Stage Route started at Fort Fetterman, just north of Douglas, and ran south past present-day Rock Creek to the Overland Trail***, located well outside the CCPA***. Only 4 miles of the ***Rock Creek to Fort Fetterman Stage Route are present*** in the far southern portion of the CCPA. No portions of the route have been recorded previously within the CCPA, but Fort Fetterman has been.

3.2.3 Resources of Native American Concern

As used in this EIS, the term resources of Native American concern ***refers to Indian sacred sites, TCPs, and a larger pool of cultural resources, natural resources, and locations on the landscape from which additional Indian sacred sites and/or TCPs potentially may be identified during on-going tribal consultation. Indian sacred sites and TCPs are specific resources of Native American interest that have been determined through tribal consultation to be very culturally significant.***

Indian ***s***acred ***s***ites are defined in EO 13007 (NPS 1996) as "any specific, discrete, narrowly delineated location on federal land that is identified by an Indian tribe, or Indian individual determined to be an appropriately authoritative representative of an Indian religion, as sacred by virtue of its established religious significance to, or ceremonial use by, an Indian religion; provided that the tribe or appropriately authoritative representative of an Indian religion has informed the agency of the existence of such a site." ***This definition does not fully acknowledge traditional Native American views that the sacred is***

present in all natural phenomena, and that sacred sites are often not confined or precisely delineated. Indian sacred sites are considered under EO 13007 and the American Indian Religious Freedom Act (AIRFA). The AIRFA requires policies of all governmental agencies to eliminate interference with the free exercise of Native American religions, based upon the First Amendment to the United States Constitution, and to accommodate access to, and use of, Native American religious sites to the extent that the use is practicable and is consistent with an agency's essential functions. Indian sacred sites are identified during tribal consultation and do not need to be 50 years old or older. Indian sacred sites may also be TCPs if they qualify as such, but they do not have to be. If an Indian sacred site is also an NRHP-eligible TCP, it must be considered under NHPA, as well as under EO 13007 and the AIRFA through the NEPA analysis (BLM 2018).

The term TCP was created by the NPS and described in National Register Bulletin 38: Guidelines for Evaluating and Documenting Traditional Cultural Properties (Parker and King 1998). TCPs are cultural resources that are "eligible for inclusion in the National Register because of [their] association with cultural practices or beliefs of a living community that (a) are rooted in that community's history, and (b) are important in maintaining the continuing cultural identity of the community" (Parker and King 1998). Since then, the term has entered widespread vernacular use and been used in court decisions related to Section 106 compliance. TCPs are not limited to Native American-related resources. However, the NEPA, NHPA, and 36 CFR 800 regulations specifically identify consultation requirements for Native American TCPs and properties of traditional religious and cultural importance under the NHPA. TCPs are by definition eligible for the NRHP (see above) and may meet one or more of the NRHP criteria. TCPs may be sacred or secular. All TCPs must be considered during the NEPA analysis, including through cultural landscape assessments and tribal consultation. Since TCPs are eligible to the NRHP, they must also be considered under the NHPA.

Only a small portion of the CCPA has been inventoried previously for cultural resources and tribal consultation is on-going; therefore, this EIS also considers a larger pool of specific types of cultural resources as resources of Native American concern. These are resource types with the most likely potential to yield additional Indian sacred sites and/or TCPs. Previous ethnographic research suggests that such cultural resources include places named in oral histories or myths, such as rock formations and the confluence of rivers; human-constructed features and sites such as petroglyphs and pictographs, burial cairns, stone circles, vision quest structures, medicine wheels, game drive systems, and prehistoric habitations; landscapes, viewscapes, and battlefields; locations used for religious practices; and traditional travel and gathering areas such as trails and dance locations; as well as natural resource areas, such as plant harvesting locations and stone and clay deposits (Parker and King 1998; Gulliford 2000).

Under numerous federal authorities and the State Protocol (BLM and SHPO 2014), the BLM will conduct on-going tribal consultation specifically about confirmed and potential Indian sacred sites, TCPs, and other resources of Native American interest.

3.2.3.1 Analysis Area

The integrity of resources of Native American concern can be particularly sensitive to both direct (i.e., physical) and indirect (e.g., visual, auditory, olfactory) impacts; therefore, the analysis area for resources of Native American concern is the CCPA plus their ***associated setting***. A specific area that is partially within the CCPA but also extends outside the CCPA and was analyzed for effects from the proposed undertaking is the Pine Ridge area, comprising up to a total of 321,920 acres within and outside of the CCPA (**Figure 3.2-1**). As of 2004, just over 9 percent of the total area had been inventoried for cultural resources. While the area has relatively low site density because of its steep topography, it contains the largest number of stone alignments and hunting blinds or traps in the ***known*** CFO, as well as a relatively large number of stone circles. This evidence suggests it was a favored location for hunting, particularly in the Late Prehistoric and early Historic periods. The only restriction for this area is that the minimum cultural resource block inventory size is 40 acres and the minimum linear inventory width is 100 feet on each side of surface disturbance (BLM 2007b).

3.2.3.2 Eligibility Criteria for NHRP

TCPs are by definition eligible for the NRHP (see above) and may meet one or more of the NRHP criteria. Indian sacred sites may be eligible for the NRHP if they are at least 50 years old (or meet Criteria Consideration G) and meet at least one of the NRHP criteria. These resources are most commonly eligible under Criteria A or B for their association with traditional teaching, cultural, or spiritual events and/or leaders, teachers, prophets, or deities. Other resources of Native American interest (e.g., game drive systems) may also be eligible under Criteria C and/or D for their methods of construction and/or potential to yield important information about past lifeways.

3.2.3.3 Regulatory Framework

Federal law and agency guidance require federal agencies to consult with Native American tribes concerning the identification of cultural values, religious beliefs, and traditional practices of Native American people that may be affected by actions on federally administered lands. This consultation includes the identification of physical locations of traditional cultural importance to Native American tribes.

The laws, ordinances, regulations, and standards that apply to cultural resource protection in general (see Section 3.2.1.3) also apply to resources of Native American concern. Additional federal laws, regulations, and directives include, but are not limited to, the following:

- ***AIRFA*** of 1978 (42 USC 1996, 1996a)
- Archaeological Resources Protection Act of 1979 (16 USC 470aa)
- EO 13007 Indian Sacred Sites (61 FR 104)
- ***EO 13175 Consultation and Coordination with Indian Tribal Governments (65 FR 218)***
- Native American Graves Protection and Repatriation Act of 1990 (25 USC 3001)
- ***Wyoming Statute SF0078 Archaeological human burial sites***

Furthermore, the following BLM manual and handbooks provide policies and guidance for tribal consultation:

- MS-1780, Tribal Relations (BLM 2016e)
- H-1780-1, Improving and Sustaining BLM-Tribal Relations (BLM 2016f)
- ***H-1790-1, Implementing the National Environmental Policy Act (BLM 2008e)***

3.2.3.4 *Tribal History Overview*

Based on historical research and tribal consultation previously conducted by the BLM, Native American groups known to have used the CCPA prehistorically (i.e., pre-contact), protohistorically, and historically include the Crow, Eastern Shoshone, Northern Arapaho, Northern Cheyenne, and Sioux tribes. This section summarizes information about the tribes' histories and cultural practices, particularly as they relate to the CCPA.

<u>Events Held in Common among the Tribes</u>

The cultural history of each of the tribes is unique, but all of the tribes were affected by Euro-American-introduced diseases, the fur trade, warfare, ***and many Federal laws and actions including*** the Dawes

Act, and the Indian Reorganization Act. The Plains tribes may have been infected by smallpox as early as 1617, with the first documented epidemic devastating the Western Cree, the Arikara, and possibly the Sioux in the 1730s. Another epidemic from 1837 to 1838 caused a mortality rate as high as 95 percent among some Plains tribes. During the 1800s, plague, whooping cough, influenza, cholera, and typhoid also infected the Plains tribes. The results of such dramatic loss of life included higher suicide rates, loss of traditional knowledge, and the formation of new groups comprising small refugee populations that merged together (Swagerty 2001). At the beginning of the 1800s, having suffered often staggering losses of population, many tribes began holding the Sun Dance. Participants in the 4-day Sun Dance fasted and danced, seeking benefits for their families and communities through prayer and self-sacrifice (Stamm 1999). Shimkin (1986) views the Sun Dance as a political event with religious elements, although visions and ritual ceremonialism are very important elements of Plains cultures in general (Shimkin 1986; Wilson 1996).

Equally devastating changes to Plains tribes resulted from the expansion of the Euro-American trade industry. Initial trading of beaver pelts between French trappers and Northern Plains tribes in the 1730s was at a comparatively small scale. To facilitate larger scale trade, the Euro-American/tribal rendezvous system developed (Swagerty 2001). This was facilitated by the fact that many tribes began to acquire large numbers of horses through theft and trade beginning in the late 1600s (Cowdrey et al. 2012). Horses enabled groups to cover a much wider area and to convene at distant locations. Numerous tribes, including the Nez Perce, Flathead, Crow, Bannock, Ute, and Shoshone met with Euro-American traders in the Green River, Bear River, Snake River, and Wind River drainages during the summer to exchange robes, skins, and especially beaver furs for manufactured goods (Stamm 1999; Utley 1984). Fifteen annual meetings were held between 1825 and 1840 (Russell 1967). However, once beaver pelts went out of fashion by the early 1840s, the rendezvous system disbanded (Dolin 2010). Based in large part at what became Fort Bridger in 1843, an important stop for emigrants on the Oregon Trail in southwestern Wyoming, the buffalo robe industry replaced the beaver trade and rose to a much greater magnitude, dominating the Plains economy by the mid-19th Century (Swagerty 2001). In 1848, the American Fur Company alone shipped 110,000 robes. Between the 1830s and 1860s, annual averages of 90,000 to 100,000 robes were sent to St. Louis, with smaller numbers going to other hubs. The decimation of herds led to the end of the buffalo robe trade. In 1883 40,000 robes were traded, but in 1884 only 300 were sent (Dolin 2010). By 1889 the total buffalo population in North America was 1,091. Before Europeans arrived in North America, the buffalo population may have exceeded 30 million (Chittenden 1986; Dolin 2010). Needless to say, this destruction of the buffalo population, on which Plains tribes had formerly depended for food, clothing, and more esoteric purposes, forever impacted Plains cultures and helped force them onto reservations (Dolin 2010).

The movement of tribes onto reservations greatly challenged their traditional ways of life, as the BIA also enacted rules that outlawed horse raids, polygamy, giveaways, medicine men, selling a horse to another Native American, hunting off-reservation with a special pass, and most ceremonies including the Sun Dance (Frey 1987; Voget 2001). With few other choices, hundreds of families were attempting to take up farming by the mid-1880s, but the Dawes Act hampered that and many families were eventually forced to lease out their lands for income (Voget 2001).

This was compounded by the Dawes Severalty Act of 1887. The objective of this act was to completely change Native American lifeways and assimilate tribal people into Euro-American society. One element of the act was to allot reservation land to individuals, rather than having the tribe hold it in common. This was thought to protect Native Americans from broken treaties and bring them into a mainstream farming economy, despite the fact that most allotted lands were unsuitable for farming (Debo 1985). However, the Dawes Act had several other consequences. The primary result of the act was confiscation of large amounts of tribal land. After giving set numbers of acres to people of different standings and genders, an enormous amount of reservation land remained unallotted, which Euro-Americans were allowed to claim, further reducing reservation sizes. Between 1889 and 1891, approximately 11.5 percent (12,071,380 acres) of tribal lands were “restored” to the public (Debo 1985). Furthermore, allottees were required to become U.S. citizens and tribes living on reservations did not have to give consent for allotment to proceed. Other provisions and amendments caused further complications for tribes, who widely protested the law. Euro-Americans also attempted to acculturate Native Americans through education. In the late 1800s and early 1900s, thousands of youth were forcibly taken from their families and sent to off-reservation schools where their hair was cut, their names were Anglicized, and they were forbidden to speak their native languages (Chief Dull Knife College 2008). Many people strongly resisted this acculturation, holding onto their traditional ways in secret if necessary.

President Franklin D. Roosevelt's Indian Reorganization Act of 1934 ended allotment, restored surplus lands to tribal ownership, and allowed for tribes to purchase additional land (Swagerty 2001). In addition, the act charged the Bureau of Indian Affairs (BIA) with creating a model constitution for tribal governments. Once tribes ratified charter constitutions, they became eligible for government loans (Debo 1985; Swagerty 2001).

<u>Crow</u>

The Crow are a Siouan-speaking tribe that lived on the Upper Missouri River in North Dakota with the Hidatsa until sometime during the 16th Century. At that time, they separated from the Hidatsa and moved west to Montana and Northern Wyoming (Voget 2001). At the beginning of the 19th Century, the Mountain Crow and River Crow were two politically distinct bands. By 1850, the Kicked in the Bellies band formed as an offshoot of the Mountain Crow. While River Crow territory ranged from the lower Yellowstone River to the Milk and Marias rivers on the Northwestern Plains, Mountain Crow territory ran along the Bighorn, middle Yellowstone, and Powder rivers and into the surrounding mountains. Kicked in the Bellies spent their winters in the Wind River region but often joined the Mountain Crow at other times of the year. In 1851, the first Treaty of Fort Laramie defined Crow lands as 38 million acres along the Yellowstone River and in the Big Horn and Wind River Mountains (Frey 1987; Rzeczykowski 1999). However, in 1868 the second Treaty of Fort Laramie reduced Crow lands to just 8 million acres in Montana.

The Crow were nomadic hunter-gatherers who became a particularly powerful tribe after they acquired horses in 1730, probably through trade with the Comanche (Ewers 1980; Voget 2001). Horses enabled the Crow to become powerful middlemen in intertribal and Euro-American trade networks of the Northern Plains by the beginning of the 19th Century (Voget 2001), exchanging beaver pelts and then horses and mules for manufactured goods. The Crow traveled to various trading posts and many rendezvous were held in Mountain Crow territory in the Wind River Mountains (Voget 2001). Another vital part of Crow culture was cultivating tobacco for ceremonial purposes (Lowie 1956). Crow oral tradition identifies the Big Horn Mountains as the origin of the Sacred Tobacco Society. Petroglyphs found there depict figures with flat headdresses, which are thought to portray members of the Sacred Tobacco Society. The Big Horn Mountains remain a sacred area for the Crow (Francis and Loendorf 2002).

In 1864 the Bozeman Trail opened to facilitate the gold mining industry in Montana. Passing through the Powder River Basin on the eastern side of the Big Horn Mountains, the trail traversed the heart of Crow territory. At that time the Sioux and Blackfoot were trying to move the Crow off their own buffalo hunting grounds. When the Sioux sought to form an alliance with the Crow to fight the U.S. Army and the Bozeman Trail, the Crow chose to remain neutral. After a time, some Crow became couriers between forts for the U.S. Army (Rzeczykowski 1999) and eventually allied with the U.S. Army to better resist the Sioux. They also became scouts in U.S. Army campaigns against the Northern Cheyenne and Arapaho (Fowler 2001a). In 1876 Crow men served with the U.S. Army at the Battle of the Little Bighorn (Rzeczykowski 1999). However, the Crow Agency was established in 1883 (Voget 2001), and reservation laws removed the Crow's means of counting coup, destroying the system whereby men acquired prestige and selected chiefs. Yet, despite these extraordinary challenges to their culture, the Crow have maintained many of their traditions and adopted new ones.

Eastern Shoshone

The Eastern Shoshone are a Numic-speaking tribe with origins in the Great Basin Culture Area, on the western side of the Rocky Mountains (Deaver 1996; Shimkin 1986; Steward 1938). Archaeologists do not all agree on the timing of the Numic expansion into Western Wyoming, but some suggest that ancestral Shoshonean groups were present in that area by the Early Archaic period (Larson and Kornfeld 1994). Linguistic and historical information provide evidence that the Eastern Shoshone were along the Wyoming Front Range by the 1500s (Deaver 1996; Shimkin 1986). A century later, a group of Eastern Shoshone moved onto the Southern Plains and became known as the Comanche, although the groups retained close ties (Deaver 1996; Shimkin 1986). The Eastern Shoshone also are affiliated with the Northern or Lemhi Shoshone, the Shoshone-Bannock, and the Northern Paiute (Steward 1938). Lewis and Clark encountered Shoshone groups on both sides of the Rocky Mountains and as far north as southern Saskatchewan (Larson and Kornfeld 1994; Shimkin 1986). In the early 1900s, most of western Wyoming, past the Wind and Bighorn rivers, was considered to be Eastern Shoshone territory (Steward 1938). During early historic times, it seems that the Wind River Basin in central Wyoming was particularly important (Deaver 1996; Shimkin 1986; Stamm 1999). The most sacred places there are those containing pictographs and petroglyphs (Shimkin 1986), traditionally believed to have been made by spirits (Francis and Loendorf 2002). As reflected in Eastern Shoshone culture itself, the Wind River Basin represented an interface between the Great Basin and Plains Culture Areas; their social organization was similar to that of other Great Basin groups, but adapted to the Plains ecosystem (Shimkin 1986; Stamm 1999).

The Eastern Shoshone were seasonally mobile hunter-gatherers who came together to communally hunt buffalo, various artiodactyls, and jackrabbits, and to fish, often using weirs. Plant resources also were vital to their economies and were largely provided by women. Eastern Shoshone bands often joined with other Plains tribes, particularly the Crow and Comanche, for hunting buffalo and trading (Shimkin 1986). The Eastern Shoshone acquired horses by at least the beginning of the 18th Century, most likely from the Comanches, who had obtained them from the Spanish (Ewers 1980). As for many other Plains tribes, horses allowed the Eastern Shoshone to travel more widely and participate in large-scale communal buffalo hunts. The Shoshone and Comanche may have been some of the earliest mounted buffalo hunters on the Plains. In addition, horse ownership gave them military superiority (Stamm 1999). However, this changed when the Blackfeet acquired both guns and horses in 1750 before the Eastern Shoshone obtained the former (Ewers 1980; Stamm 1999). In addition, smallpox epidemics in 1781 and 1800 greatly reduced their population. As a result of these and other factors, the Eastern Shoshone largely retreated back to the Big Horn and Wind River basins; by 1806 only small hunting parties or individual traders ventured east of the Big Horn Mountains (Stamm 1999).

About this same time, the Eastern Shoshone had their first direct contact with Euro-American fur trappers and traders (Shimkin 1986). The Eastern Shoshone soon acquired guns and other manufactured goods from traders, giving them more equal standing with other Plains tribes (Stamm 1999). After the demise of the beaver pelt trade and the rendezvous system, a community of trappers and Eastern Shoshone gathered around Fort Bridger in southwestern Wyoming, which was an important stop for emigrants on the Oregon Trail and served as a focal point for the buffalo robe trade. Bands often gathered at Fort Bridger for the Sun Dance after the spring buffalo hunt and in the fall to receive annuities from the U.S. government (Stamm 1999). In the 1840s, most Eastern Shoshone joined under Chief Washakie in reaction to escalating confrontations with the Blackfeet, Arapaho, Cheyenne, Gros Ventre, and Sioux. They also made several alliances with the growing number of Euro-Americans in the area to continue to acquire guns and ammunition (Stamm 1999).

After the 1851 Treaty of Fort Laramie gave the upper Wind River Basin, the Big Horn Basin, and much of the Yellowstone region to the Crow, the Eastern Shoshone were forced to travel to Montana for buffalo. This caused friction among the two tribes and may have led Chief Washakie to repeatedly negotiate with the U.S. government for a reservation in the Wind River region. The government viewed the Eastern Shoshone as peaceful, and granting them a reservation in the Wind River may have helped discourage more hostile groups from entering the area (Stamm 1999). The Shoshone, Bannock, and U.S. signed a treaty in June 1868 creating the Wind River Reservation. That reservation is unique in that it was the only one in the U.S. to encompass lands chosen by the tribe assigned to it (Shoshone Indian Tribe 2003). Shoshone started moving to the reservation in the early 1870s but continued to hunt and gather off the reservation as well. As with tribes relegated to other reservations, the Eastern Shoshone were expected to give up hunting and become farmers. However, the latter was unsuccessful and the U.S. government often did not provide enough food. To help feed themselves and their families, many Shoshone men joined the Army to fight against their traditional Native American enemies. In the 1874 Bates Battle the Shoshone supported the Army during an engagement against the Northern Arapaho (Stamm 1999). After the battle, the Northern Arapaho petitioned the U.S. government for a reservation of their own, and in 1877 the Eastern Shoshone agreed to let the Northern Arapaho temporarily settle on the eastern side of their reservation. However, that situation became permanent after the first bands of Arapaho arrived in 1878 (Shoshone Indian Tribe 2003), violating Eastern Shoshone treaty rights. In 1939 the Eastern Shoshone received compensation for the loss of that land. As a result of encroachment by Euro-American settlers and stockmen, the decimation of the buffalo population, and the Dawes Allotment Act of 1887, two-thirds of the Wind River Reservation had passed out of tribal ownership by 1904 (Stamm 1999). In the face of great poverty and even starvation, the Eastern Shoshone continued to practice the Sun Dance as a source of hope and healing. Some people also adopted elements from Mormonism, Christianity, peyote rituals, and the Ghost Dance (Shimkin 1986; Stamm 1999).

Northern Arapaho

The Northern Arapaho are Algonquian speakers but their language is very different from that of the Blackfoot and Cheyenne who are the other Algonquian speakers on the Plains. It appears that the languages probably separated as long as 1,000 years ago (Schlesier 1994). During prehistoric (i.e., pre-contact) times, the Arapaho appear to have lived in villages in the Great Lakes and upper Mississippi River region as semi-sedentary horticulturalists (Schlesier 1994). However, it seems that pressure from other groups, most likely the Sioux, led the Arapaho to move south and west at some unknown time (Anderson 2001; Fowler 2001b; Gregg 1994). This geographic move coincided with a change to a more mobile lifestyle on the Northern Plains that was intimately tied to the buffalo as well as to horses by at least the late 1600s or early 1700s (Ubbelohde et al. 1995).

Before 1800, the Spanish called the Arapaho “Caminanbiches” and reported that they lived on the headwaters of the Cheyenne River in western South Dakota and eastern Wyoming near the Kiowa. A map obtained from the Gros Ventre (an Arapaho tribe) in 1800 showed four separate Arapaho groups. At that time, Arapaho lived between the Yellowstone and Platte rivers, were wealthy in horses, and traded prairie turnip flour to the Arikara for corn. They also used hunting grounds in the Black Hills, where in 1806 they formed an alliance with the Cheyenne, largely to counter the Sioux who were pushing west from the Missouri River (Fowler 2001b). Either simultaneously (Ubbelohde et al. 1995) or with the Arapaho moving first (Baker et al. 2007), the two tribes traveled farther south along the east edge of the Rocky Mountains in the early 1800s, pushing out the Kiowa who then joined the Comanches south of the Arkansas River. Based on historical accounts, by about 1815 the Arkansas River generally separated the ranges of the Arapaho and Cheyenne from those of the Kiowa and Comanche (Ubbelohde et al. 1995). The Arapaho and Cheyenne traveled seasonally between the Continental Divide in the Rocky Mountains on the west and the open plains to the east.

In 1846 the U.S. government created the Upper Platte and Arkansas Indian Agency. In 1849, the government bought the American Fur Company’s post at Fort Laramie for an Indian agent base, which was the site of a Great Plains Indian council in 1851, with more than 10,000 Indians attending. Represented tribes included the Cheyenne, Arapaho, Snake, Sioux, Assiniboine, Gros Ventre, Arikara, and Crow. The meeting resulted in a treaty through which the tribes agreed to hunt within designated tribal boundaries and to let non-Native Americans journey through tribal lands and build forts to protect travelers on overland trails. In return the agents promised to distribute $50,000 worth of trade goods each year for the next 15 years. However, this amount decreased to $15,000 per year by the time the treaty was enacted (Ubbelohde et al. 1995). The Cheyenne and Arapaho were assigned to an area defined by the Platte River on the north and the Arkansas River on the south. It included much of eastern Colorado, southeastern Wyoming, southwestern Nebraska, and western Kansas. Still, Euro-Americans settled in tribal territories, so some Arapaho bands began to move north and others south (Fowler 2001b).

In 1858, gold was discovered at the confluence of the Platte River and Cherry Creek near Denver, Colorado. This brought much larger numbers of Euro-American settlers to the region, with miners moving onto lands reserved for tribes and demanding that the government dissolve Indian claims (Clark 1999). In reaction, a group that became known as the Northern Arapaho began to withdraw into the Bighorn region of Wyoming and Montana, allying themselves with the Sioux and Northern Cheyenne. Another group that became known as the Southern Arapaho withdrew down the Arkansas River (Fowler 2001b). In 1861 the Southern Arapaho and Cheyenne were pressured to relinquish their previously assigned territory, but they chose not to go to war with the U.S. That changed after the Sand Creek Massacre in September of 1864, when a peaceful encampment of some Arapaho and many more Cheyenne was attacked. The incident led to war between the tribes of the southern and central Plains and the U.S. (Fowler 2001b).

Lands of the Northern Arapaho who had moved to Wyoming and Montana also were trespassed on by Euro-Americans, particularly after gold was discovered in Montana in 1862. A war between Native Americans and Euro-Americans over hunting territory lasted from 1865 to 1868. Negotiations during that time led to the Northern Arapaho, Cheyenne, and Sioux agreeing to cede much of their more extensive territory, established during the aforementioned 1851 treaty. They agreed to settle on a reservation as long as they were able to hunt undisturbed north of the Platte River and east of the Big Horn Mountains. For a while the Northern Arapaho worked to develop good relations with army officers at Fort Fetterman near Douglas in east-central Wyoming. They also pursued peace with the Eastern Shoshone, their former enemies, who had obtained a reservation in Wyoming in 1868, and considered arranging settlement on the Gros Ventre reservation in Montana. For a while the Northern Arapaho did live on the Eastern Shoshone reservation but conflicts with trespassing Euro-Americans resulted in their relocation to the Red Cloud Agency of the Oglala Sioux. However, continuing conflicts with Euro-Americans and Eastern Shoshones between 1870 and 1876 led to many deaths and to pressure from peace commissioners for the Arapaho, as well as the Cheyenne and Sioux, to cede their claims to the Black Hills and all lands outside the Great Sioux Reservation. The Northern Arapaho were amenable to settling with the Sioux or Southern Arapaho but continued to negotiate for their own separate reservation. Most of the Northern Arapaho warriors enlisted in the U.S. Army in 1876–1877; therefore, they gained the army's backing for their settlement in Wyoming and moved back to the Wind River Reservation in March 1878 (Fowler 2001b). In 1900, the Northern Arapaho accepted allotment of a large block of land to receive official title to land on the Wind River Reservation (Fowler 2001b).

Northern Cheyenne

Like the Arapaho, the Cheyenne are Algonquian speakers who appear to have originated in the Great Lakes region (Binnema 1998; Moore et al. 2001; Schlesier 1994). The Cheyenne comprise two affiliated groups, the Tsistsistas and the Sutaio (BLM and Joe Little Coyote 2002; Moore et al. 2001). The name Cheyenne first appeared as a Sioux village on a 1678-1679 map of present-day Minnesota. At that time, the Cheyenne subsisted largely on wild rice and other locally available resources, making occasional buffalo hunting trips to the eastern edge of the plains (Swagerty 2001).

During the 18th Century, in the early days of the fur trading era, the Chippewa and Assiniboine obtained firearms through trade and used them against the Cheyenne (Moore et al. 2001). This apparently led the Cheyenne to move west to the Black Hills of South Dakota. Once there, the Tsistsistas and Sutaio unified and stopped practicing horticulture (Swagerty 2001). The Cheyenne soon became close allies with the Arapaho (Binnema 1998). Like many other Plains tribes, the Cheyenne also obtained horses during the 1700s and began following and hunting buffalo herds as well as other animals (Ewers 1980).

In addition, they gathered at least 40 different edible plants as the Cheyenne moved across the landscape. Buffalo hunts occurred in early summer and fall (Moore et al. 2001). After becoming horse people, the Cheyenne's territory increased from the Black Hills to encompass the Great Plains from the Dakotas to the Arkansas River (Northern Cheyenne Tribe 2013).

The Cheyenne split into northern and southern branches in the 1830s. The Southern Cheyenne stayed fairly close to that area. Nearby Bent's Fort provided good trading opportunities (BLM and Joe Little Coyote 2002; Moore et al. 2001). In contrast, the Northern Cheyenne traveled north and lived in the Black Hills, the Powder River, the Yellowstone River, and the Tongue River regions in the Dakota and Montana Territories (BLM and Joe Little Coyote 2002). Still, the two tribal divisions remained in close contact.

The Oregon-California Trail ran through Northern Cheyenne territory and the Santa Fe Trail ran through Southern Cheyenne territory. It is estimated that approximately 19,000 Euro-American emigrants crossed the Plains between 1840 and 1848, putting pressure on the resources available to all of the Plains tribes. Furthermore, the cholera epidemic of 1848–1849 killed over half of the Cheyenne people (Swagerty 2001), eliminated two of the original ten bands, and forced the survivors of the Flexed Leg Society to merge with the Dog Soldiers (Moore et al. 2001). As a result, Bent's Fort was abandoned.

In 1825 the U.S. signed the first "friendship treaty" with the Cheyenne as an attempt to bring them in line with the government's Indian Policy (Swagerty 2001). The 1851 Treaty of Fort Laramie officially recognized the two divisions of the Cheyenne (Moore et al. 2001) and assigned the Cheyenne to an area shared with the Arapaho north of the Arkansas River and south of the North Platte River in present-day Wyoming, Colorado, Nebraska, and Kansas. The Sioux received the area north of the North Platte River even though both Northern Cheyenne and Northern Arapaho bands were living there (Fowler 2001b).

Due largely to encroachment of Euro-Americans, the Cheyenne went to war with the U.S. in 1854 and engaged U.S. troops in nearly 50 battles between 1854 and 1879 (Moore et al. 2001). The 1864 Sand Creek Massacre was the culmination of a campaign of extermination carried out by the U.S. against the Cheyenne (BLM and Joe Little Coyote 2002). After another short period of warfare against the U.S., the Southern Cheyenne and Southern Arapaho were removed to Oklahoma in 1868 (Moore et al. 2001). The Northern Cheyenne also fought in some well-known battles, including The Great Sioux War of 1876–1877 (Moore et al. 2001). During the Battle of the Little Bighorn, allied tribes overwhelming defeated General George Armstrong Custer. Despite winning the battle, the Northern Cheyenne and Teton Sioux lost the war and were forced onto reservations. The Northern Cheyenne temporarily relocated to the Cheyenne-Arapaho Agency in Oklahoma (Fowler 2001b) beginning in 1877. Nearly 300 Northern Cheyenne broke out of the Agency in 1878 (Chief Dull Knife College 2008; Fowler 2001b) but were followed by the U.S. Army and suffered many casualties and starvation as they eventually made their way home. They eventually settled with other Northern Cheyenne in Montana (Chief Dull Knife College 2008; Moore et al. 2001).

The Tongue River Reservation was established in 1884 near present-day Colstrip in southeastern Montana (Fowler 2001b). Originally 371,200 acres, the reservation's size was increased in to 444,157 acres in 1900, at which time it came to be known as the Northern Cheyenne Indian Reservation (Chief Dull Knife College 2008; Peters and Wooley 2014). At first the Northern Cheyenne ran a successful livestock industry, but the BIA implemented policies that limited the size of their herds in order to reduce competition with Euro-American ranchers (BLM and Joe Little Coyote 2002). Most of the Northern Cheyenne reservation was conducive to ranching but not farming; therefore, their lands were not disastrously allotted in the way that many of the other tribes' reservation lands were (Chief Dull Knife College 2008). However, the Northern Cheyenne chose allotment in the 1930s (Fowler 2001a). They also adopted their own constitution at that time and regained a small herd of cattle (BLM and Joe Little Coyote 2002; Fowler 2001a; Moore et al. 2001). In the 1970s the tribe effectively put a stop to oil and gas extraction by outside parties. In 1972 the tribe established Dull Knife College to help revitalize their language and culture and to educate future generations. The Northern Cheyenne still hold Sun Dances and other traditional ceremonies and view Bear Butte in South Dakota as a particularly special place (Chief Dull Knife College 2008).

Sioux

The Sioux are Siouan language speakers who may have originated in North Carolina but were first historically documented in 1640 in Minnesota (Kaelin and the Pikes Peak Society 2008). The Sioux Nation consisted of seven separate tribes: the Mdewakanton, the Wahpeton, the Wahpekute, the Sisseton, the Yankton, the Yanktonai, and the Teton (including six additional bands), the Brulé, the Oglala, Two Kettle, the Minneconjou, Sans Arc, and the Hunkpapa (Hoover 1988). After their enemies, the Chippewa, obtained firearms from Canadian traders in the 1700s, the Sioux moved westward to the Black Hills of western South Dakota. This became their core area, although their territory extended from the upper Mississippi River Valley in Minnesota to the Black Hills (Hoover 1988) and from Wyoming as far south as Pike's Peak in southern Colorado (Howard 1966). Raiding and hunting of buffalo herds took small groups of Sioux to those distant places (Kaelin and the Pikes Peak Society 2008).

By the 1830s the Oglala and Brulé moved into eastern Wyoming (Deaver 1996), pushed west by Euro-American settlers. In turn the Sioux tried to move the Crow farther west. However, when the Bozeman Trail opened through the Powder River Basin in 1864 to facilitate the movement of men and supplies to the Montana gold mines, the Sioux were outraged and sought an alliance with the Crow, who refused to fight. Eventually the Crow allied with the U.S. Army to better resist the Sioux (Rzeczykowski 1999).

Between 1868 and 1870 the Sioux made incursions into the Wind River Basin and attacked the Shoshone several times (Deaver 1996). At one point, like many other tribes, the Sioux claimed the Yellowstone River region as their own (Deaver 1996; Frey 1987). The Sioux sometimes allied with the Cheyenne and Arapaho, and in the 1890s large bands of Sioux left their reservations in the Dakotas and traveled to the Wind River Reservation to visit with the Northern Arapaho and Eastern Shoshone (Deaver 1996). However, most Sioux life occurred in the Dakotas during this time (DeMallie 2001; Kaelin and the Pikes Peak Society 2008).

The 1868 Treaty of Fort Laramie established the Great Sioux Reservation, encompassing all of present-day western South Dakota and acknowledging a large portion of eastern Wyoming and northern Nebraska as "unceded" territory. After gold was discovered in the Black Hills in 1874, miners frequently trespassed on the reservation. In 1877, the U.S. appropriated the Black Hills, and in 1887 they broke up the reservation into five smaller reserves. In the first decades of the reservation, the U.S. delivered cattle to the Sioux as live animals and tribal people used horses to hunt them, thereby maintaining some semblance of their traditional way of life. However, in 1901 the government began delivering already butchered meat, which also deprived the Sioux of income from selling hides. In the 1930s the Civilian Conservation Corps briefly helped to stimulate the reservation's economy. Although the Sioux made a claim for their traditional lands in the Black Hills, the U.S. has offered only monetary compensation (DeMallie 2001).

3.2.3.5 Background

WYCRO file searches were conducted on November 6, 2013, May 1, 2014, and June 8, 2017. Files in the BLM CFO were examined on March 5–7, 2014. The WYCRO database identified two known TCPs within the CCPA ***that were identified through previous Tribal consultation***. No additional known TCPs or ***Indian sacred sites*** were identified in the BLM or USFS files. ***File searches also*** identified additional ***cultural resource*** types ***(e.g., rock cairns, rock alignments, stone circles, burials/graves, and trails/roads) from which other TCPs and/or Indian sacred sites*** potentially could be ***identified during on-going tribal consultation***.

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3.3 Geology and Mineral Resources

The analysis area for geology and minerals is the CCPA and a 2-mile buffer. Impacts on these resources from the Project primarily would be limited to direct surface disturbance and drilling activities; however, a 2-mile buffer around the CCPA also was considered to account for effects that may extend beyond the Project boundary. The CCPA is located in the southern Powder River Basin, an area with a history of oil, gas, uranium, and coal production from underlying sedimentary strata. Exploration and development of these resources are likely to continue, subject to favorable economic conditions. The topography of the CCPA has been shaped by the erosion of continental deposits over geological time, leaving widespread deposits of residuum, alluvial channels, and exposed bedrock.

3.3.1 Laws, Ordinances, Regulations, and Standards

Major federal laws applicable to mineral resources include the General Mining Law of 1872 (30 USC Sections 22-42), the Mineral Leasing Act of 1920 (30 USC 181 et seq.), the Mineral Materials Act of 1947 (30 USC 601 et seq.), and the Multiple Minerals Development Act of 1954 (30 USC 521 et seq.). These laws are implemented through associated regulations on BLM- and USFS-administered lands. Specific stipulations and other mitigation regarding mineral development on federal lands in the CCPA are implemented through management decisions and guidelines in the Casper RMP ROD (BLM 2007b) and TBNG LRMP ROD (USFS 2002). For example, subject to valid existing rights, the portion of the CCPA in the BLM CFO includes areas closed to oil and gas leasing or subject to no surface occupancy (NSO) stipulations (i.e., surface disturbance prohibited).

The State of Wyoming regulates oil and gas development through statutes found in Title 30, Chapter 5, Oil and Gas, of the Wyoming Code (WS Ann. 30-5-100 et seq.) and the rules and regulations promulgated and enforced by the WOGCC. Laws, ordinances, regulations, and standards discussed in the Paleontology, Soils, and Water sections may have indirect effects on geology but are not specifically intended to preserve or manage geological resources.

3.3.2 Geologic Setting

The description of the affected environment for geology and minerals is composed of the following elements:

- Structural Geology – Geologic history and characteristics of the major structural basin encompassing the CCPA.
- Surficial Geology – Type and distribution of landforms and unconsolidated sediments that occur at the ground surface.
- Bedrock Geology – Characteristics, distribution, and depths of consolidated rock formations that are buried beneath the ground surface or exposed as outcrops.
- Geologic Hazards – Historic occurrence and anticipated risks of earthquakes, landslides, wind and water erosion of sand dunes, and floods.
- Minerals – Historic and ongoing oil and gas development and mining activities as well as major mineral-bearing formations in the analysis area that present opportunities for future development of mineral resources.

3.3.2.1 Geologic Structure

The analysis area occupies the southern portion of the Powder River Basin. In its entirety, the Powder River Basin is roughly 100 miles wide from east to west and 300 miles from north to south, encompassing approximately 25,500 square miles (Thamke et al. 2014). As shown in **Figure 3.3-1**, the basin is bounded by the Miles City Arch to the north; the Black Hills uplift to the east; the Laramie Range to the south, as defined by the Northern Boundary Fault of Blackstone (1996); and the Casper Arch, Bighorn Mountains, the Pryor Uplift, and the Porcupine Dome to the west (Blackstone 1996; Thamke et al. 2014). The southern boundary of the basin is structurally complex and buried beneath a cover of Tertiary deposits. An example cross-section of the structural relationships at the boundary with the northern Laramie Range is shown in **Figure 3.3-2**.

The Powder River Basin was formed through uplift of the surrounding mountains during the Laramide Orogeny (70 to 50 million years ago) in the late Cretaceous and early Tertiary periods (BLM 2004g). The basin forms an asymmetrical syncline whose axis runs parallel to the eastern front of the Bighorn Mountains near the western margin (Thamke et al. 2014). The basin contains over 17,000 feet of Paleozoic to Tertiary sedimentary rocks that rest on Precambrian rocks. Structural relief from the basin axis to the Big Horn Mountains is over 20,000 feet (Jensen 1972; Kleinkopf et al. 1972). The sedimentary rocks dip steeply on the west side of the basin, while east of the basin axis the sedimentary section dips gently to the west.

3.3.2.2 Surficial Geology

The CCPA is located in the unglaciated Missouri Plateaus section of the Great Plains physiographic province (Feeneman 1928). The topography of the CCPA consists of rolling hills, mesas, broad uplands, wide valleys, and badlands and was formed primarily through erosion of continental deposits that covered the basin during Oligocene and Miocene time (34 to 5 million years ago) (Beikman 1962). Important topographic features in the area are high-level, low relief terraces called “flats” bounded by escarpments that are thought to be the remnants of former erosion surfaces (Sharp and Gibbons 1964). The general topographic gradient slopes down to the northeast and elevations range from approximately 6,000 feet amsl on the west side of the CCPA to approximately 4,500 feet amsl on the east side of the CCPA. Elevations along the North Platte River are approximately 5,000 feet amsl.

Surficial deposits consisting of residuum mixed with alluvium, eolian deposits, slopewash, grus, or bedrock outcrops are widespread throughout the analysis area (Wyoming State Geological Survey [WSGS] 1998). Deeper alluvial deposits occur in incised drainages that generally run in a northeasterly direction across the analysis area. Slopewash and colluvium are concentrated along the eastern slope of higher elevation areas that run parallel to the southwest border of the analysis area. The southwest corner of the analysis area contains an area of eolian sand dunes. Surficial cover is often too thin to be mapped accurately; therefore, deposits are likely to occur over larger areas than depicted on **Figure 3.3-3**.

3.3.2.3 Bedrock Geology

The Powder River Basin contains a greater than 17,000-foot sequence of Phanerozoic sedimentary strata (542 million years ago to present) that overlie Precambrian basement rocks. The Precambrian rocks are granitic and gneissic in composition and may range in age from 3,200 to 2,500 million years ago (Sims et al. 2001). Phanerozoic strata are divided into three primary age classes: Paleozoic rocks (541 to 252 million years ago), which are approximately 2,500 feet thick and primarily consist of marine carbonate rocks and sandstone; Mesozoic rocks (252 to 66 million years ago) composed of marine and non-marine siltstone and sandstone, which are approximately 9,500 feet thick; and Cenozoic rocks (66 million years ago to the present), which are 4,000 to 6,000 feet thick and largely composed of sandstone, shale, and coal (Beikman 1962). The following paragraphs briefly describe, in ascending order, the geologic units that outcrop or are relatively shallow (i.e., 10 to 3,000 feet deep) in the subsurface and are important from the standpoint of mineral resources, paleontological resources, and groundwater resources in the CCPA. The bedrock units are shown on **Figure 3.3-4**.

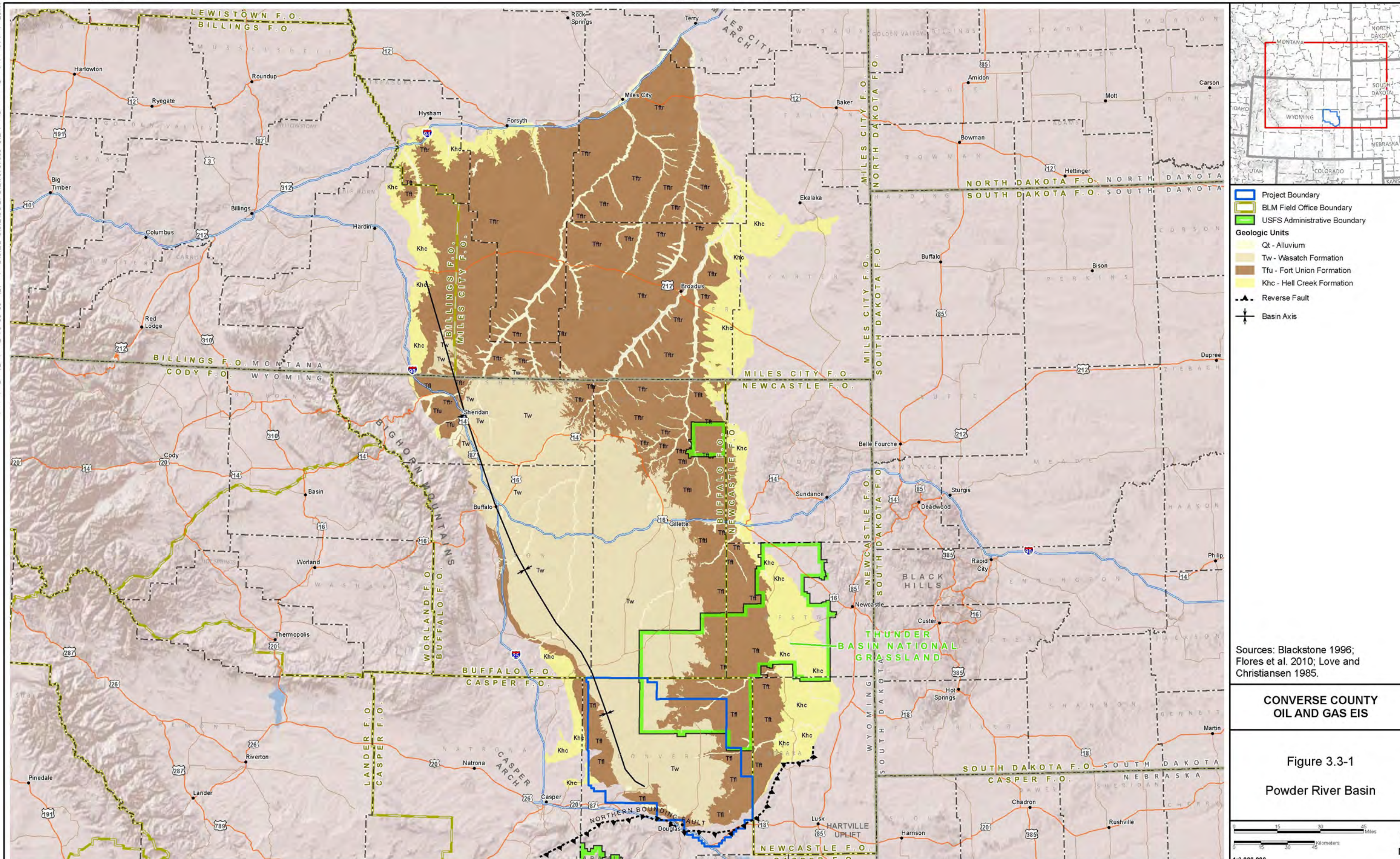

Figure 3.3-1

Powder River Basin

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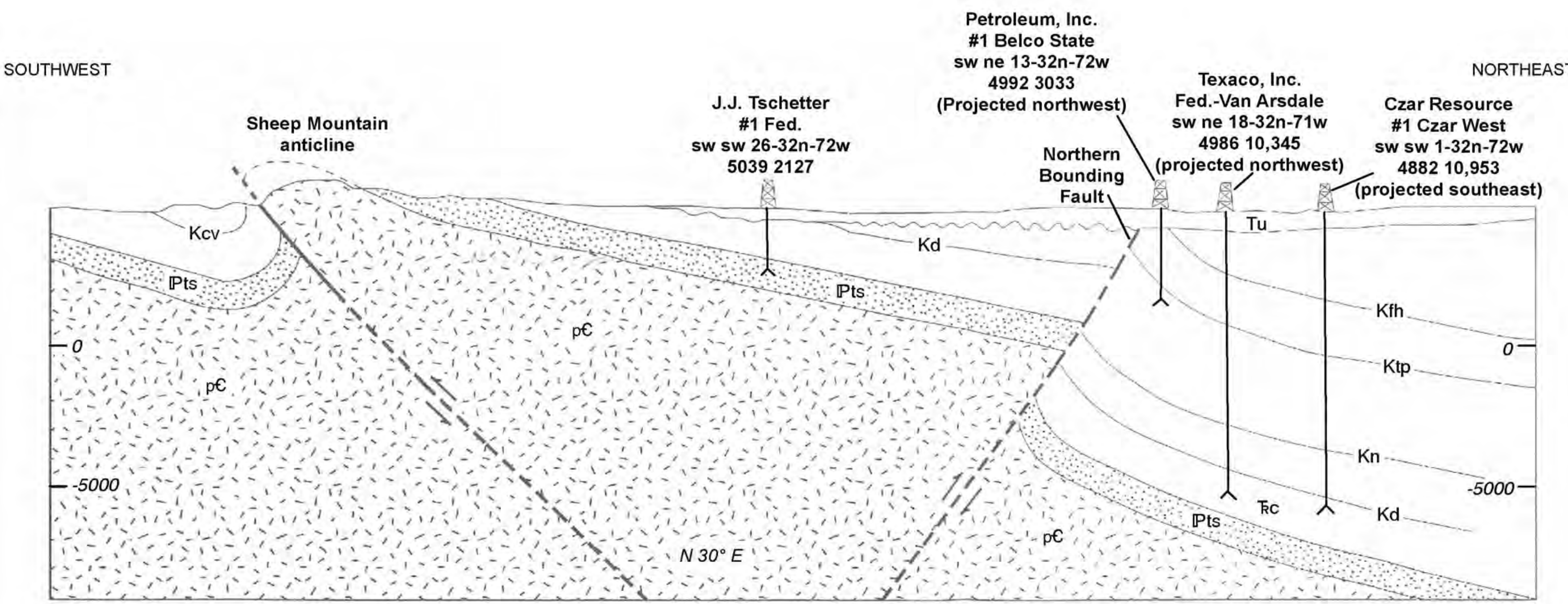

D. Southwest-Northeast cross section D-D' across Sheep Mountain and the Northern Bounding Fault (NBF).

Tu - Tertiary undivided
Kfh - Fox Hills Sandstone
Ktp - Teapot Sandstone
Kn - Niobrara Formation
Kd - Dakota Sandstone
Kcv - Cloverly Formation
Ŧc - Chugwater Formation
Pts - Tensleep Sandstone
pЄ - Precambrian Rocks

Source: Blackstone 1996

CONVERSE COUNTY
OIL AND GAS EIS

Figure 3.3-2
Cross-section of the
Southern Powder River Basin

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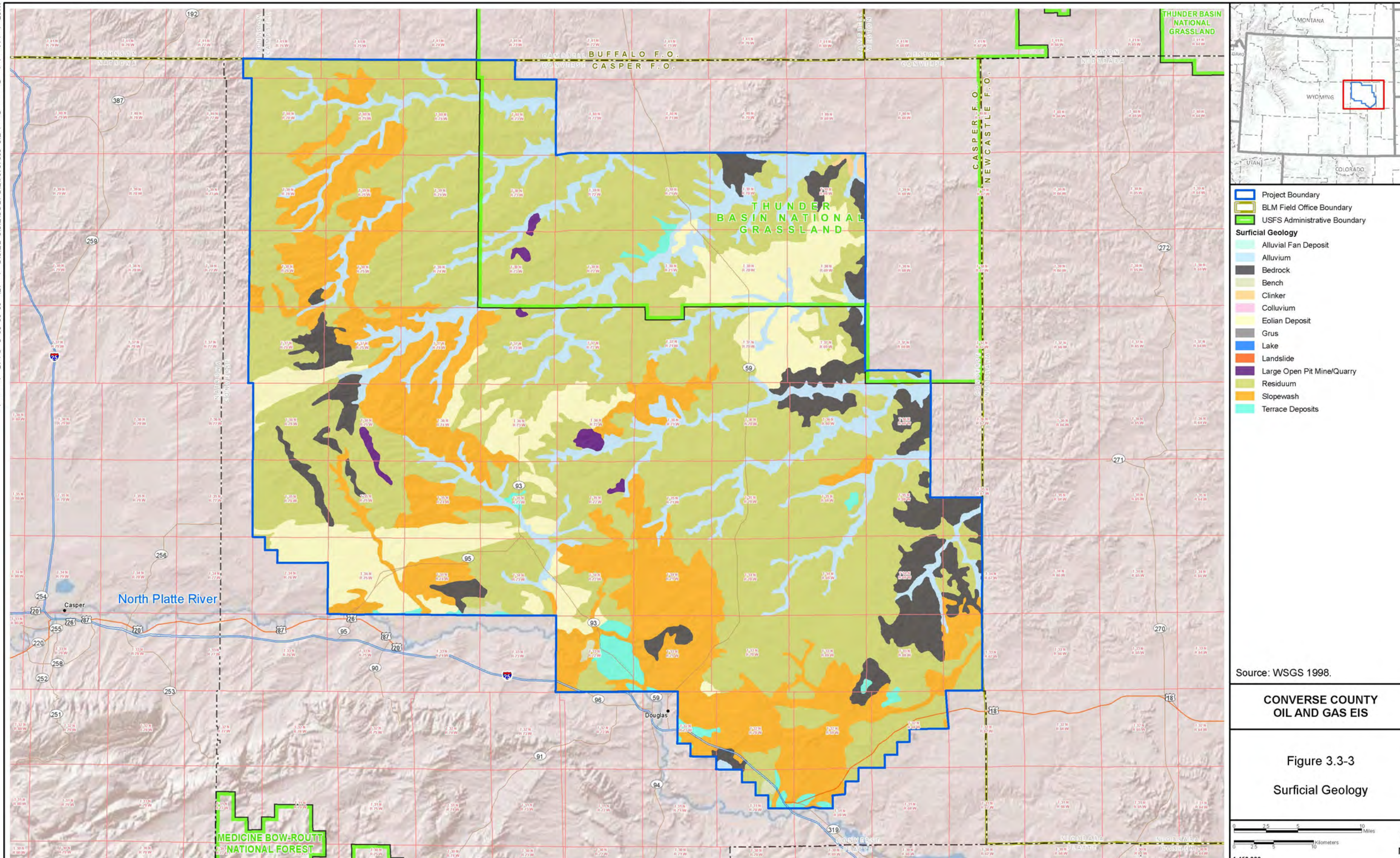

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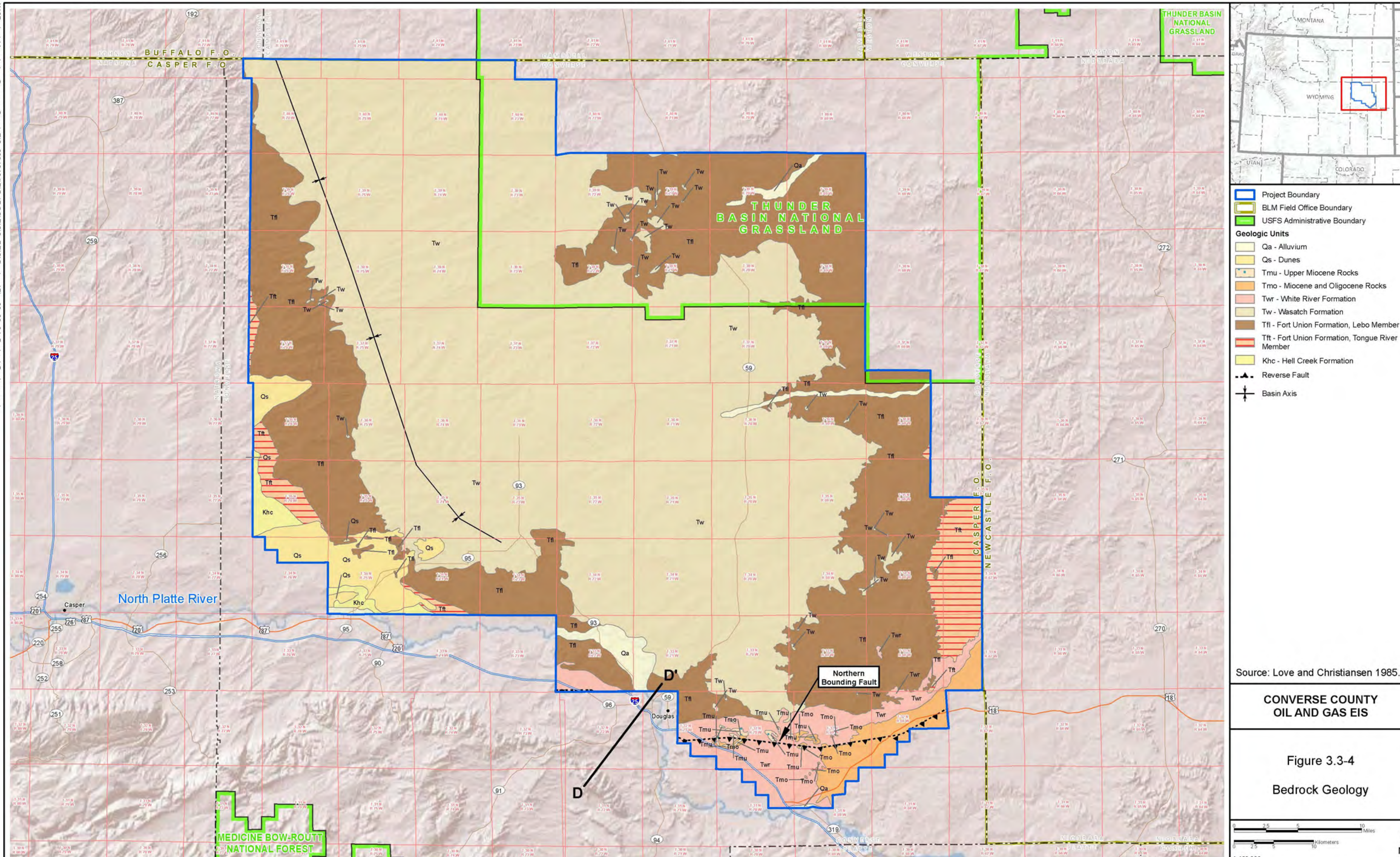

CONVERSE COUNTY OIL AND GAS EIS

Figure 3.3-4

Bedrock Geology

Print Date: 8/7/2017

The upper Cretaceous Fox Hills Sandstone does not outcrop in the CCPA, but rather underlies the White River Formation that is in angular unconformity with older units at the southern end of the basin. The White River Formation also obscures the trace of the Northern Bounding fault of the Laramie Range that defines the southern extent of the Powder River Basin (**Figure 3.3-2**). The Fox Hills Sandstone consists of marginal marine sandstones and interfingers with the overlying Hell Creek Formation (Connor 1992). The boundary between the units is hard to define because of the interfingering relationship between the upper portion of the Fox Hills and the lower Hell Creek Formation; however, the Fox Hills Sandstone generally is considered to be 100 to 300 feet of largely massive sandstone measured from the base of the unit. The upper transitional portion of the Fox Hills Sandstone is composed of shale, siltstone, and thin sandstones and is difficult to distinguish from the Hell Creek Formation. The contact between the Fox Hills Sandstone and the underlying Pierre Shale (or Lewis Shale) generally is quite distinct because of the abrupt change upward from marine shale to clean sandstone.

The Hell Creek Formation outcrops in the southwestern corner of the CCPA. It is the uppermost Cretaceous unit in the Powder River Basin and is equivalent to the Lance Formation, a commonly used name for rocks in the uppermost Cretaceous interval. Hell Creek Formation is used in this document to be consistent with the hydrostratigraphic nomenclature discussed in Section 3.16.2. The Hell Creek Formation is composed of thick-bedded sandstone and shale with thin lenses of conglomerate, sandstone, and shale. It also has thin coal beds and carbonaceous shale beds (U.S. Geological Survey [USGS] 2014b). The Hell Creek Formation ranges in thickness from approximately 3,000 feet in the southern portion of the CCPA to approximately 2,500 feet on the north side of the CCPA (Connor 1992). The Paleocene Fort Union Formation outcrops on the west, south, and east sides of the CCPA and is composed of, in ascending order, the Tullock, Lebo, and Tongue River Members. The Fort Union Formation was deposited in a river system and is largely composed of sandstone, shale, claystone, and coal. The different members are distinguished by lesser or greater proportions of coarse and fine materials and relative amounts of coal (Lewis and Hotchkiss 1981). The Tullock Member is composed of sandstone, shale, and thin coal, grading upward to sandier material. The Lebo Member generally is finer-grained than the Tullock Member and contains predominantly shale, carbonaceous shale, siltstone, and thin coals. However, isolated lenticular sandstones may occur randomly in the Lebo (Connor 1992). The Tongue River Member contains thick-bedded medium- to coarse-grained sandstones and thick coal zones that can be correlated over many miles. Work by Flores et al. (2010) indicates individual coal seams in the Tongue River Member may not be as widespread as originally thought, but the seams are still remarkably thick and widespread compared to coal in other geologic settings. The coal seams are thickest and most numerous in the northern and western portions of the basin and become thinner and less numerous to the south. Generally, the Fort Union Formation is approximately 3,600 feet thick in Converse County and thickens to the north and west (Flores 2004). The Tullock Member is approximately 1,900 feet thick in the southern Powder River Basin and thins to the north.

The Wasatch Formation is composed of continental deposits of medium- to coarse-grained sandstone, siltstone, mudstone and coal (Ethridge and Jackson 1980). It is the primary bedrock unit exposed or shallowly buried throughout the central and western portions of the analysis area (Love and Christiansen 1985). Similar to the Tongue River Member, Wasatch coals can be thick and widespread but are abundant north of Converse County. The Wasatch Formation was deposited in a north-flowing river system that transported sediment from uplifted areas to the south and west (Ethridge and Jackson 1980). The Wasatch Formation ranges in thickness from 1,400 feet in Johnson County (Flores 2004) near the axis of the basin to zero thickness at the outcrop limits. In northwest Converse County along the axis of the basin, the Wasatch Formation is approximately 500 feet thick, but in most of the CCPA it is approximately 100 feet thick or less.

The Oligocene White River Formation is exposed along the southern boundary of the analysis area. The White River Formation in Converse County is composed of tuffaceous claystone and lenticular coarse-grained conglomeratic sandstone and is up to 750 feet thick (Evanoff et al. 1992; USGS 2014b).

Figure 3.3-5 is a chart illustrating the general stratigraphy of the Powder River Basin. Formations that are of particular interest for this Project are those that are known to contain recoverable mineral resources, may contain fossils, are known or potential aquifers, and those that have been identified as possible zones for produced water injection. The mineral resources of the CCPA are summarized in Section 3.3.3, Mineral Resources. For information on the water-bearing properties and paleontological potential of geologic formations in the analysis area, refer to Section 3.16, Water Resources and Section 3.8, Paleontological Resources.

3.3.2.4 Geologic Hazards

Seismicity and Faults

The location, magnitude, intensity, and recurrence intervals of earthquakes are subject to extreme variation from predicted values, especially at small geographic scales and over short spans of time; therefore, the ability to forecast future seismic activity in the analysis area is limited. However, historic seismicity, fault patterns, and probabilistic analysis, as described below, suggest that seismic risks in the analysis area are unlikely to damage facilities or disrupt common activities.

One way to measure the strength of earthquakes is magnitude, which measures the energy released at the source (epicenter) of the earthquake based on seismograph readings. A search of the USGS (2014a) earthquake catalog from 1973 to the present using a search radius of 60 miles from a point in the center of the CCPA indicated earthquake magnitudes of generally between 2.0 and 3.0. Many earthquake events recorded to the north of the CCPA were identified as coal mine cast shots and quarry explosions. Two events of magnitude 4.5 and 5.3 occurred in October 1984 southwest of Douglas in the northern Laramie Range (Case et al. 2002). Although earthquakes have been felt, no damage has been reported in association with earthquakes in or near Converse County.

The energy generated by an earthquake results in ground movement that can cause damage to structures and endanger people. One method of measuring the potential for damage is to estimate the amount of horizontal ground motion from a hypothetical strong earthquake that could occur in a given region. The USGS has compiled seismic hazard maps that estimate the probabilities of ground motions that could occur over different time intervals (Petersen et al. 2015). The longer the time interval, the greater the probability of a strong event to occur and a correspondingly greater probability that strong ground motions also would occur. USGS seismic hazard mapping indicates that the analysis area could experience peak ground acceleration ranging from 14 to 21 percent of the acceleration of gravity over a 2,500-year recurrence interval, with a 2 percent probability of exceedance in 50 years (Petersen et al. 2015). The highest peak ground accelerations are likely to occur in the south and west portions of the CCPA and decrease along a northeasterly gradient.

There are no known active faults with a surficial expression in Converse County (Larsen and Wittke 2013). A fault is considered to be active if it can be determined that movement has occurred in the last 10,000 years. Fault activity is based on the ability to measure the displacement of surficial deposits; therefore, earthquake potential exists from active faults that are buried and have no surface expression.

Induced Seismicity

Seismicity is commonly regarded as a natural phenomenon, but human actions also can cause earthquakes or seismic events. Anthropogenic causes of earthquakes are referred to as induced seismicity (Larsen and Wittke 2014). Although there are numerous sources of induced seismicity, coal mine blasting is a well-documented cause in the Powder River Basin. There also is a potential, but not identified, cause of induced seismicity from the injection and withdrawal of fluids.

Era	System	Series	Stratigraphic Units – West		Stratigraphic Units – East
Cenozoic	Quaternary	Holocene	Undifferentiated unconsolidated deposits[1]		
	Tertiary	Oligocene	White River Formation[2]		
		Eocene	Wasatch Formation[3]		
		Paleocene	Fort Union Formation	Tongue River Member[4]	
				Lebo Member	
				Tullock Member	
Mesozoic	Upper Cretaceous		Hell Creek Formation[2]		
			Fox Hills Sandstone[2]		
			Teckla Sandstone – Lewis Shale[5]		Pierre Shale[2]
			Mesaverde Formation	Teapot Sandstone Member[5]	
				Parkman Sandstone Member[5]	
			Cody Shale[7]	Sussex Sandstone Member[5]	
				Shannon Sandstone Member[5]	
					Niobrara Formation[5,7]
					Carlile Shale[7]
			Frontier Formation	Turner Sandstone Member[5]	Greenhorn Formation[7]
					Belle Fourche Shale[7]
	Lower Cretaceous		Mowry Shale[5]		
			Muddy Sandstone[5]		Newcastle Sandstone[6]
			Thermopolis Shale[7]		Skull Creek Shale[7]
			Cloverly Formation		Fall River Formation[6]
					Lakota Formation[6]
	Jurassic		Morrison Formation		
			Sundance Formation		
			Gypsum Spring Formation		
	Triassic		Chugwater Group/Formation		Spearfish Formation
Paleozoic	Permian		Goose Egg Formation		Goose Egg Formation
					Minnekahta Limestone
					Opeche Shale
	Pennsylvanian		Tensleep Sandstone		Minnelusa Formation
			Amsden Formation		
	Mississippian		Madison Formation		Pahasapa Limestone
					Englewood Limestone
	Devonian		No Units		
	Silurian		No Units		
	Ordovician		Bighorn Dolomite		Whitewood Dolomite
			Harding Sandstone		Winnipeg Formation
	Cambrian		Gallatin Limestone		Deadwood Formation
			Gros Ventre Formation		
			Flathead Sandstone		
Precambrian			Gneiss and Granite		

Mineral Commodities from formation:

[1] Aggregate
[2] Uranium
[3] Coal, coalbed natural gas, uranium, and clinker
[4] Coal, coalbed natural gas, and clinker
[5] Oil and gas
[6] Oil and gas, uranium
[7] Bentonite

Source: AECOM 2012a; Love et al. 1993.

Figure 3.3-5 Generalized Stratigraphic Nomenclature for the Powder River Basin

Induced seismicity due to coal mine blasting is a common occurrence in the vicinity of the CCPA. The surface coal mines that are located at various distances north of the CCPA are responsible for the induced seismicity that has been detected by the USGS (USGS 2014a). The blasting or cast shots typically involve the use of hundreds of thousands to millions of pounds of explosives to facilitate the removal of overburden or to break up the coal seams (Arrowsmith et al. 2006). The seismic energy generated not only comes from the blast, but from the collapse of overburden. Most of the seismic events that have occurred to the north of the CCPA were due to blasting at surface coal mines with magnitudes ranging from 2.0 to 3.0. The coal mine blasting is highly documented due to extensive research to determine better methods for detection of detonation of underground nuclear weapons.

Other potential causes of induced seismicity related to the proposed Project could involve injection and withdrawal of subsurface fluids and hydraulic fracturing. Withdrawal of fluids can result in seismic activity, but the well-lithified rocks in the Powder River Basin are not likely be subjected to deformation that could cause seismic events (De Bruin et al. 2004). Subsurface injection of water also poses potential risk for induced seismicity, but recent work by the WSGS indicated that there were no recorded seismic events that could be related to the underground injection of fluids in the Powder River Basin (Larsen and Wittke 2014). The statewide study investigated some of the major oil and gas producing basins, but did not find compelling evidence of seismicity associated with fluid injection. However, at the Lost Soldier and Wertz fields, the evidence was inconclusive and more study including monitoring was recommended. The aforementioned fields are located in the Red Desert area, which is more than 100 miles southwest of the CCPA.

Hydraulic fracturing has been suspected of inducing seismic events that are capable of causing damage. Although it is undisputed that hydraulic fracturing is a source of induced seismicity in the strict definition of the term, the magnitude of induced seismicity due to hydraulic fracturing is quite small and is referred to as “micro-seismicity.” Oil and gas operators and oilfield hydraulic fracturing service companies use micro-seismicity to measure and monitor the direction and growth of fractures to assess the efficiency and efficacy of fracturing operations. Thousands of measurements from various shale gas basins indicated that the magnitudes typically are less than -2.5 and average -3.0 (Warpinski et al. 2012). Given that the earthquake magnitude scale is logarithmic, these micro-seismicity magnitudes are several orders of magnitude smaller than the coal mine cast shots described previously.

Landslides

No landslides have been mapped in the analysis area (WSGS 2004). Small landslides or slumps could occur in localized areas along rims and buttes, incised stream and river banks, and other areas with steep slopes along the southern and western margins of the analysis area. Large storm events are the most common natural triggers.

Wind and Water Erosion of Sand Dunes

Active eolian sand dunes in the southwestern portion of the analysis area are highly unstable and pose hazards for development. Areas of stable eolian deposits that border active dune fields may become active again if disturbance occurs in the absence of proper stabilization and revegetation. Refer to Section 3.12 (Soils) for a detailed discussion of soil susceptibility to erosion and erosion hazards.

Floods

The most probable areas in Converse County prone to flooding occur along the North Platte River, despite much of the flow in the river being strictly controlled by upstream dams (Converse County 2014d). Heavy runoff from rapid snowmelt or precipitation from heavy storms can cause flooding of low-lying areas and tributaries to the river such as Antelope Creek and East Antelope Creek located northeast of Douglas. Flooding also is prone to occur in the mountainous areas south of the river. Elsewhere in the county, localized flooding could occur along other drainages located in the CCPA.

3.3.3 Mineral Resources

3.3.3.1 Fluid Leasable Minerals

Fluid leasable minerals include oil, gas, and geothermal resources. As of January 2015, there were 1,520 existing oil, gas, and industry service wells of various status categories and classifications as shown on **Table 3.3-1** (WOGCC 2015). Producing oil wells composed the largest category of wells, followed by producing gas wells. **Figure 3.3-6** displays the oil and gas infrastructure of the CCPA.

Table 3.3-1 Well Status and Classification in the CCPA

Well Status	Well Classification (number of wells)										
	Disposal Class I	**Class II**	**Gas**	**Gas Orphaned**	**Injector**	**Monitoring**	**Oil**	**Source**	**Strat Test**	**Water Supply**	**Total**
Active injector	9	15			11						**35**
Dormant							4	1	1		**6**
Flowing			2								**2**
Monitoring well						1					**1**
Not determined			3				1				**4**
Notice of intent to abandon			5		1	1	29				**36**
No report			1				2				**3**
Producing			70				1,119				**1,189**
Pumping rods							12				**12**
Shut in	2	5	5	5			38			2	**57**
Suspended operations		1					15				**16**
Well spudded		1					68				**69**
Subsequent report abandoned		1	6	1		1	62				**71**
Temporarily abandoned			2				17				**19**
Grand Total	**11**	**23**	**94**	**6**	**12**	**3**	**1,367**	**1**	**1**	**2**	**1,520**

Source: WOGCC 2015b.

At the end of 2014, there were approximately 300 existing permits for wells that presumably had not been spud (i.e., drilling operations had not commenced) and approximately 1,250 wells had been plugged and abandoned (WOGCC 2014a). Wells with approved WOGCC permits to drill may still require additional approvals prior to drilling, especially for wells that require access to federal surface or mineral estate. Approximately 72 percent of wells in the CCPA are vertical wells, 26 percent are horizontal wells, and 1 percent are directional wells; approximately 0.4 percent were not identified (WOGCC 2015c). Wells drilled in the analysis area have an average depth of 9,044 feet, with a minimum depth of 90 feet, and maximum depth of 22,454 feet (WOGCC 2015c).

Within the CCPA, many wells were drilled in the 1930s before the official discovery in 1936 of the Shawnee Field (WOGCC 2014b). The Shawnee Field is located in the southeast part of the CCPA and has produced approximately 650,000 barrels of oil and 1.8 billion cubic feet of gas. Wells targeting the Frontier, Muddy, Teapot, and Parkman reservoirs accounted for approximately 74 percent of the 188 million barrels of oil produced in Converse County from 1978 through 2014 (WOGCC 2016a). Gas production has been reported primarily from the Frontier, Muddy, and Teapot reservoirs (80 percent of total volume). **Table 3.3-2** provides a summary of cumulative oil, gas, and water production by reservoir from 1978 through the end of 2014. Approximately 188.5 million barrels of oil and more than 809 trillion cubic feet of natural gas have cumulatively been produced from Converse County**.**

The 2009 USGS oil and gas resource assessment for the entire Powder River Basin (including Montana) indicated mean undiscovered resources of 638.96 million barrels of oil, 16,631 billion cubic feet of gas, and 131 million barrels of natural gas liquids (Anna et al. 2010). Based on this USGS resource assessment, there is an estimated undiscovered mean 142 million barrels of oil, 2,123 billion cubic feet of gas, and 19 million barrels of natural gas liquids in the CCPA.

Prospective geological targets for the Project include (but are not limited to) the Frontier, Muddy, Mowry, Niobrara, Parkman, Shannon, Sussex, Teapot, Tekla, and Turner. Other prospective zones may be identified in the future. The Niobrara and Mowry formations are considered unconventional shale formations and the remaining formations contain conventional sandstone reservoirs that may have enhanced productive potential when subjected to modern drilling and completion methods (horizontal drilling and hydraulic fracturing) that have been successful in the shale formations.

The BLM forecasted to the year 2020 a high potential (100 to 500 wells per township) of coalbed natural gas development in southern Campbell County and northern Converse County just north of the CCPA; with moderate to low development potential ranging from 2 to 200 wells per township for most of the CCPA (BLM 2005). However, it has since been determined that this level of development is not likely to occur over the specified time period because of southward thinning of coals, fewer coals, unfavorable economics, and the emphasis on the development of oil and gas resources that can be recovered using horizontal drilling and modern hydraulic fracturing. As of March 2017, a total of 399 coalbed natural gas well permits had been issued in Converse County; 310 permits expired without drilling, 75 wells were plugged and abandoned, 3 had notices of intent to abandon, and 11 wells were completed (i.e., production status not determined).

Although geothermal resources in the analysis area could be developed for heating or electrical power generation for domestic or small-scale commercial use, no areas have been identified with sufficiently high temperatures to produce steam to generate electricity for distribution (BLM 2007b).

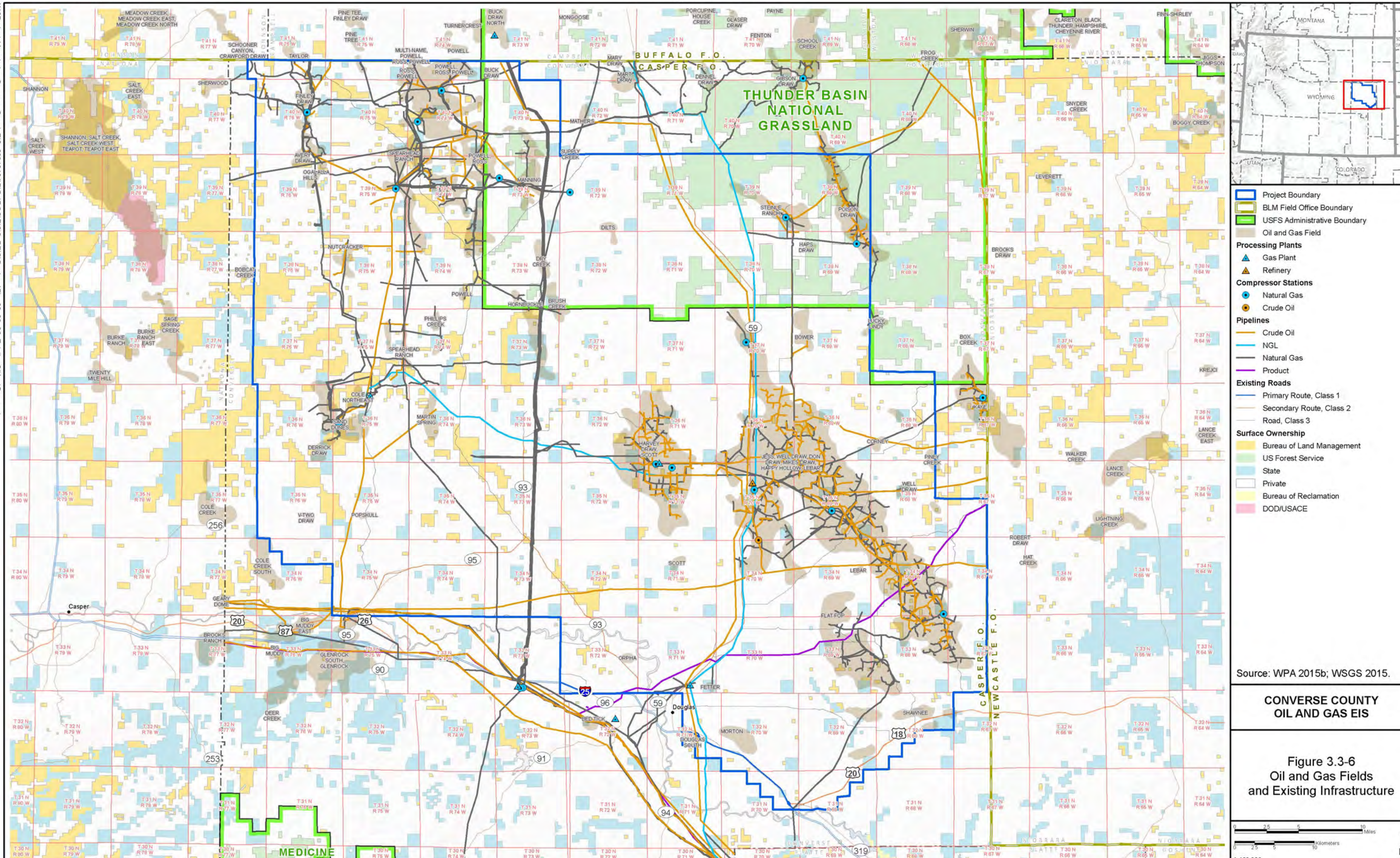

Figure 3.3-6
Oil and Gas Fields and Existing Infrastructure

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Table 3.3-2 Cumulative Oil, Gas, and Water Production in Converse County 1978 through 2014

Reservoir	Cumulative Production 1978-2014		
	Oil (barrels)	**Gas (thousand cubic feet)**	**Water (barrels)**
Frontier	37,972,446	365,349,063	4,942,311
Muddy	30,487,515	155,706,828	91,704,747
Teapot	42,656,039	123,248,676	24,116,626
Parkman	28,153,473	36,388,325	23,555,432
Dakota	12,164,040	48,692,731	181,487,088
Niobrara	8,875,089	40,866,961	3,961,882
Sussex	14,994,357	11,558,955	1,877,890
Teckla	3,961,782	7,601,696	13,577,609
Turner	2,040,931	6,199,845	246,813
Teapot-Parkman	1,205,491	1,470,517	831,165
Shannon	1,173,175	979,566	727,977
Teapot-Teckla	830,662	991,377	1,974,693
Sussex-Parkman	561,310	1,150,184	159,309
Frontier-Dakota	494,033	1,149,578	12,243
Dakota-Lakota	157,680	1,383,299	2,560
Frontier-Niobrara-Greenhorn	184,312	1,127,939	166,608
Coal Bed Natural Gas[1]	0	1,253,511	19,403,218
Muddy-Turner	283,427	901,211	8,411
Lakota	649,181	372,778	15,173,108
Mowry	122,442	831,032	199,205
Wall Creek	677,309	8,160	20,999,600
Hell Creek	88,536	568,223	1,402,669
Belle Fourche Shale	366,615	272,826	5,896
Frontier-Niobrara	56,409	463,687	20,267
Mowry-Frontier	159,625	182,682	57,499
Dakota-Muddy-Turner	36,334	253,312	1,915
Lewis	20,943	268,014	34,438
Dakota-Turner	12,636	49,401	3,758
Frontier-Sussex	48,005	5,677	0
Stray	51,094	0	27,159
Muddy-Greenhorn	24,482	9,169	1,094
White River	29,863	300	3,404
Other[2]	3,360	1,595	58
Total	**188,542,596**	**809,307,118**	**406,686,652**

[1] Includes multiple named formations in the WOGCC database that account for coalbed natural gas production only.

[2] Includes other named formations in the WOGCC database that account for a smaller percentage of cumulative production than those listed.

Source: WOGCC 2016b.

3.3.3.2 Solid Leasable Minerals

The CCPA is within the Powder River Basin Coal Field and coal is the primary solid leasable mineral. The primary subbituminous coal-bearing formations in the Powder River Basin are the Wasatch, Fort Union, Hell Creek, and Mesaverde formations (Glass 1978). Historic coal production in the CCPA occurred primarily from Glenrock Coal Company's Dave Johnston Mine, a surface mine that produced 104 million tons of coal from more than 13,000 acres between 1958 and 2000 (**Figure 3.3-7**) (Office of Surface Mining Reclamation and Enforcement 2012). Although there has been recent expansions of the Antelope and North Antelope/Rochelle mines north of the CCPA, there currently are no active coal mines within the CCPA (WSGS 2012) and future coal development is not anticipated (BLM 2004g).

3.3.3.3 Locatable Minerals

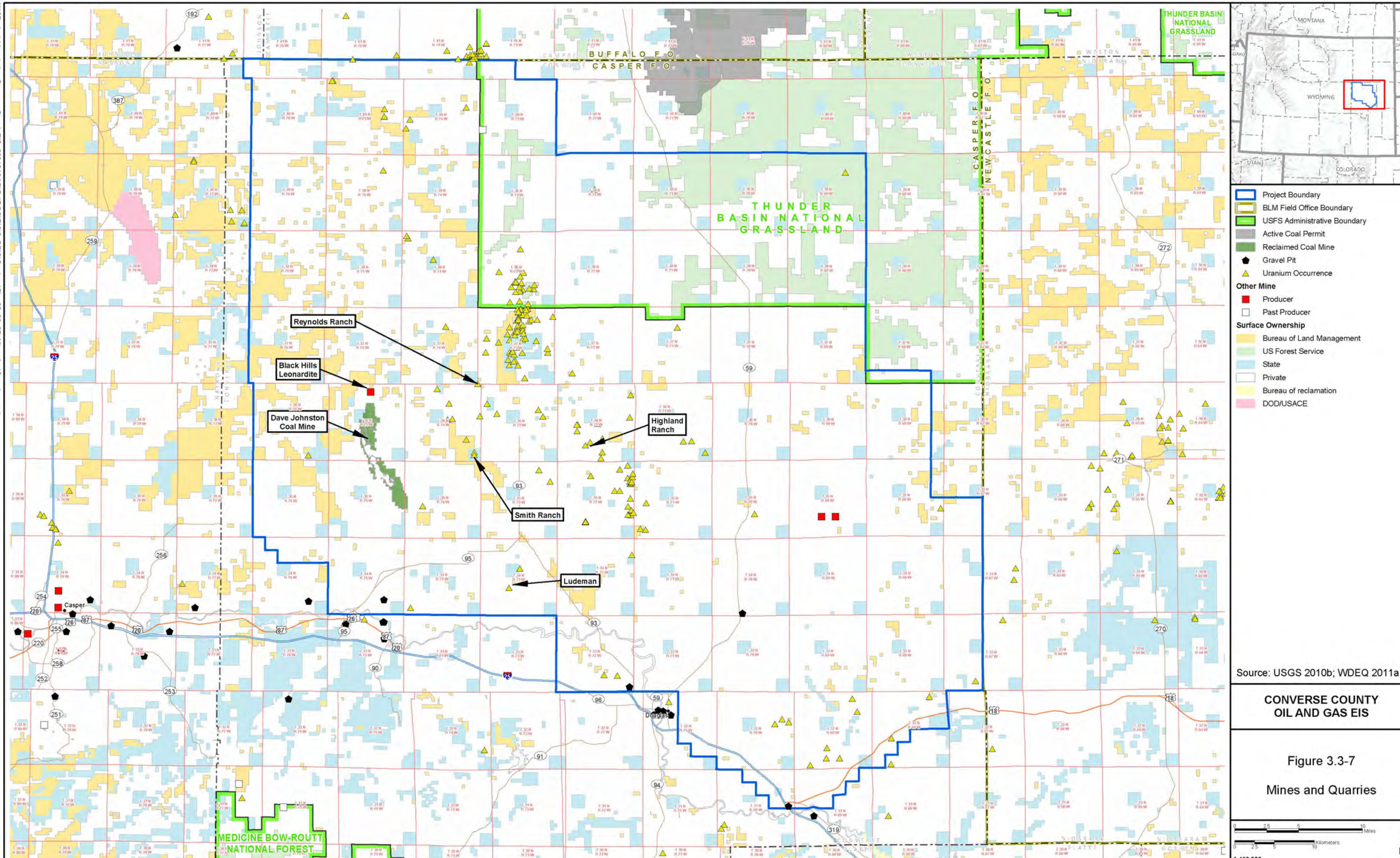
Uranium is the primary locatable mineral produced in the CCPA, occurring as roll-front deposits in the sandstones of the Wasatch Formation and, to a limited extent, the Fort Union Formation (BLM 2004g; Davis 1970). Uranium mineralization in the Wasatch Formation extends from approximately 10 miles north of Douglas to southwest Campbell County and is approximately 80 miles long and 10 to 25 miles wide (Sharp and Gibbons 1964). Numerous small mines and exploration prospects within the CCPA were worked in the 1950s, some under the auspices of the Atomic Energy Commission. The largest of these small mines had a pit measuring approximately 300 feet across and 30 feet deep. None of these earlier mines appear to have reached the level of commerciality. However, the Exxon-Mobil Highland uranium mine eventually was developed and produced over 11.3 million tons of ore from 1970 to 1984 from surface, in situ, and underground mines (U.S. Nuclear Regulatory Commission [NRC] 2014). The facility is still under reclamation due to groundwater concerns.

Cameco USA's Smith Ranch/Highland Uranium Mine is an active in situ leaching mining operation in the CCPA with current plans for expansion. The Smith Ranch/Highland Uranium Mine produced 17.6 million pounds of uranium from 2002 to 2013, 1.7 million pounds of which was produced in 2013 alone. (Cameco USA 2014). Three additional in situ leaching uranium projects have been proposed or are under construction in the CCPA including the Reynolds Ranch, Allemand-Ross, and Ludeman projects (World Information Service for Energy 2016a). There are no mining claims for other locatable minerals in the CCPA (BLM 2004g).

3.3.3.4 Saleable Minerals

Sand and gravel, scoria (clinker), limestone, crushed stone, and decorative stone are the primary salable minerals produced in the analysis area. There are 29 permitted mineral sites in the CCPA for sand and gravel (WDEQ 2016d). Gravel deposits cap hills and ridges and may be residual material from the erosion of the White River Formation that once covered the entire area (Sharp and Gibbons 1964). Scoria, or rock that has been altered by coal seam fires, also is used as road base and is present in the northern part of Converse County, but the deposits are largely outside of the CCPA (Luppens et al. 2008). The demand for sand and gravel is likely to be strong because of current and proposed oil and gas development in the region.

A commodity called leonardite is mined in the CCPA. Leonardite is a form of low-grade or lignite coal that has properties that make it valuable as a drilling fluid additive. The Black Hills Leonardite mine is located less than 1.0 mile from the northern boundary of the old Dave Johnston Mine (WDEQ 2014). Production in 2008 was 54,162 tons, an increase of approximately 3,000 tons over the previous year's production, but production in 2013 was down again to approximately 50,000 tons (AECOM 2011; Wyoming Department of Revenue 2014a). Prospective locations for mineable leonardite occur in the southwest portion of the CCPA.



CONVERSE COUNTY OIL AND GAS EIS

Figure 3.3-7

Mines and Quarries

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3.4 Hazardous Materials, Solid Waste, and Public Health and Safety

The affected environment considers the presence of hazardous materials and solid waste that may affect air, water, soil, biological resources, and human health. Other considerations for public health and safety are hazards that not only present risks to oil field workers, but to the public at large. The analysis area for public health and safety is the CCPA.

3.4.1 Hazardous Materials and Solid Waste

3.4.1.1 Regulatory Definitions of Hazardous Materials

Hazardous materials, which are defined in various ways under a number of regulatory programs, can represent potential risks to both human health and to the environment when not properly managed. The term hazardous materials include the following materials that may be utilized or disposed of in conjunction with fluid minerals drilling and completion operations:

- Substances covered under the OSHA Hazard Communication Standard (29 CFR 1910.1200). The types of materials that may be used in drilling and completion activities and that would be subject to these regulations would include almost all of the materials covered by the regulations identified below.
- Hazardous materials as defined under the USDOT regulations in 49 CFR, Parts 171.8 and 172.101.
- Hazardous substances as defined by the CERCLA as listed in 40 CFR Table 302.4.
- Hazardous wastes as defined in the RCRA Subtitle C (40 CFR Parts 260-299).
- Hazardous substances and extremely hazardous substances that are subject to reporting requirements (Threshold Planning Quantities) under Sections 311 and 312 of the Superfund Amendments and Reauthorization Act. Hazardous substances under the reporting requirements include petroleum or products derived from petroleum including crude oil, condensate, methane, gasoline, diesel, propane, and a wide variety of chemicals and materials that are used in drilling and production.
- Petroleum products defined as “oil” in the Oil Pollution Act of 1990. The types of materials used in drilling and completions activities and that would be subject to these requirements include fuels, lubricants, hydraulic oil, and transmission fluids.

Hazardous materials as defined by USDOT would include fuels and other chemical products. These materials often are transported to work sites in accordance with applicable USDOT rules and regulations. Gasoline and diesel are required for construction, drilling equipment, and vehicles, and typically are transported along roads during the construction and operational phase of an oil and gas development project. In conjunction with the definitions noted above, the following lists provide information regarding management requirements during transportation, storage, and use of particular hazardous chemicals, substances, or materials:

- Superfund Amendments and Reauthorization Act Title III List of Lists (USEPA 2012d) also known as the Consolidated List of Chemicals Subject to the Emergency Planning and Community Right-to-Know Act and Section 112(r) of the CAA.
- USDOT listing of hazardous materials in 49 CFR 172.101.

3.4.1.2 Project-related Hazardous Materials

A large variety of hazardous materials are used or stored in oil and gas drilling and production. Chemicals and materials that may be used for this Project are listed in **Table 3.4-1**. Potentially hazardous substances used in the development or operation of wells are kept in limited quantities on drill pads and at production facilities for short periods of time. Some of the chemicals or materials listed in **Table 3.4-1** are found on the Superfund Amendments and Reauthorization Act Title III List (USEPA 2012d) of Lists or defined as hazardous materials by the USDOT.

Table 3.4-1 Potentially Hazardous Materials Used or Stored in Typical Oil and Gas Well Drilling, Completion, and Production Operations

Drilling and Completion Operations	
Diesel	Engine lubricants
Gasoline	Biocides
Drilling fluid additives	Solvents
Caustics	Paint and thinners
Well completion and treatment fluid and additives (to include hydraulic fracturing chemicals)	Pipe thread sealer
Silica sand	Explosives (for perforating)
Corrosion inhibitors	Compressed gases
Cement	Lead-acid batteries
Cement additives	Ethylene glycol
Hydraulic fluids	Weight materials (e.g., barite)
Production Operations[1]	
Crude oil, condensate, natural gas liquids, natural gas, carbon dioxide (CO_2), hydrogen sulfide (H_2S).	Methanol (line freezing prevention, gas wells)
Well workover treatment chemicals	Water treatment chemicals
Emulsion breakers (oil wells)	Catalysts (natural gas processing, sulfur recovery)
Corrosion inhibitors	Caustics (gas treatment)
Triethylene glycol (natural gas dehydration)	Paint and thinners
Biocides	Lead-acid batteries
Diesel and gasoline	Herbicides
Amines (natural gas processing)	Defoamers

[1] Includes field gas processing and gathering pipelines.

Source: AECOM 2012a; Government Accountability Office 2012, Interstate Oil and Gas Compact Commission (IOGCC) 1999, USFS and BLM 2003.

Under Emergency Planning and Community Right-to-Know Act, operators are required to report the presence of chemicals or substances on-site if those materials are considered hazardous by OSHA and exceed threshold planning quantities. Chemicals subject to reporting in quantities more than 10,000 pounds may be used or stored at well pads or facilities. There are substances that are defined as Extremely Hazardous Substances that may have threshold planning quantities much lower than 10,000 pounds. Types of chemicals or materials that may trigger reporting requirements include the following (Government Accountability Office 2012; IOGCC 1999):

- Cement and associated additives
- Silica
- Shale control additives

- Drilling mud and associated additives
- Deflocculants
- Lubricants
- Alkalinity and pH control material
- Produced hydrocarbons
- Fuels

The above list contains just a few examples of the thousands of chemicals subject to Emergency Planning and Community Right-to-Know Act reporting requirements (USEPA 2014). It is important to note that produced hydrocarbons are considered hazardous materials subject to Emergency Planning and Community Right-to-Know Act reporting and seemingly small amounts would exceed the threshold planning quantity for those materials. For instance, the threshold amount for crude oil or condensate is approximately 33 barrels (Elliott 2013), a quantity that could be easily exceeded at many typical oil and gas field sites. A release of a reportable quantity of a hazardous substance must be reported to the WDEQ, and possibly to the USEPA depending on the circumstances and the substance involved (WDEQ 2014a). As required by regulation, operators would develop and maintain SPCC plans as part of overall emergency response plans for well pad development and production facilities in the CCPA to prevent and contain accidental releases.

3.4.1.3 Regulatory Definition of Solid Waste

Solid waste comprises a broad range of materials that include garbage, refuse, sludge, non-hazardous industrial waste, municipal wastes, and hazardous waste (USEPA 2011). Solid waste as defined includes solids, liquids, and contained gaseous materials. Hazardous waste are those materials that either exhibit certain characteristics (as defined by laboratory analysis), are generated from specific industrial processes, or are chemical compounds that if abandoned or discarded, could pose a threat to human health and the environment. Non-hazardous solid waste is regulated under Subtitle D of RCRA, and hazardous waste is regulated under Subtitle C. In Wyoming, solid waste is regulated by the WDEQ under a USEPA delegated RCRA program.

The USEPA has specifically exempted certain waste materials generated in oil and natural gas exploration and production from regulation as hazardous waste (USEPA 1993b, 1988). To classify as exempt exploration and production waste, these materials must be intrinsic or uniquely associated with the production of oil and natural gas. Examples of exempt exploration and production waste include, but are not limited to, produced water, drilling mud, hydraulic fracturing flow back fluids, and treatment chemicals (e.g., acids) that have been used in the well. Although specifically exempted from regulation as hazardous waste, these materials are solid waste and must be disposed of in ways that are protective of human health and the environment. Although specific exploration and production wastes are exempted from RCRA Subpart C, it does not mean that the waste can be discarded in a haphazard manner or disposed onsite. Disposition of exempt waste is regulated by the ***Wyoming Solid Waste Rules and Regulations under RCRA Subtitle D***.

RCRA non-exempt waste would include materials such as spent solvents, discarded lubricants, and paints. These and other non-exempt wastes would be classified according to the process that generated the waste and are handled and disposed or recycled in accordance with applicable rules and regulations. Project-related activities may generate non-exempt waste that may be hazardous, but these would be generated in limited quantities and would have to be disposed of according to hazardous waste rules.

Another type of waste is derived from the presence of naturally occurring radioactive material (NORM), which primarily occurs in formation water or in the rocks at low levels. In general, radionuclides include the following (USEPA 2016d):

- Uranium and decay products.
- Thorium and decay products.
- Radium and decay products.
- Potassium-40.
- Lead-210/Polonium-210.

NORM in Wyoming was characterized by the USGS (1999) as being at background levels or marginally detectable. Although uranium and thorium are not very soluble in water, the radioactive decay daughter products such as radium are soluble (USEPA 2016d). Although NORM may occur at low levels, the radionuclides can be concentrated in various types of oil and gas waste. ***NORM typically occurs in scales, sludge, and soil (WDEQ 2011b).***

In Wyoming, the disposal of NORM is regulated by the WDEQ Solid and Hazardous Waste Division under Guideline #24 ***(WDEQ 2011b)***. The guideline sets the threshold above which NORM is managed as a solid waste and subject to Solid and Hazardous Waste Division regulations. NORM is defined according to Guideline #24 as:

- Any waste material exceeding the greater background levels found in non-impacted natural soils at the surface (i.e., 8 picoCuries per gram radium-226; and/or
- Decommissioned equipment from crude oil/gas operations exceeding 50 microRoentgens per hour emanation at any accessible point.

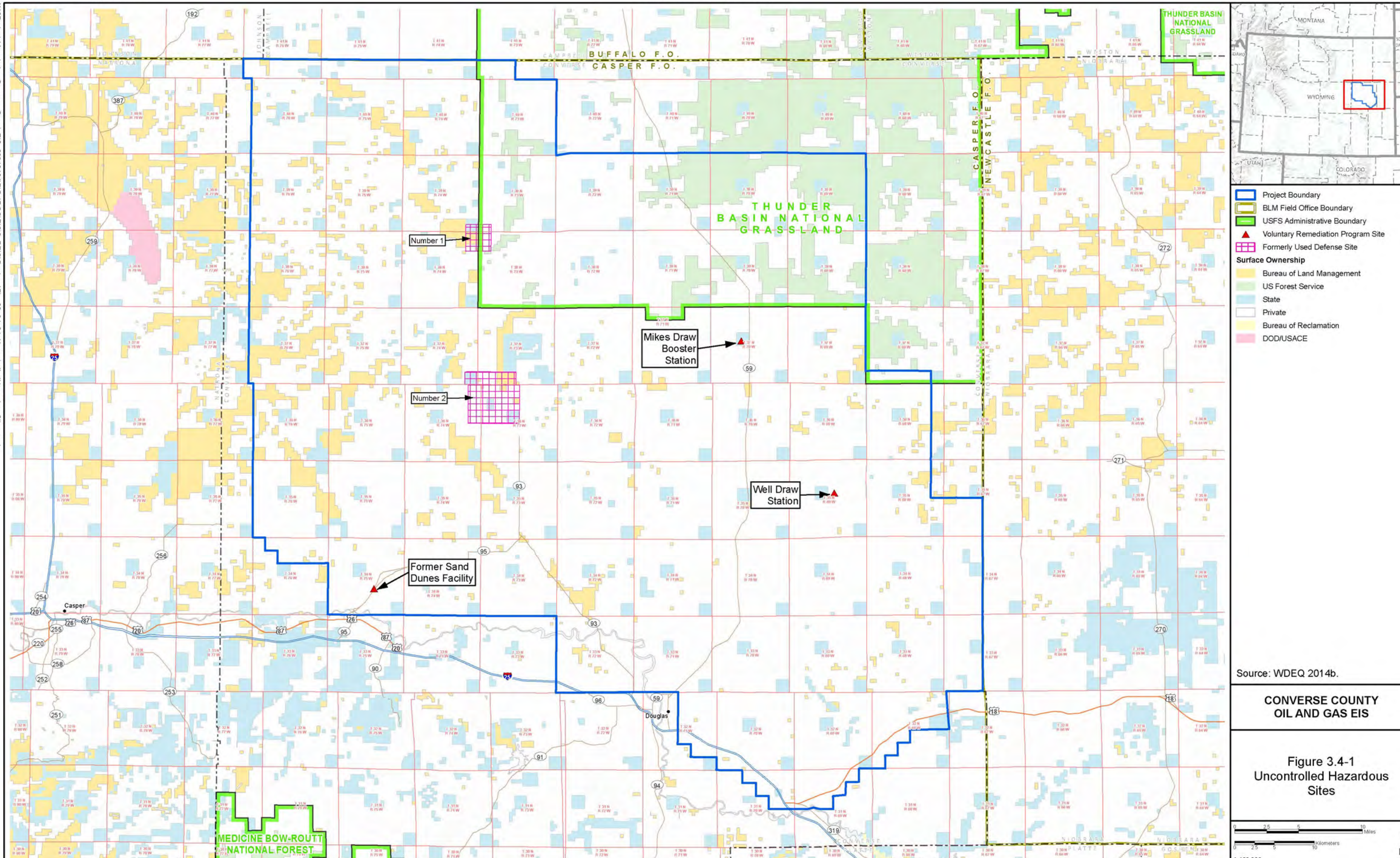
Any waste exceeding these thresholds is subject to controls and guidance by Solid and Hazardous Waste Division. Guideline #24 also explicitly states that waste generators have the responsibility to know what is in their waste and manage the waste accordingly. Guideline #24 does not provide for mandatory reporting for all NORM waste generated and disposed.

3.4.1.4 Uncontrolled Hazardous Sites

Wyoming Voluntary Remediation Program Sites

The Wyoming Voluntary Remediation Program, administered by the WDEQ Solid Waste Division, was established to provide a mechanism to allow owners and developers to clean up contaminated sites and return them to a condition fit for productive use (WDEQ 2014b). There are three Wyoming Voluntary Remediation Program sites in the CCPA where contaminants and spills are being remediated (**Figure 3.4-1**):

- Niject Services Company, Former Sand Dunes Facility; Section 26, T34N, R75W; Status: No Further Action.
- Belle Fourche Pipeline Company, Well Draw Station; Section 15, T35N, R69W; Status: Open.
- DCP Midstream, Mikes Draw Booster Station; Section 16, T37N, R70W; Status: Certificate of Completion.



CONVERSE COUNTY OIL AND GAS EIS

Figure 3.4-1
Uncontrolled Hazardous Sites

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Formerly Used Defense Sites

Casper Precision Bombing Range Number 1 and Number 2 are formerly used defense sites located within the CCPA (**Figure 3.4-1**). These formerly used defense sites are located approximately 20 and 12 miles north of Douglas, Wyoming, respectively. Both sites primarily were used for precision bombing practice in connection with the Casper Army Air Field during World War II and have been decommissioned. The Department of Defense retains the responsibility for any remaining ordnance, explosives, or munitions on public lands, and the USACE is responsible for implementing the formerly used defense sites cleanup program. The BLM supports USACE cleanup activities by providing access for investigation, surveys, and cleanup activities while also providing stipulations to protect natural and cultural resources.

Although no extensive on-the-ground investigations have been performed for these formerly used defense sites, initial reports conducted by the USACE indicate that various hazards could be present (BLM 2007b). These hazards include unexploded ordnance, lead contamination, metal fragments, ammunition casings, and abandoned structures.

3.4.2 Health and Safety

The individuals most likely to be affected by health and safety concerns are the Project workers as well as rural residents. Health and safety issues associated with oil and gas development may arise from improper handling of hazardous materials, improper disposal of solid waste, unauthorized access to oil and gas facilities, uncontrolled release of fluids from a well (blowout), unsafe drilling and maintenance practices, and unsafe vehicle travel. These health and safety concerns are addressed by the operators' compliance with state and federal regulations that require compliance with spill plans, OSHA regulations, and all applicable regulations listed in Section 3.4.1 or **Table 1.5-1**. Oil and gas drilling and production sites can be fenced to limit access and promote onsite security, and employees are required to take safety training and adhere to safety regulations. Public uses in the CCPA include livestock grazing, hunting, and motorists traveling on local roads and highways.

3.4.2.1 Oil and Gas Exploration, Development, and Production Operations

Health and safety concerns within the CCPA primarily are associated with occupational hazards from oil and gas exploration, development, and operations as well as potential hazards related to vehicle accidents, contact with objects and equipment, fires and explosions, falls, and overexertion. Natural gas gathering, compression, stabilization, and transmission operations also currently take place in the CCPA. Operators working within the CCPA are governed by the Wyoming OSHA program, which has adopted the general construction rules and regulations of the federal OSHA program. These include special rules for oil and gas development and operations. Most natural gas transmission and gathering operations are regulated by the USDOT Office of Pipeline Safety. The Office of Pipeline Safety regulations require stringent system maintenance programs, emergency response planning, risk management planning, and individual personnel operations and maintenance training for regulated pipeline systems.

Nationwide, a total of 1,400 recordable nonfatal injuries and illnesses and 112 fatal work-related injuries occurred in the oil and gas extraction industry in 2011 (U.S. Bureau of Labor Statistics 2014). In 2011, transportation incidents accounted for 51 fatalities, contact with objects and equipment accounted for 26 fatalities, and fires and explosions accounted for 12 fatalities (U.S. Bureau of Labor Statistics 2014b). In 2013, 4 fatalities were recorded in the mining and oil and gas extraction industries in Wyoming (Wyoming Department of Employment 2014). Additionally, the Wyoming State Occupational Epidemiology Program releases annual reports detailing worked-related injuries and fatalities. In some instances, a large percentage of oil and gas related fatalities are related to transportation (**Table 3.4-2**). The annual 2014 Work-related Fatal and Non-Fatal Injury Report indicates that of the nine fatalities associated with oil and gas extraction in 2014, six (67 percent) were transportation related involving vehicle rollovers.

Table 3.4-2 Oil and Gas Extraction Occupational Fatalities

Year	Total Fatalities (Oil and Gas Extraction)	
	Number	Transportation related
2015	4	0
2014	9	6
2013	4	0
2012	3	0

Source: Wyoming Department of Workforce Services 2016a, 2015, 2014e, 2013.

H_2S gas that can occur naturally with oil and gas or as a result of bacterial contamination of oil and gas production wells is of particular concern for worker and public safety. H_2S may be produced in sufficient quantities to pose health and safety concerns beyond drill sites and production and processing facilities. It is a toxic gas that can be dangerous or immediately lethal in relatively small concentrations (i.e., 1,000 ppm or 0.1 percent) (EP Energy 2012). In addition to its toxic effects, H_2S is highly flammable, and the combustion products can be hazardous (SO_2). The gas is heavier than air, so it can be trapped in low areas. Due to the hazards posed by H_2S, the BLM requires that an operator conduct contingency planning to deal with the hazards when there is a “reasonable” expectation that that H_2S would be encountered. Onshore Order Number 6, Hydrogen Sulfide Operations (BLM 1990), requires that “for proposed drilling operations were formations will be penetrated which have zones known to contain or which could reasonably be expected to contain concentrations of H_2S of 100 ppm in the gas stream” an H_2S Drilling Operation Plan must be submitted with the APD. If applicable, the operator also must submit a Public Protection Plan. The threshold H_2S concentration of 100 ppm is not expected in oil and gas wells that would be drilled and produced pursuant to the Project. The nearest occurrences of H_2S with oil and gas production include oil production in western Niobrara County, production areas in central Natrona County, and at the Salt Creek oil field in northeast Natrona County (BLM 2012g, 1984).

3.4.2.2 Vehicle Safety Issues

Existing health and safety concerns within the CCPA include occupational hazards associated with the operation of vehicles on improved and unimproved roads, winter driving conditions, and potential collisions with livestock and big game. I-25 and Highways 20, 59, and 93 intersect the CCPA. These high-volume highways provide access to the CCPA for contractors, drilling crews, production personnel, and the general public. As indicated in Section 3.4.2.1, highway accidents accounted for three-quarters of U.S. oil and gas industry transportation-related fatalities in 2008 and comprised 31 percent of all fatalities for that year (U.S. Bureau of Labor Statistics 2010). During 2013, there were 3 fatalities on Converse County roads out of a total of 544 crashes that included fatalities, injuries, and property damage only (WYDOT 2014).

3.4.2.3 Emergency Services

The Converse County Emergency Planning Agency is responsible for emergency planning, information, and hazard mitigation. Inventories of hazardous chemicals required by Emergency Planning and Community Right-to-Know Act would be submitted to the Converse County Emergency Planning Agency.

There are three fire departments in Converse County, including the Converse County Rural Fire Department and the volunteer fire departments of the towns of Glenrock and Douglas. Converse County is divided into nine zones; each zone has a designated fire warden. The CCPA lies primarily within zones 1, 2, 3, 5, 7, 8, and 9 (Converse County 2014c).

One hospital is located in the vicinity of the CCPA. Memorial Hospital of Converse County is a state-licensed, 25-bed critical access facility located in downtown Douglas, Wyoming. Memorial Hospital is a voluntary non-profit facility with approximately 186 full-time nurses and other medical professionals.

The Converse County Sheriff's Office is located in downtown Douglas, Wyoming. The largest municipal police department near the CCPA is the Douglas Police Department; additional municipal police departments are located in the towns of Glenrock, Lost Springs, and Rolling Hills.

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3.5 Land Use

The primary land uses within the CCPA are mineral extraction, agriculture, livestock grazing, wildlife habitat, and recreation. There is a small amount of cultivated cropland (mostly hay and wheat) near the North Platte River. Additionally, a large portion of the CCPA has a mixed grassland / sage land cover that is conducive to grazing. The majority of recreational activities, such as big game hunting as well as boating and fishing, take place along the North Platte River.

3.5.1 Regulatory Guidance

3.5.1.1 Federal

FLPMA mandates that the BLM manage public lands and their resource values on the basis of multiple use (43 USC 1701[a][7]). Oil and gas development and livestock grazing are the predominant uses for public lands within the CCPA, with recreation and agricultural uses occurring in adjacent and overlapping areas. Current land use patterns are consistent with Section 103 of the FLPMA (43 USC 1702[l]), which identifies mineral exploration and production and domestic livestock grazing among the principal uses on public lands.

Lands administered by the BLM within the CCPA are managed under the guidance of the Casper RMP (BLM 2007b). The CFO issued a ROD for a new RMP in 2007; however, subsequent updates and amendments have been made through 2012. The Casper RMP provides management objectives and actions for BLM-administered lands in portions of the CCPA. The development of federal oil and gas leases, as well as associated ROW applications and temporary use permits, must be authorized by BLM, subject to the terms and conditions incorporated into the approved APD or ROW grant by BLM. To maintain multiple-use management and meet resource management objectives, BLM can apply a variety of surface use restrictions pertaining to mineral development and other activities (e.g., visual resource management designations, closure/withdrawal, no surface occupancy, controlled surface use, seasonal limitations).

Lands administered by the USFS within the CCPA are managed under the guidance of the TBNG LRMP (USFS 2001) and associated ROD (USFS 2002), which provides management objectives and actions for National Forest System lands in portions of the CCPA. In 2006, the USFS completed a Supplemental Information Report for available lands and oil and gas leasing west of the Wyodak coal outcrop (USFS 2006a). Later that year, they issued a ROD (USFS 2006b) and a subsequent errata to the ROD (USFS 2006c) pertaining to this report. Numerous special leasing restrictions for oil and gas activities were included, addressing drilling or production activities within the TBNG. Oil and gas leasing and development activities on USFS-administered federal lands within the TBNG are allowed, subject to the limitations imposed by the LRMP as well as the 2002 and 2007 RODs. Proposed projects must be in conformance with the management goals. Under the FOOGLRA, USFS lands that are available for oil and gas leasing were identified, along with the stipulations that are considered appropriate to protect surface resources.

3.5.1.2 Wyoming State Lands

The State Land Use Planning Act (WS 9-849 through 9-862) was enacted by the Wyoming legislature in 1975; it established the State Land Use Commission to guide land use planning in the state. The Office of State Lands and Investments, the administrative and advisory arm of the Board of Land Commissioners and State Loan and Investment Board, is responsible for all leases, easements, and temporary uses on state lands.

The WOGCC regulates drilling and well spacing, and requires an approved APD for all oil and gas wells drilled in the State of Wyoming regardless of land ownership, including wells on federal lands. The APD approval process includes securing the necessary legal access to or across state or privately owned lands.

3.5.1.3 Converse County

The Converse County Land Use Plan (Converse County 2015a) describes the current land use in the CCPA as primarily agriculture, predominantly dryland (non-irrigated) grazing. Mineral extraction is the second prominent use for this portion of the county. Mineral extraction is exempted from local regulations by state law; however, mineral processing is regulated to minimize conflicts between mineral extraction and historic surface land uses. Converse County currently does not have county-wide zoning.

The general statement of the county's goal for mineral resources as contained in the Converse County Land Use Plan is "to minimize the conflict between mineral extraction and the historic surface use" (Converse County 2015a). The county's stated objective for mineral resources is to "discourage non-compatible increases in the intensity of the surface use in areas underlain by extractable minerals, i.e., residential and commercial uses." (Converse County 2015a).

3.5.2 Surface Ownership and Land Use

As summarized in **Table 3.5-1** and shown in **Figure 3.5-1**, the majority of the land in the CCPA is privately held, followed by state land, BLM-administered lands, and USFS-administered lands. Mineral extraction, grazing, wildlife habitat, and recreation are common land uses on both BLM- and USFS-administered lands. Mineral extraction and grazing are detailed below, as well as in Sections 3.3 and 3.9, respectively. Recreation and wildlife habitat are discussed in Sections 3.10 and 3.18, respectively.

The Wyoming Office of State Lands and Investments manages State Trust Land. Revenues generated by trust lands and minerals are reserved for the exclusive benefit of public schools and certain other designated public institutions in Wyoming such as the Wyoming State Hospital (Wyoming Office of State Lands and Investments 2011). Wyoming state-administered lands account for approximately 7 percent of land ownership in the CCPA.

Table 3.5-1 Surface Land Ownership/Administration

Ownership/Administrator	Percent Ownership/Administered	Acres
Private Lands	83	1,247,477
State Lands	7	101,012
Federal Lands (BLM)	6	88,466
Federal Lands (USFS)	4	63,911
Water	<1	1,515
Total	**100**	**1,502,381**

3.5.2.1 Rangeland

Cattle and sheep grazing is a substantial land use within the CCPA. There are 83 grazing allotments fully or partially within the CCPA totaling 1,162,316 acres. Of these, 62 allotments are administered by the BLM and 21 allotment (also referred to as range management units) are administered by the USFS. More detailed information regarding livestock grazing is located in Section 3.9, Range Resources.

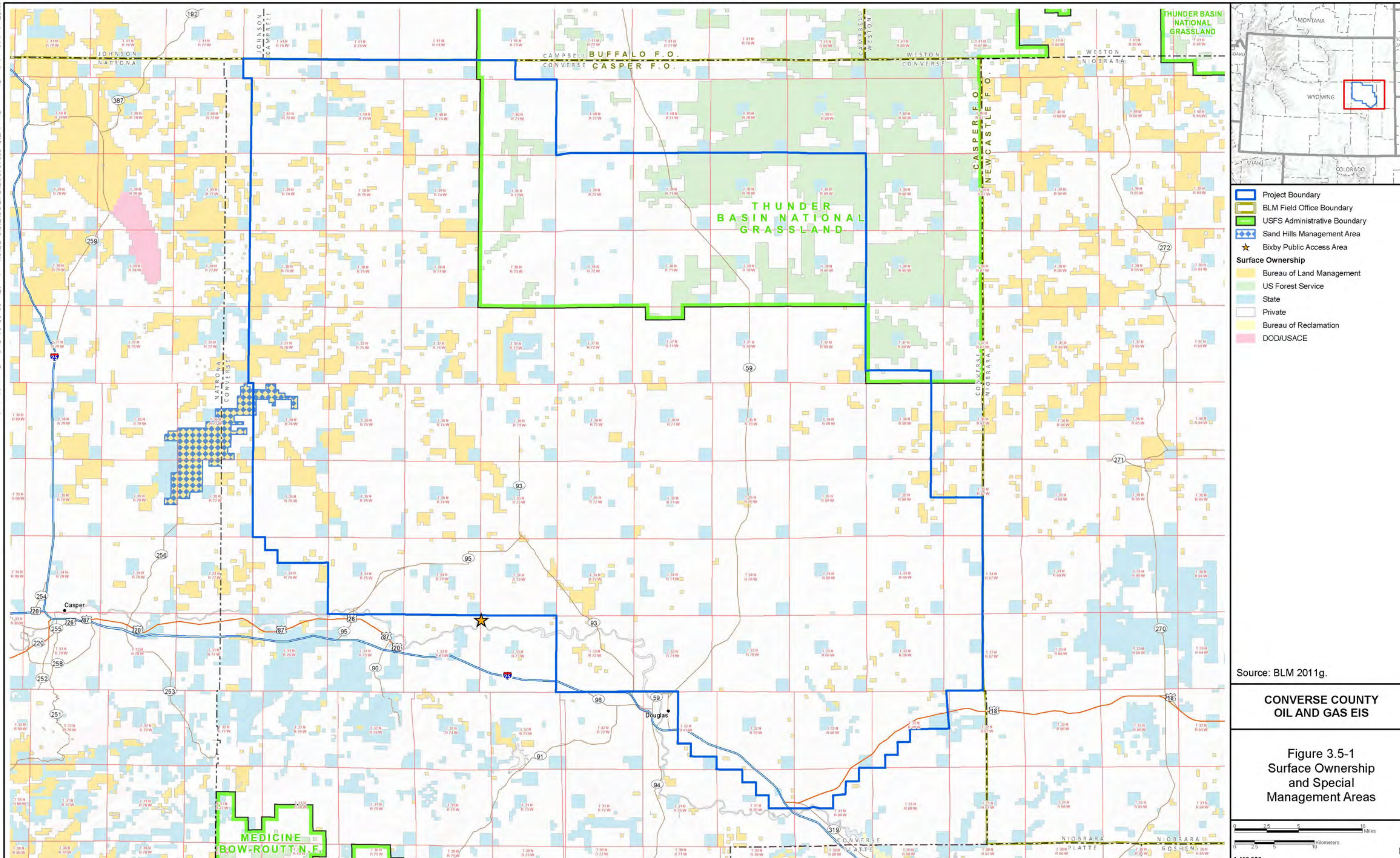

Figure 3.5-1
Surface Ownership and Special Management Areas

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3.5.2.2 Agriculture

Less than 1 percent (approximately 10,426 acres) of the CCPA has been identified as land in agricultural production (primarily hay and wheat) and has been designated as cultivated cropland. These areas consist of a combination of row crops and crops on pivot irrigation and are concentrated near the North Platte River northwest of Douglas and adjacent to the Town of Orin. There also is agricultural acreage near County Roads 53 and 47, mainly consisting of row crops.

3.5.2.3 Energy

The CCPA contains numerous oil and gas fields and related activity, which includes three gas processing plants and a network of pipelines for natural gas, crude oil, and other products (**Figure 3.3-5**). As of January 2015, there were 1,520 wells supporting existing oil and gas activities within the CCPA (WOGCC 2015b). However, in addition to oil and gas production, there are many other types of energy production that occur within the CCPA, including coal, uranium, and wind energy, as depicted in **Figure 3.5-2**.

The CCPA is within Powder River Basin coal field and coal is the primary leasable mineral. There are no active coal mines within the CCPA at this time, although historic coal production did occur primarily from Glenrock Coal Company's former Dave Johnston Mine. The Antelope and North Antelope/Rochelle coal mines north of the CCPA near the Converse County and Campbell County border are active and have experienced recent expansions. The Antelope Mine shipped 31.4 million tons of coal in 2013 (Cloud Peak Energy 2014).

Uranium mining also has a presence within the CCPA. This concentrated energy source is highly valued for its use in nuclear power and electrical generation, and Wyoming contains the largest known economic uranium ore reserves in the U.S. (WSGS 2014). Uranium production in the U.S. steadily increased from 2009 to 2013, reaching levels not seen since the mid-1990s (Converse County 2014a). Although numerous small mines and exploration prospects within the CCPA were worked in the 1950s, some under the auspices of the Atomic Energy Commission, none of these were commercially viable. However, Converse County is now home to one commercially active uranium mine. The Smith Ranch/Highland Uranium Mine, operated by Cameco-owned Power Resources, has been in continuous operation since the early 1990s and is the nation's largest in situ leaching uranium mine in terms of production capacity (Converse County 2014; WSGS 2014). The mine has a production capacity of 5.5 million pounds of uranium per year (Converse County 2014a). See Section 3.3, Geology and Minerals, for details regarding oil and gas production as well as coal and uranium mining within the CCPA.

Portions of the CCPA are within high class ratings of wind energy with approximately 20 percent and 44 percent designated as Classes 3 and 4 wind potential, respectively. Another 28 percent of the CCPA has been designated as Class 5, and 6 percent has been designated as Class 6. Areas designated as Class 3 or greater typically are suitable for most utility-scale wind turbine applications. **Table 3.5-2** provides a summary of wind power classes as defined by the National Renewable Energy Lab 2014.

Currently, there are six wind energy centers that are online within the CCPA. Most of the wind energy centers are located north of the Town of Glenrock (National Renewable Energy Lab 2014). The largest wind energy center in terms of megawatt (MW) capacity is the Top of the World Windpower energy center, operated by Duke Energy. The wind energy center has a 200-MW capacity and consists of 110 wind turbines on 17,000 acres of land (Duke Energy 2015). The six wind energy centers within the CCPA are shown in **Figure 3.5-2**.

Table 3.5-2 Classes of Wind Power Density at 10 meters and 50 meters [1]

	10 meters (33 feet)		50 meters (164 feet)	
Wind Power Class	Wind Power Density (W/m 2)	Speed [2] m/s (mph)	Wind Power Density (W/m 2)	Speed [2] m/s (mph)
1	0	0	0	0
	100	4.4 (9.8)	200	5.6 (12.5)
2				
	150	5.1 (11.5)	300	6.4 (14.3)
3				
	200	5.6 (12.5)	400	7.0 (15.7)
4				
	250	6.0 (13.4)	500	7.5 (16.8)
5				
	300	6.4 (14.3)	600	8.0 (17.9)
6				
	400	7.0 (15.7)	800	8.8 (19.7)
7				
	1000	9.4 (21.1)	2000	11.9 (26.6)

m/s = meters per second

mph = miles per hour

W/m 2 = watts per square meter

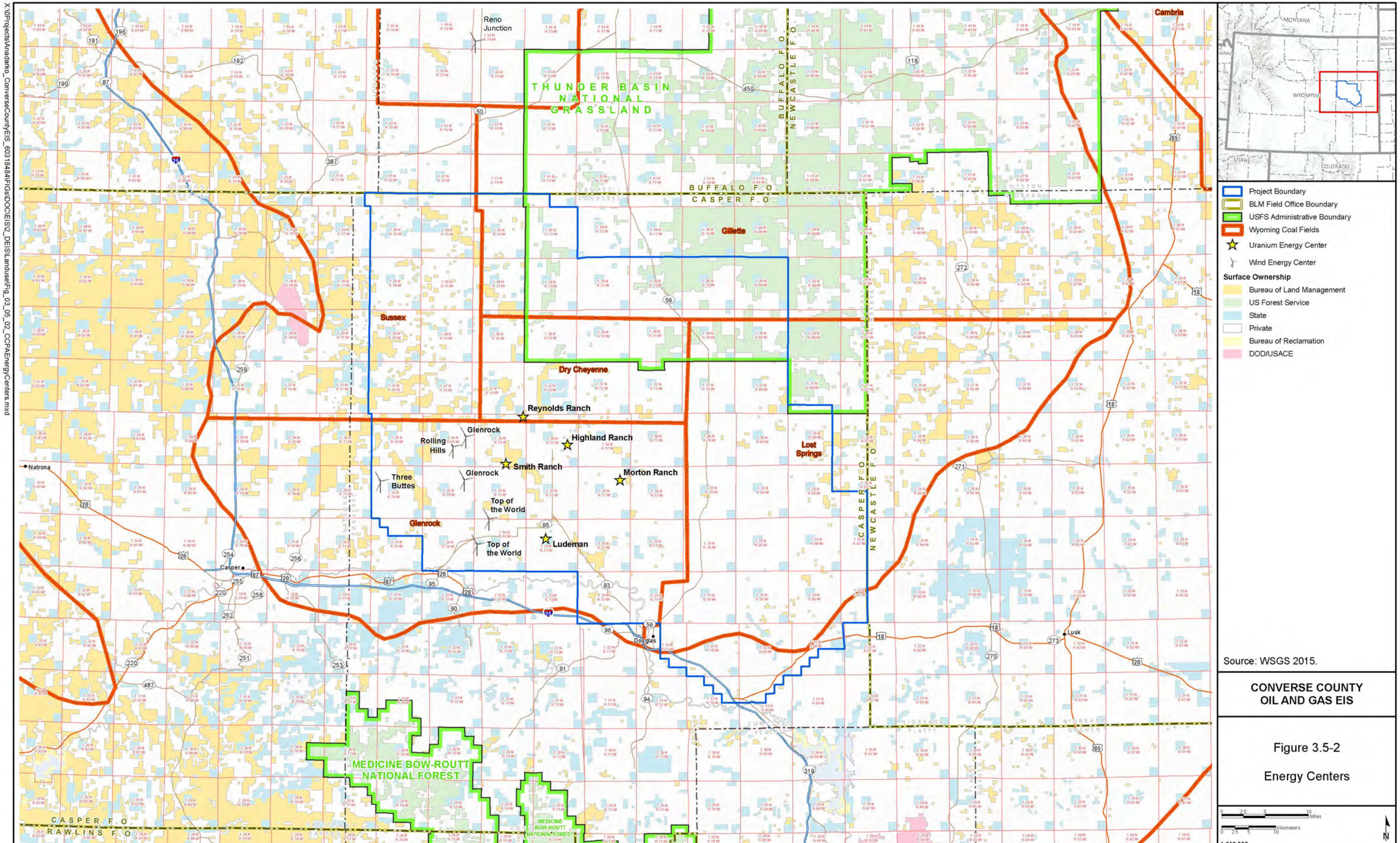
[1] Vertical extrapolation of wind speed based on the 1/7 power law.

[2] Mean wind speed is based on Rayleigh speed distribution of equivalent mean wind power density. Wind speed is for standard sea-level conditions. To maintain the same power density, speed increases 3%/1000 m (5%/5000 ft) elevation.

3.5.2.4 Special Management Areas

There are no special recreation management areas (SRMAs), wilderness study areas, or inventoried roadless areas within the CCPA (BLM 2007b; USFS 2001). There is one management area, the Sand Hills Management Area, which transects the CCPA boundary. The Sand Hills Management Area totals 20,090 acres, of which 2,006 acres are located within the boundary of the CCPA (**Figure 3.5-1**). Within the Sand Hills Management Area, specific routes are designated as open for motorized use including off-highway vehicles (OHVs). Routes designated for authorized use only are limited to persons who have permitted uses in the area. Within the management area, 28 miles of primitive roads are open to motorized use, 12 miles of primitive roads are limited to authorized use only, and 8 miles of existing travel routes are closed.

The Bixby Public Access Area is a designated recreation area just outside of the CCPA along the North Platte River. It is portrayed in **Figure 3.5-1**.



CONVERSE COUNTY OIL AND GAS EIS

Figure 3.5-2

Energy Centers

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3.6 Lands and Realty

The BLM and USFS lands and realty program is aimed at managing the underlying land base that hosts and supports all resources and management programs. The key activities of the lands and realty program include: 1) land use authorizations (e.g., leases and permits, airport leases); 2) land tenure adjustments (e.g., retention, disposal, acquisition); 3) withdrawals, classifications, and other segregations; and 4) ROW grants. The BLM and USFS work cooperatively to execute the lands and realty program with other federal agencies, the State of Wyoming, counties and cities, and other public and private landholders. Management actions incorporated into the alternatives are described in more detail in Chapter 2.0.

3.6.1 Regulatory Guidance

Lands administered by the BLM within the CCPA are managed under the guidance of the Casper RMP (BLM 2007b). The CFO issued a ROD for a new RMP in 2007 with subsequent updates and amendments as posted to the BLM CFO website. The Casper RMP provides management objectives and actions for BLM-administered lands in portions of the CCPA. The development of federal oil and gas leases, as well as associated ROW applications and temporary use permits, must be authorized by BLM. To maintain multiple-use management and meet resource management objectives, BLM can apply a variety of surface use restrictions pertaining to mineral development and other activities (e.g., visual resource management designations, closure/withdrawal, no surface occupancy, controlled surface use, seasonal limitations).

Lands administered by the USFS within the CCPA are managed under the guidance of the TBNG LRMP (USFS 2001) and associated ROD (USFS 2002), which provides management objectives and actions for National Forest System lands in portions of the CCPA. In 2006, the USFS completed a Supplemental Information Report for available lands and oil and gas leasing west of the Wyodak coal outcrop (USFS 2006a). Later that year, they issued a ROD (USFS 2006b) and a subsequent errata to the ROD (USFS 2006c) pertaining this report. Under the FOOGLRA, USFS lands that are available for oil and gas leasing were identified along with the stipulations that are considered appropriate to protect surface resources. In the case of the TBNG where the USFS administers federally owned surface estate, a special use permit is required to authorize any disturbance to federally owned surface. A special use permit includes conditional provisions (USFS 2001).

3.6.2 Key Activities

3.6.2.1 Land Use Authorizations

Land use authorizations include various authorizations to use public surface for leases, permits, and easements under Section 302(b) of the FLPMA; Section 28 of the MLA; Recreation and Public Purpose leases under the Recreation and Public Purposes Act (Recreation and Public Purpose Act) of June 14, 1926 (43 USC 869 et seq.); and airport leases under the Act of May 24, 1928, as amended (49 USC Appendix, Sections 211-213). The development of federal oil and gas leases (which may include associated ROW applications and temporary use permits), must be authorized by BLM, subject to the terms and conditions incorporated into the approved APD or ROW grant by BLM. On USFS-administered surface, a special use permit is required to authorize any disturbance to federally owned surface. The existing surface management pattern within the CCPA is shown on **Figure 3.5-1** and detailed in Section 3.4. The Recreation and Public Purpose Act is discussed further in Section 3.6.2.2. The BLM or USFS do not administer any airport leases within the CCPA (surface stipulations surrounding the Converse County Airport are detailed in Section 3.6.2.2).

3.6.2.2 Land Tenure Adjustments

Land tenure adjustments refer to those actions that result in the retention of public land, disposal of public land, the acquisition by a federal agency of non-federal lands or interests in land. FLPMA requires that public land be retained in public ownership unless, as a result of land use planning, disposal of certain parcels is warranted. Lands identified for retention usually consist of special designations or resources that serve the public interest. Acquisition of and interests in land can be accomplished through several means, including exchange, purchase, donation, and condemnation. Land disposals, exchanges, and stipulations are further discussed below.

Disposals and Exchanges

The BLM's policy for disposing of public lands is through the federal land exchange program rather than through competitive land sales. Disposal areas include tracts of land that are economically difficult to manage and/or parcels that could serve important public objectives including, but not limited to, expansion of communities and economic development. Prior to any disposal, a site-specific analysis must determine that the lands considered contain no important wildlife, recreation, or other resource values, the loss of which could not be mitigated; have no overriding public values; represent no substantial public investments; and have no hazardous materials present. Disposal also must serve the public interest. Lands will not be considered for disposal if they are allocated for a specific use, even though they meet the general disposal criteria.

Exchange is the process of trading lands or interests in lands and serves as a viable means for the BLM and USFS to accomplish their goals and mission. Public lands may be transferred from BLM or USFS to other federal agencies for management; furthermore, disposal by sale or through the Recreation and Public Purpose Act also can occur. The Recreation and Public Purpose Act authorizes the federal land administrator to lease or convey public surface to state and local governments and qualified nonprofit organizations for recreation or public purposes. Lands are leased or conveyed for less than fair market value or at no cost for qualified uses. Examples of typical uses under the Recreation and Public Purpose Act include historic monument sites, campgrounds, schools, parks, public works facilities, and hospitals. Leases and conveyances under the Recreation and Public Purpose Act reserve all minerals in the land to the U.S. Currently, there are no lands within the CCPA that the BLM administers as either Recreation and Public Purpose Act conveyances or leases.

On BLM-administered land within the CCPA, approximately 64,785 acres have been identified for disposal, 361 acres for restricted disposal, and 23,363 acres for retention. These locations are depicted on **Figure 3.6-1**. The TBNG LRMP includes criteria for identifying lands or interests in land for acquisition or disposal, but it does not identify specific parcels that meet the criteria (USFS 2001).

The BLM, NPS, and the State of Wyoming are working on a land exchange to acquire lands for the NPS in Teton National Park and dispose of lands to the State of Wyoming in northwestern Converse County. The proposal has yet to be finalized.

Formerly Used Defense Sites

The DOD is responsible for environmental restoration of properties that formerly were owned by, leased to, or otherwise possessed by the U.S. under the jurisdiction of the Secretary of Defense. These properties are known as formerly used defense sites. The USACE is responsible for implementing the formerly used defense sites cleanup program. The BLM supports USACE cleanup activities through providing access for investigations, surveys, and cleanup activities; providing stipulations to protect natural and cultural resources; and assisting in the development of appropriate cleanup standards. Various hazards potentially present on these sites include unexploded ordnance, lead contamination, metal fragments, ammunition casings, and abandoned structures. With the exception of livestock grazing, commercial use is allowed on these sites with notification of the risk and a requirement to submit a safety plan prior to use. There are two formerly used defense sites within the CCPA (**Figure 3.6-1**). The larger site is approximately 10,320 acres and is located just east of Ross Road CR 31, approximately 8 miles north of the intersection of Ross Road and SR 96. The smaller site approximately 2,635 acres and is located north of the intersection of Ross Road CR 31 and Jenne Trail Road CR 34. Both sites were associated with military munitions.

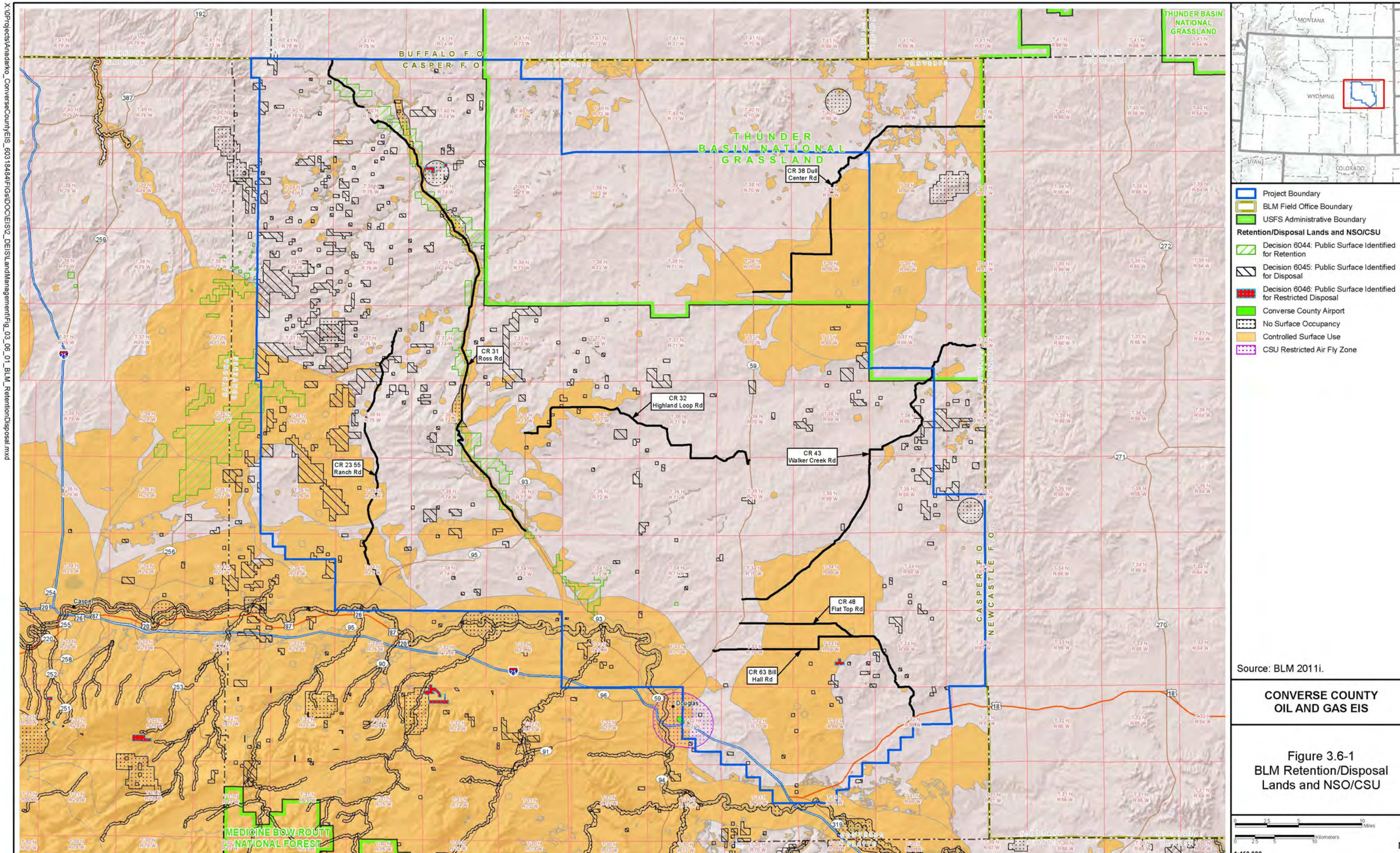

Figure 3.6-1
BLM Retention/Disposal Lands and NSO/CSU

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Surface Use Stipulations

A ROW exclusion area typically is an area with high resource values where new ROW development is prohibited. Approximately 5,555 acres of BLM-administered surface within the CCPA have been designated as ROW exclusion areas. Of this acreage, 2,006 acres are within the Sand Hills Management Area.

A ROW avoidance area is an area designated in a land use plan for which a ROW should be avoided if at all possible and typically includes additional constraints. Approximately, 80,181 acres have been designated as ROW avoidance areas on USFS- and BLM-administered surface (BLM 2007b). The majority of ROW avoidance areas in the CCPA are associated with historic trails and protected wildlife such as raptor nests. ROWs are discussed further in Section 3.6.2.4.

Land that is designated as closed generally is an area that is not available for a particular use or uses. Approximately 8,297 acres of BLM-administered surface estate are closed to specific activities. Of this acreage, 2,005 acres are closed to oil and gas activity as well as other leasable solids, 5,306 acres are closed to salable mineral activity, and the remaining acreage (986 acres) is closed to OHV use.

A conditional surface use (CSU) stipulation is applied where current stipulations are deemed insufficient to achieve the level of resource protection necessary to protect the public interest, but where a NSO is deemed overly restrictive. Approximately 464,398 acres within the CCPA are under CSU stipulations. These areas include but are not limited to, areas with sensitive vegetation and wildlife (e.g., greater sage-grouse ***PHMA*** and potential habitat for Ute ladies' tresses) as well as areas with high scenic quality. Surface occupancy or use within 10,000 feet of the Converse County Airport near the city of Douglas also is subject to a CSU restriction to protect aircraft fly zones (**Figure 3.6-1**). This acreage is included in the 464,398 acres of CSU within the CCPA. Further information on these resources can be found in Section 3.14, Vegetation; Section 3.15, Visual Resources; and Section 3.18, Wildlife and Aquatic Biological Resources.

An NSO stipulation prohibits occupancy or disturbance of all or part of the surface to protect special values. Approximately 3,567 acres of BLM-administered surface estate are under NSO stipulations. These areas include, but are not limited to, sensitive cultural resources and species habitat. Further analysis of cultural resources is located in Section 3.2, Cultural Resources. On USFS-administered lands within the CCPA there are 29,507 acres under NSO stipulations. Land managed under NSO or CSU is depicted in **Figure 3.6-1**. These areas are comprised almost exclusively of sensitive wildlife habitat and are further detailed in Section 3.18, Wildlife and Aquatic Biological Resources.

3.6.2.3 Withdrawals

Withdrawals are formal land designations that set aside, withhold, or reserve federal lands for a specific public use. Withdrawals accomplish one or more of the following:

- Transfer total or partial jurisdiction of federal land between federal agencies.
- Close federal land from operation of all or some of the public land laws and/or mineral laws.
- Dedicate federal land to a specific purpose.

Withdrawals are established for a wide range of public purposes such as military reservations, administrative sites, national forests, reclamation projects, recreation sites, stock driveways, and power site reserves. There are three major types of withdrawals: 1) administrative withdrawals – those made by the Secretary of the Interior or some other authorized officer of the executive branch of the federal government; 2) congressional withdrawals – withdrawals legislated by Congress; and 3) Federal Power Act or Federal Energy Regulatory Commission withdrawals – power project withdrawals established under the authority of the Federal Power Act of June 10, 1920. Nearly 603 acres in the CCPA have been withdrawn from various types of activities, such as locatable and leasable minerals.

3.6.2.4 Right-of-Way Grants

A ROW grant is an authorization to use specific pieces of public land for certain projects such as developing roads, pipelines, electrical lines, and communication sites. The grant authorizes rights and privileges for a specific use of land for a specific period of time. The BLM and USFS manage ROWs through a system of designated corridors and designated ROW exclusion and avoidance areas. The BLM and USFS have encouraged the placement of new facilities within established corridors, and overlapping or adjacent ROWs are issued whenever possible. Generally, the use of designated ROW corridors for ROW grants is actively encouraged; however, the presence of a designated ROW corridor or a system of ROW corridors does not preclude the granting of a ROW on public lands outside the designated corridor, if appropriate.

Various existing ROWs have been authorized on BLM- and USFS-administered lands in the CCPA, primarily for pipelines, roads, electrical lines, and railroads. In the CFO RMP, the BLM has identified preferred locations for the placement of new ROWs as designated ROW corridors, such as the Cabin Creek Corridor from the southwestern CFO boundary to the northern CFO boundary. This 1-mile-wide corridor does not transect the CCPA, but traverses northwest of the CCPA boundary. In the TBNG LRMP, guidelines for Management Area 3.65, Rangeland with Diverse Natural-Appearing Landscapes, require new utilities to be located along road corridors or within other areas already disturbed. The remainder of the TBNG within the CCPA is in Management Area 6.1, Rangeland with Broad Resource Emphasis, which has no specific restriction on the placement of utilities (USFS 2001).

3.7 Noise

Noise is defined as any sound that is undesired, extraneous or interferes with one's hearing. Noise is considered a human health concern as it can interfere with speech communication and hearing or is otherwise considered annoying. An individual's response to noise is influenced by the type of noise, perceived importance of the noise, appropriateness in the setting, time of day, type of activity during which the noise occurs, and the sensitivity of the individual.

3.7.1 Regulatory Guidance

The USEPA Noise Control Act of 1972 provides guidance on noise levels to protect public health and welfare against hearing loss, annoyance and activity interference. Outdoor noise levels below 55 decibels are identified as preventing activity interference and annoyance.

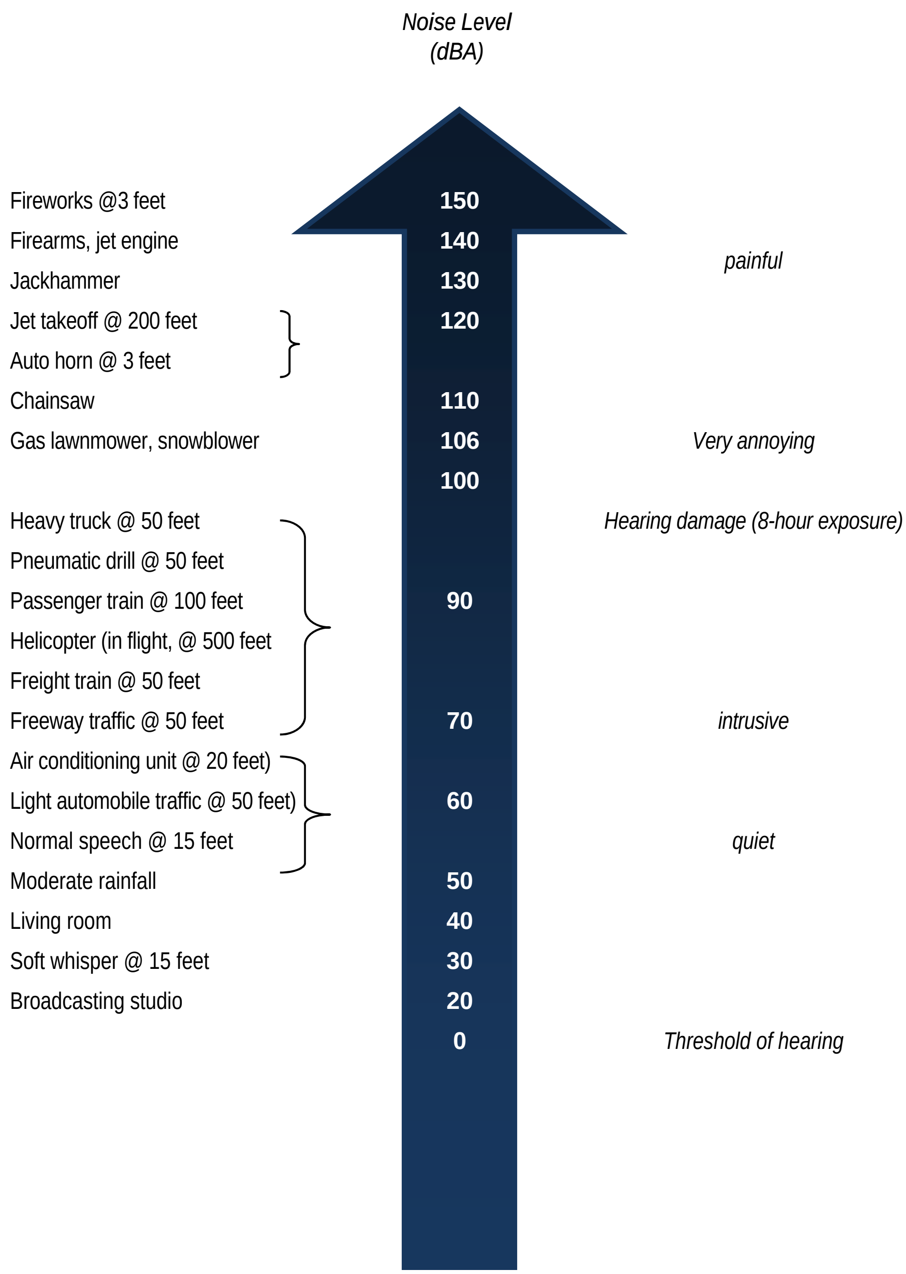
Wyoming EO ***2019-3***, as adopted by BLM, specifies Wyoming's statewide requirements for protecting greater sage-grouse. General stipulations in Wyoming EO ***2019-3*** related to noise are further discussed in Section 3.18, Wildlife and Aquatic Biological Resources. Additionally, WS 31-5-1601 states that OHVs operating on public lands in Wyoming must have a muffler that reduces noise to less than 102 dBA.

There are no local noise standards relevant to the study area that pertain to unincorporated areas of Converse County.

3.7.2 Acoustics and Existing Background Noise Levels

Sound is measured in dBA and is based on a logarithmic scale to account for the wide range of audible sound intensities. The "A-weighted" sound level approximates the frequency response of the average healthy human ear when listening to most ordinary sounds. Under the logarithmic scale for sound (and noise), a 10-dBA increase would increase sound intensity by a factor of 10; a 20-dBA increase would increase sound intensity by a factor of 100. As a result, methods have been developed for weighting the sound frequency spectrum to approximate the response of the human ear. The dBA scale is widely used for environmental noise assessments because of its relative convenience and accuracy in correlating with people's judgments of what constitutes noise. Typical A-weighted sound and noise levels associated with common activities or situations are shown in **Figure 3.7-1**.

Ambient noise, or background noise, is defined as the total noise from nearby and distant sources, relatively steady and homogeneous, with no particular source identifiable within it (GE Energy 2005; National Wind Coordinating Committee 2002). The proposed project would occur primarily in rural rangeland areas (a small percentage of agricultural land is present within the CCPA). ***Given that most of the proposed study area is largely undeveloped and sparsely populated, it would be expected to have background noise day-night (average sound) levels closer to 35 dBA.*** Levels near developed areas and along area roads and highways (e.g., SR 59 and U.S. Highway 18/20) are likely to be higher due to vehicle movement and other human activities. As detailed in Section 3.13, traffic on local and major roads within the CCPA has increased in recent years, adding to the background ambient noise level. Rail lines in the CCPA also provide for elevated noise levels. Wind is frequently a major contributor to ambient noise levels within the area, as is agricultural machinery noise when operated near residences and other sensitive receptors. Existing gas field developments are distributed throughout the CCPA and generate noise through construction and operation activities. These activities include, but are not limited to, well pad and access road construction, construction and operations traffic, construction and operation of ancillary facilities, and flaring. Sensitive receptors within the study area are limited to residents in scattered rural locations as well as low population urban areas, and to greater sage-grouse leks and nesting areas.



Source: Council on Environmental Quality 1970.

Figure 3.7-1 Typical A-weighted Noise Levels

Noise level from a line source (e.g., a highway) will decrease by 3 dBA for every doubling of the distance away from the source (Truax 1999). This concept is known as cylindrical spreading. Noise level from a point source (e.g., concentrated construction activity) will decrease by 6 dBA for every doubling of the distance away from the source (Truax 1999). This concept is known as geometric spreading, and is based on the inverse square law. This law states that the intensity of the influence at any given radius is the source strength divided by the area of the sphere. The energy twice as far from the source is spread over four times the area, hence the sharp drop off in intensity. Sound intensity follows the inverse square law assuming there are no reflections or reverberations. **Table 3.7-1** displays the human perception of a change in dBA levels.

Table 3.7-1 Human Perception of Noise Level Changes

Change in Noise Level (dBA)	Result
1	Insignificant
3	Barely discernible
5	Noticeable community response
10	Causes an adverse community response

As shown above, when comparing similar sounds (e.g., changes in traffic noise levels) a 3-dBA change in sound-pressure level is considered detectable by the human ear in most situations. A 5-dBA change is readily noticeable by most people, and a 10-dBA change is perceived to be a doubling (or halving) of sound or noise. Impacts to wildlife from noise are addressed in Section 3.18, Wildlife and Aquatic Biological Resources.

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3.8 Paleontological Resources

The analysis area for paleontology is the CCPA because impacts on paleontological resources from the Project would be limited to areas of direct surface disturbance and drilling activity.

3.8.1 Regulatory Framework

The primary statute under which the BLM and USFS manage paleontological resources is the Paleontological Resource Preservation Act (Public Law 111-11, Title VI, Subtitle D, Sections 6301-6312, 123 Stat. 1172, 16 USC 470aaa). The Paleontological Resource Preservation Act defines paleontological resources as “any fossilized remains, traces, or imprints of organisms, preserved in or on the earth’s crust, that are of paleontological interest and that provide information about the history of life on earth.” (BLM 2017b)

Other statutes and regulations that govern the management of paleontological resources on federal lands include the following:

- FLPMA (Public Law 94-579).
- NEPA (Public Law 91-190).
- Various sections of BLM regulations in Title 43 CFR that address the collection of invertebrate fossils and, by administrative extension, fossil plants.
- USFS regulations in Title 36 CFR 228.62(e) and 261.9(j i) governing petrified wood and special use authorization for removal of any paleontological resource for commercial purposes.

In addition to the statutes and regulations listed above, paleontological resources on public lands are managed through the use of internal BLM guidance and manuals. Included among these are the BLM Manual 8270 and the BLM Handbook H-8270-1.

Management direction for paleontological resources also is provided in the BLM Casper RMP (BLM 2007b) and the USFS TBNG LRMP (USFS 2001). Various internal instructional memoranda ***(e.g., IM2009-011 and IM2016-124)*** have been issued to provide guidance to the BLM in implementing management and protection of paleontological resources.

3.8.2 Potential Fossil Yield Classification

Paleontological resource classification is a ranking of areas and geologic units according to their potential to contain vertebrate fossils or noteworthy occurrences of invertebrate or plant fossils. These rankings are used in land-use planning as well as for identifying areas that may warrant special management or special designations.

The Potential Fossil Yield Classification (PFYC) system classifies geologic units on the basis of relative abundance of vertebrate fossils or uncommon invertebrate or plant fossils and sensitivity to adverse impacts. A higher class number indicates a higher potential for occurrence of fossils. The classification should be applied at the geologic formation or member level. The system provides baseline guidance to assess and mitigate impacts on paleontological resources. The classification should be an intermediate step in the analysis and used to assess additional mitigation needs. The PFYC originally contained five major classes of fossil potential, but new classes were recently added (BLM 2016c). The classes are summarized below.

- Class 1: Very low potential for fossil remains.
- Class 2: Low potential for fossils such as alluvial deposit.
- Class 3: Moderate potential for fossil content that varies in significance and predictable occurrence.

- Class 4: High potential for occurrence of fossils not exposed on the surface but may be exposed by disturbance of the surface.
- Class 5: Very high potential for highly fossiliferous geologic units that consistently and predictably produce vertebrate or important invertebrate or plant fossils.

The new PFYC classes that have been added are summarized below (BLM 2016c):

- Class U, Unknown Potential: Geologic units that cannot receive an informed PFYC assignment. Until a provisional assignment is made, geologic units that have an unknown potential have medium to high management concerns. Lacking other information, field surveys normally are necessary, especially prior to authorizing a ground-disturbing activity.
- Class W, Water: Includes any surface area that is mapped as water. Most bodies of water do not typically contain paleontological resources. However, shorelines should be carefully considered for uncovered or transported paleontological resources. Reservoirs are of special concern because important paleontological resources often are exposed during low water intervals. In karst areas, sinkholes and cenotes may trap animals and contain paleontological resources. Dredging river systems may result in the disturbance of sediments that contain paleontological resources.
- Class I, Ice: Includes any area that is mapped as ice or snow. Receding glaciers, including exposed lateral and terminal moraines, should be considered for their potential to reveal recently exposed paleontological resources.

3.8.3 Existing Conditions

Using the PFYC System and data from the Casper RMP (BLM 2007b) and USFS LRMP (USFS 2001), the acres of the PFYC designations within the CCPA are provided in **Table 3.8-1** and on **Figure 3.8-1**.

Table 3.8-1 PFYC Designations and Acres in the CCPA

PFYC	Acres in CCPA
2 – Low	54,203
3 – Moderate	1,359,390
5 – Very High	88,788

Source: BLM 2007a; USFS 2001.

The PFYC System was used to determine the paleontological sensitivities of the six primary geologic groups and/or formations exposed within the CCPA (**Table 3.8-2**). The six older units (from older to younger) that outcrop in the CCPA and have potential to contain scientifically important fossils are the Cretaceous Lance Formation, Paleocene Fort Union Formation, Paleocene to Eocene Wasatch Formation, Eocene to Oligocene White River Formation, lower Oligocene to Miocene Rocks (no formation designation), and upper Miocene rocks (no formation designation). Geologic units are depicted in **Figure 3.3-4**. The alluvial and colluvial deposits of Quaternary age are either too young to contain fossils or have a very low PFYC classification; therefore, they are not included in this table. The one notable exception is a single mammoth fossil find in Pleistocene lake bed deposits in northwest Converse County within the CCPA (Sundell 2014).

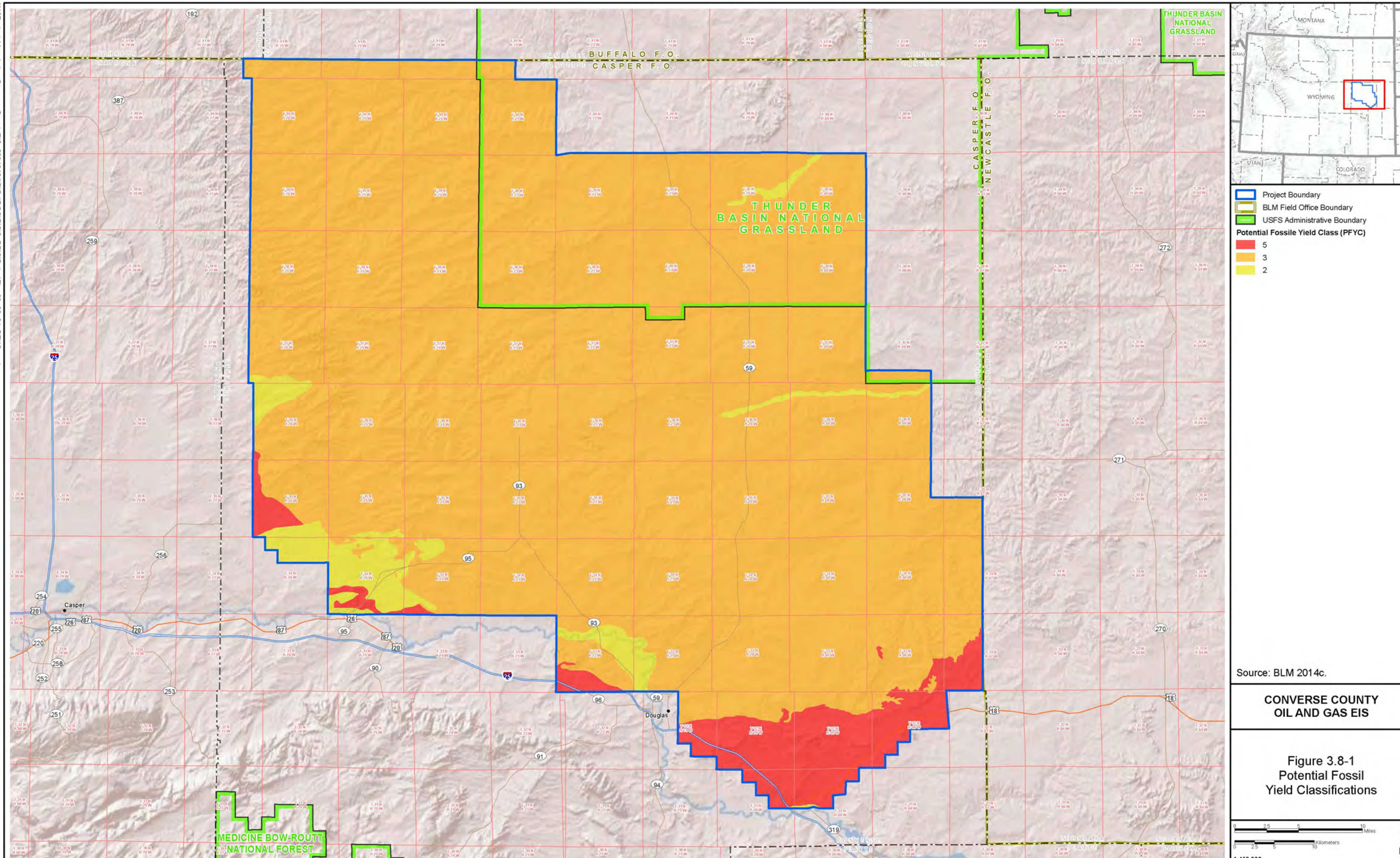

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Table 3.8-2 Paleontological Sensitivities of Geologic Units in the CCPA Using the PFYC System

Geologic Unit[1]	Age	Typical Fossils	Source	PFYC[2]
Upper Miocene Rocks	Miocene	Mammals, birds, reptiles	University of Wyoming (2014a)	Class 5
Lower Miocene and Oligocene Rocks	Oligocene to Miocene	Mammals, reptiles	University of Wyoming (2014b)	Class 5
White River Group	Eocene to Oligocene	Mammals, birds, reptiles	University of Wyoming (2014c)	Class 5
Wasatch Formation	Paleocene to Eocene	Mammals, birds, reptiles, fish	University of Wyoming (2014d)	Class 5, 3
Fort Union Formation	Paleocene	Mammals, birds, reptiles, fish	University of Wyoming (2014e)	Class 3
Lance/Hell Creek Formation	Cretaceous	Dinosaurs, mammals, birds, reptiles, fish	University of Wyoming (2014f); University of California Berkeley Museum (2014a)	Class 5

[1] Love and Christiansen 1985.

[2] BLM 2008b.

3.8.4 Geologic Units in the CCPA

The Wasatch Formation geographically dominates the CCPA. The Fort Union Formation is second in geographic extent, occupying less than one-fifth the area of the Wasatch Formation and bounding it to its east, west, and south. The remainder of the formations occupy small areas in the southern CCPA margins.

3.8.4.1 Upper Miocene Rocks

Geological Description

Upper Miocene Rocks (Tmu) in eastern Wyoming consist of light colored claystone, sandstone, and conglomerate. They are equivalent to the Moonstone Formation of central Wyoming and the Ogallala Formation of the Denver Basin. Upper Miocene Rocks unconformably overlie the Lower Miocene and Oligocene Rocks and crop out in a very small area at the south edge of the CCPA (Love and Christiansen 1985; Love et al. 1993).

Paleontological Potential of the CCPA – Fossils from Equivalent Rocks

Camelids, sparse mammal bones, and teeth were found in the Upper Miocene Rocks of central Wyoming (Love 1961). A new species of camelid from Carbon County, Wyoming, was identified (Cassiliano 2008). In northern Kansas, the Ogallala Formation, an equivalent of the Moonstone Formation, has yielded vertebrates such as horse, rhinoceros, tortoise, fish, and birds (Frye et al. 1956); in New Mexico, vertebrate tracks (artiodactyl and carnivore) (Williamson and Lucas 1996).

3.8.4.2 Lower Miocene and Oligocene Rocks

Geological Description

Lower Miocene and Oligocene rocks (Tmo) in eastern Wyoming consist of light colored sandstone and white claystone and siltstone. They are equivalent to the Arikaree Formation in the Denver Basin. Lower

Miocene and Oligocene rocks unconformably overlie the White River Formation and crop out in very small isolated areas at the south edge of the CCPA (Love and Christiansen 1985; Love et al.1993).

Paleontological Potential of the CCPA – Fossils from Equivalent Rocks

In North Dakota, mammals were found in the Lower Miocene and Oligocene Rocks (Hoganson et al. 1998). The Lower Miocene and Oligocene Rocks have produced fossil tracks of large (hooved) mammals in western Nebraska (Loope 1986). Carnivores were found in the Lower Miocene and Oligocene Rocks of southeast Wyoming; these also were found in several other Wyoming localities (Hunt 2002). The Chalk Canyon Formation of Arizona produced mammals of Arikareean age (Late Oligocene to Late Early Miocene); other referred material of the same type and age was found in Arizona, California, New Mexico, Wyoming, and Nebraska (Lander and Lindsay 2011).

3.8.4.3 White River Group

Geological Description

In eastern Wyoming, the White River Formation (31–35 million years ago) consists of white to pale pink claystone and arkosic conglomerate (Twr). It unconformably overlies the Wasatch and Fort Union formations and is unconformably overlain by Upper and Lower Miocene and Oligocene rocks. It has three members, Chadron, Brule, and Upper Conglomerate. Locally, the Brule Member may include the Upper Conglomerate. The Upper Conglomerate is a light gray conglomeratic sandstone and conglomerate. The Brule is pale pink to white claystone and sandstone. The Chadron is light gray to dark red claystone, sandstone, and conglomerate (Love and Christiansen 1985; Love et al. 1993).

Paleontological Potential of the CCPA – Fossils from Equivalent Rocks

In North Dakota, the Chadron has produced numerous mammals as well as fish, amphibians, and reptiles (Hoganson et al. 1998). The Brule of North Dakota has produced many mammal orders, fish, amphibians, reptiles, and one bird (Hoganson et al. 1998). Boyd et al. (2013) details small mammals from the Chadron of South Dakota and Nebraska. A mammal (insectivore) was found in the Middle White River Group (Meehan and Martin 2012).

3.8.4.4 Wasatch Formation

Geological Description

The Wasatch Formation (Tw) is the most geographically widespread unit exposed on the surface in the CCPA. Its PFYC rank in the Powder River Basin (CCPA) is 3; elsewhere, its PFYC rank is 5 (BLM 2008a). It is composed of light gray sandstone, variegated to gray mudstone and claystone, and coal and unconformably underlain by the Fort Union Formation. The Wasatch Formation is unconformably overlain by the White River Group along its southern margin in the CCPA. In some areas of eastern Wyoming, the Wasatch Formation has two conglomeratic members. From the base, they are the Kingsbury conglomerate and the Moncrief (Love and Christiansen 1985; Love et al 1993).

Paleontological Potential of the CCPA – Fossils from Equivalent Rocks

Outside the CCPA, the Wasatch Formation of Wyoming has yielded an abundance of diverse vertebrate fossils. The University of Wyoming Geological Museum online collection summaries show vertebrate fossils in the early Eocene Wasatch Formation in Fossil Basin (southwest Wyoming) and in the Table Rock area of the northern Washakie Basin (south-central Wyoming), mammals in the Great Divide Basin (west-central Wyoming), and birds from the Bird Quarry in the northeastern Green River Basin (University of Wyoming 2014a).

Specific reports detail the occurrence of mammals, birds, fish, and reptiles in the Wasatch Formation, from southwestern to central Wyoming, and north of the Rock Springs Uplift to south-central Wyoming (Roehler 1991); lizards from southeastern Wyoming (Caldwell 2003; Gauthier 1982); mammals, birds, salamander tracks, and fish from the Green River Basin (Foster 2001; Robinson et al. 2004); and diverse species of mammals as well as reptiles from the Fossil Butte National Monument in western Wyoming (Gunnell et al. 2002).

North of the CCPA, the Wasatch in the Powder River Basin of Wyoming has yielded mammal fossils that include multituberculates, marsupials, insectivores, primates, rodents, carnivores, and horses (Delson 1971) (Robinson and Ivy 1994; Robinson and Williams 1997).

3.8.4.5 Fort Union Formation

Geological Description

In eastern Wyoming, the Fort Union Formation (Tfl and Tft) consists of light gray to yellowish brown sandstone, light gray siltstone, mudstone, gray to black carbonaceous shale, and thin coals. Most areas underlain by the Fort Union Formation are mantled with soils and residuum and/or exhibit baked or clinker outcrops in red “scoria” hills (Love and Christiansen 1985; Reheis and Coates 1987). The Fort Union Formation unconformably overlies the Lance Formation and is unconformably overlain by the Wasatch Formation. In the Powder River Basin, it has three members, Tullock, Lebo, and Tongue River, in ascending order (Love and Christiansen 1985; Love et al. 1993).

Paleontological Potential of the CCPA – Fossils from Equivalent Rocks

The University of Wyoming Geological Museum online collection summaries show Fort Union Formation vertebrate fossils only outside the Powder River Basin of Wyoming. Fort Union Formation mammals have been collected from the southern and southwestern Bighorn and eastern Washakie Basins and the eastern Rock Springs uplift. Fort Union Formation vertebrates also have been reported from the Bison and the northern Wind River basins (University of Wyoming 2014b).

No published vertebrate fossil records from the Fort Union Formation in the CCPA have been found. Beyond the Powder River Basin, the Fort Union Formation of Wyoming has yielded bird tracks (Mustoe 2002); mammals in Carbon County (Rigby 1980) and the Carbon Basin (Secord 1998); lizards, amphibians, turtles, and fish in the Big Horn Basin (Estes 1975); and mammals in the Rock Springs Uplift area (Winterfeld 1982).

3.8.4.6 Lance/Hell Creek Formation

Geological Description

In the CCPA, the Late Cretaceous Lance/Hell Creek Formation is composed of brown and gray sandstone and shale, with thin coals and dark shale beds (Love and Christiansen 1985). It conformably overlies the Fox Hills Sandstone and partially unconformably underlies the Fort Union Formation (Love et al. 1993).

Paleontological Potential of the CCPA – Fossils from Equivalent Rocks

Most vertebrate fossils from the Lance Formation are from the type locality in Niobrara County, east of the CCPA. Fossils include dinosaurs reptiles, amphibians, mammals, birds, and fish (Dalman 2013; Donohue et al. 2013; Elzanowski et al. 2000; Encyclopedia Britannica, no date; Estes 1964; Estes and Sanchíz 1982; Forster 1996). The Alkali Divide Paleontological Special Interest Area in the TBNG has yielded fossils from not only the animals described above, but also triceratops, shark teeth, coprolite, and stingray teeth.

3.8.4.7 Paleontological Resources in the CCPA

A rich and diverse assemblage of vertebrate fossils has been uncovered in Converse County from the White River Formation in the Douglas area. They include mammals, reptiles, birds (Cavigelli 2014), and fish (Sundell 2001). Both large and small mammals have been found.

Online listings of the University of California, Berkeley Museum for this area show 76 vertebrate specimens, mostly Oligocene mammals from localities near Douglas and Orin Junction (University of California Berkeley Museum 2014b). Eastern museums, including the Smithsonian, have collected from this area of the White River Formation for a century, and the University of Wyoming also has large holdings of White River Formation vertebrates. In addition, approximately 250 skulls a year are collected commercially from this area (Cavigelli 2014; Sundell 2014).

Northeast of Douglas, Wyoming Miocene outcrops (undifferentiated formations) have produced a few vertebrate fossils (Cavigelli 2014).

The large number of known localities demonstrates the paleontological importance of the CCPA. Current data reveal that fossils are found primarily in badland or residuum topography (i.e., exposures of eroded and incised mudstone and small sandstone units involving primarily the White River***, Wasatch, Fort Union,*** and Lance formations). Conversely, relatively undissected areas within the CCPA are unlikely to yield fossils because of alluvium and grasslands cover (Sundell 2014)***, however paleontological resources may still be encountered***.

3.9 Range Resources

Approximately 61 percent (***914,382*** acres) of the CCPA consists of grazing allotments that encompass privately owned lands in addition to state and federally managed public lands (**Figure 3.9-1**). Approximately 10 percent (***88,808*** acres) of this acreage is ***on*** BLM-administered land, 7 percent (***63,768*** acres) is USFS-administered land, 7 percent (65,050 acres) is state owned land, and 76 percent (***696,756*** acres) is privately owned land and/or open water. Grazing within these allotments is by cattle, sheep, and wildlife (elk, mule deer, and pronghorn).

3.9.1 Overview

The CCPA consists of 1,502,381 acres and includes, fully or in part, ***90*** grazing allotments. Of these, ***69*** allotments are administered by the BLM providing approximately ***19,229 federally permitted*** AUMs, and 21 allotments (also referred to range management units by the USFS) are administered by the USFS providing approximately 26,862 ***federally permitted*** AUMs within the TBNG (**Table 3.9-1**). ***An AUM as defined under 43 CFR 4100.0-5 (10-01-05 Ed.) means the amount of forage necessary for the sustenance of one cow or its equivalent for a period of 1 month*****.” *Federally permitted AUMs are those that take into account the federal surface acreage only and do not account for AUMs that may occur on private surface.***

The following statutes, regulations, and orders authorize or are relevant to BLM's grazing administration program:

- The Taylor Grazing Act of 1934.
- The Federal Land Policy and Management Act of 1976.
- The Public Rangelands Improvement Act of 1978.
- EOs 10046 of March 24, 1949; 10175 of October 25, 1950; 10234 of April 23, 1951; 10322 of January 26, 1952; 10787 of November 6, 1958; and 10890 of October 27, 1960. These EOs transferred land acquired under the Bankhead-Jones Farm Tenant Act, 7 USC1010, to the Secretary of the Interior for administration under the Taylor Grazing Act. EO 12548 of February 14, 1986 indefinitely extended the PRIA grazing fee formula.
- The Oregon and California Railroad Grant Land Act of 1937, 43 USC 1181d.
- Other public land orders, EOs, or agreements that relate to the Secretary of the Interior's authority to administer livestock grazing on specified lands.

Furthermore, the BLM-administered allotments are managed to permit livestock grazing in accordance with the 2007 Casper RMP and the Standards for Healthy Rangelands and Guidelines for Livestock Grazing Management for Public Lands Administered by the BLM in the State of Wyoming (BLM 1997).The USFS-administered ***range management units*** are managed in accordance with the Granger-Thye Act of 1950, the National Forest Management Act of 1976, Forest Service Manual 2200, the 2002 TBNG LRMP, and the Thunder Basin Grazing Association Grazing Agreement #TBGA-2012.

Under the 1997 Wyoming Standards and Guidelines for Livestock Grazing Management, the BLM is responsible for achieving the following four fundamentals of rangeland health on public lands (BLM 1997):

- Watersheds are functioning properly. This requires adequate soil stability, water infiltration, optimal plant growth, and minimal surface water runoff.
- Water, nutrients, and energy are cycling properly. Riparian and wetland vegetation need to display structural, age, and species diversity as well as adequate resiliency to human disturbance, the ability to provide forage and ground cover, dissipate energy, and provide for groundwater recharge.

- Water quality meets State of Wyoming standards. All actions authorized by the BLM that affect chemical, physical, or biological characteristics will comply with federal and state water quality rules and regulations.
- Protection of special status species habitat. Rangeland conditions are capable of sustaining viable and diverse populations of native plant and animal species and providing habitat to support threatened and endangered species, special status species, and species of concern.

The Casper RMP and ROD establishes the objectives for managing livestock grazing on BLM-administered lands. Through these objectives, the BLM is committed to avoiding a net loss of AUMs whenever possible and to identifying and implementing opportunities to improve vegetation and increase AUMs available to livestock grazing operations. Additionally, the Casper RMP requires an adequate supply of forage vegetation be available for livestock grazing and encourages the conversion of suitable abandoned oil and gas wells to water wells in areas that have a need based on livestock or wildlife activity (BLM 2007b).

3.9.2 Existing Conditions

3.9.2.1 BLM Allotments

Livestock operators graze cattle and sheep throughout the CCPA on the ***69*** BLM-administered grazing allotments (**Table 3.9-1**). These BLM allotments provide for a total of ***19,229 federally permitted*** AUMs for cattle and sheep. Operators typically are permitted to graze livestock year-round on the BLM portion of the allotments; however, 10 of the ***69*** allotments do have seasonal timing restrictions for grazing.

Management Categories

Depending on overall rangeland health, the BLM manages allotments at different levels of intensity per three management categories as follows (BLM 2008g):

- Improve (I) Category – Monitoring will be required for allotments that do not meet rangeland health standards. Rangeland health evaluations will be completed prior to processing authorizations to determine if the allotment meets or does not meet rangeland health standards. If the allotment does not meet rangeland health standards, causal factor(s) will be identified, and a proposed action and alternatives will be developed to comply with NEPA.
- Maintain (M) Category – Rangeland health evaluations will need to be conducted, if not already completed, and monitoring may be required to detect changes in rangeland health. NEPA analysis may be required to process authorizations for livestock grazing.
- Custodial (C) Category – Grazing authorizations will be processed using existing information. Rangeland health evaluations will only be required in the case of fire or drought events or if first (category I) or second (category M) priority work has caused a change in overall rangeland health.

Of the ***69*** BLM-managed allotments, 9 are designated under the Improve category, and the remaining ***60*** are designated as Custodial. Within the CCPA, the greatest threats to livestock grazing operations is the loss of forage vegetation due to oil and gas and other forms of development as well as infestations of noxious weeds and invasive plant species.

Rangeland Improvements

Rangeland improvements can include fencing, cattle guards, water tanks and wells, reservoirs, and vegetation manipulations (e.g., seedings and prescribed burns). The BLM typically documents water improvements; however, not all improvements are documented. Thirty-seven water improvement projects have been documented on BLM allotments within the CCPA (**Table 3.9-2**). Livestock fencing is prevalent throughout the CCPA.

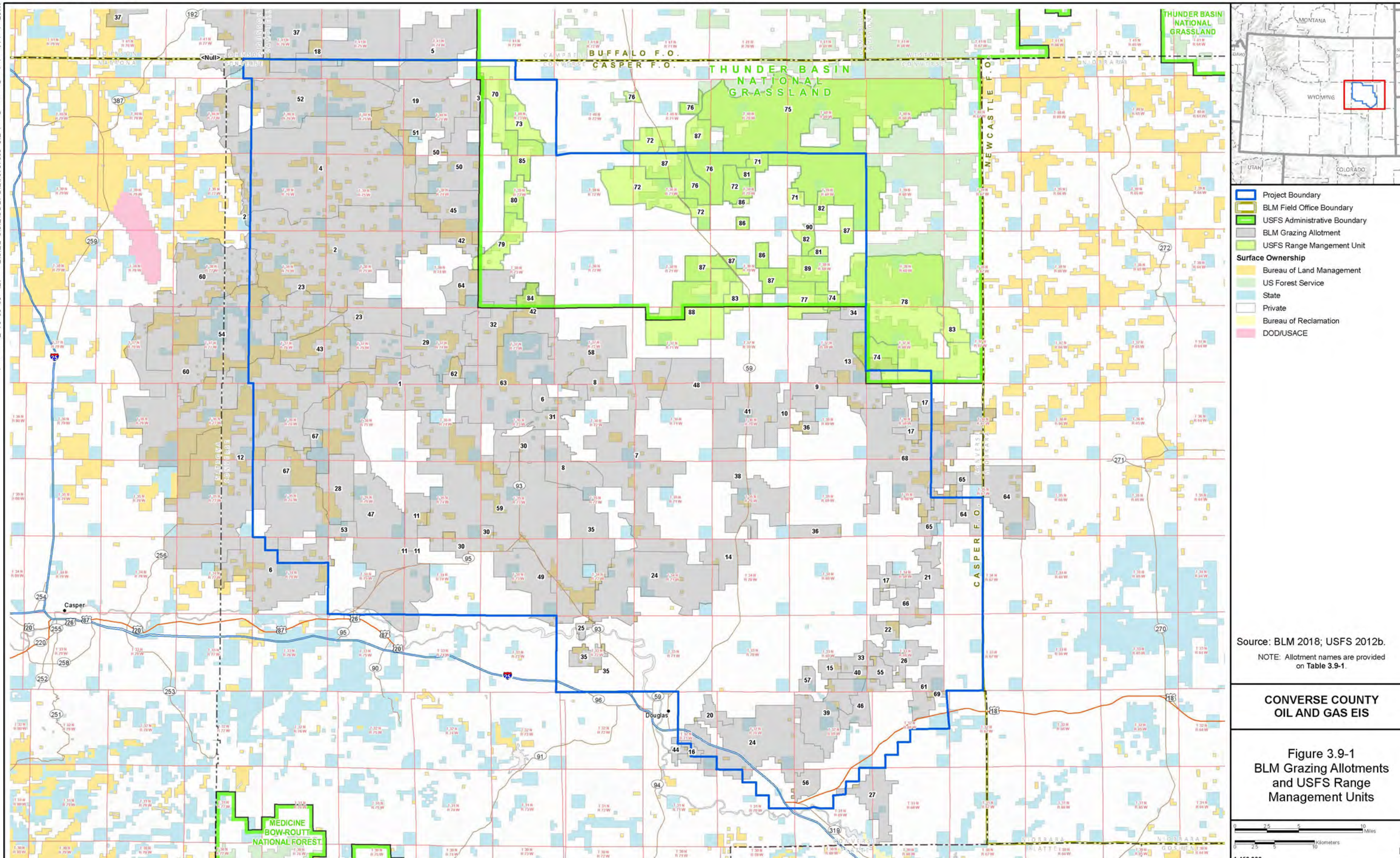

Figure 3.9-1
BLM Grazing Allotments and USFS Range Management Units

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Table 3.9-1 BLM Grazing Allotments and USFS Range Management Units Intersecting the CCPA

Allotment Name[1]	Total Acreage	Acres within CCPA	Percent in CCPA	Total Federal Acres	Federal Acres in CCPA	Percent of Federal Acres within CCPA	Total Federally Permitted AUMs	Federally Permitted AUMs within the CCPA
BLM Grazing Allotments								
1-55 Ranch	15,301	15,301	100	3,138	3,138	100	863	863
2-Allemand	53,458	52,990	99	8,151	8,151	100	1,976	1,976
3-Antelope Creek	2,630	2,630	100	118	118	100	18	18
4-Antelope Creek 2	58,374	53,357	91	5,368	4,514	84	1,097	921
5-Bates Creek[2]	22,490	6,263	28	81	41	51	12	6
6-Boner	24,899	6,377	26	3,948	495	13	12	2
7-Bowman Draw	32,179	32,179	100	2,714	2,714	100	579	579
8-Box Creek	12,041	12,041	100	306	306	100	72	72
9-Box Creek 2	4,527	4,527	100	81	81	100	8	8
10-Box Creek 3	4,800	4,800	100	83	83	100	24	24
11-Coates 2	4,224	4,224	100	484	484	100	79	79
12-Cole Creek	66,832	25,226	38	19,277	6,026	31	933	289
13-Colter Draw	18,040	16,639	92	2,237	2,158	96	163	156
14-Converse 1	6,242	6,242	100	116	116	100	30	30
15-Converse 3	1,687	1,687	100	161	161	100	36	36
16-Converse 5	1,435	520	36	45	0	0	4	0
17-Cottonwood Creek 2	6,756	5,668	84	1,161	556	48	121	58
18-Crawford Draw[2]	50,092	5,008	10	4,051	373	9	780	70
19-Death Call Draw	15,998	15,998	100	2,680	2,680	100	764	764
20-East Antelope Creek	2,188	2,188	100	41	41	100	8	8
21-East Fork Twentymile	3,242	3,242	100	41	41	100	5	5
22-Etchemendy	2,114	2,114	100	483	483	100	48	48
23-Farnsworth Draw	16,745	16,745	100	1,920	1,920	100	478	478

Table 3.9-1 BLM Grazing Allotments and USFS Range Management Units Intersecting the CCPA

Allotment Name[1]	Total Acreage	Acres within CCPA	Percent in CCPA	Total Federal Acres	Federal Acres in CCPA	Percent of Federal Acres within CCPA	Total Federally Permitted AUMs	Federally Permitted AUMs within the CCPA
24-Fetterman Creek	48,617	46,799	96	1,081	1,081	100	244	244
25-Fetterman Creek 2	751	751	100	83	83	100	19	19
26-Flat Top	3,730	3,730	100	81	81	100	8	8
27-Grey Hills	6,901	232	3	83	0	0	18	0
28-Henrie	7,977	7,977	100	1,440	1,440	100	121	121
29-Henry	21,859	21,859	100	2,161	2,161	100	822	822
30-Highland Flats	9,465	9,465	100	752	752	100	174	174
31-Highland Flats 2	5,394	5,394	100	245	245	100	47	47
32-Hornbuckle	13,527	13,527	100	1,273	1,273	100	375	375
33-Horner	2,611	2,611	100	82	82	100	13	13
34-Horse Creek	1,291	1,291	100	41	41	100	10	10
35-La Prele Creek 4	17,126	13,700	80	1,493	1,177	79	209	165
36-Lightning Creek	3,736	3,736	100	569	560	98	166	163
37-Linch[2]	74,444	1,317	2	1,553	<1	0	173	0
38-Little Lightning Creek	14,276	14,276	100	232	232	100	48	48
39-Middle Fork Shawnee Creek	10,689	10,689	100	436	436	100	96	96
40-Middle Fork Shawnee Creek 2	1,040	1,040	100	160	160	100	35	35
41-Mikes Draw	12,573	12,573	100	433	433	100	87	87
42-Monument Hill	9,646	9,646	100	3,094	3,094	100	656	656
43-North Fork	10,308	10,308	100	4,865	4,865	100	637	637
44-North Platte 4	960	46	5	37	0	0	6	0
45-North Stinking Water Creek	8,552	8,552	100	2,883	2,883	100	877	877

Table 3.9-1 BLM Grazing Allotments and USFS Range Management Units Intersecting the CCPA

Allotment Name[1]	Total Acreage	Acres within CCPA	Percent in CCPA	Total Federal Acres	Federal Acres in CCPA	Percent of Federal Acres within CCPA	Total Federally Permitted AUMs	Federally Permitted AUMs within the CCPA
46-Park	4,005	4,005	100	159	159	100	35	35
47-Red Butte	45,454	43,607	96	4,109	4,109	100	382	382
48-Rice Reservoir	12,411	12,411	100	146	146	100	32	32
49-Sage Creek	10,569	9,963	94	160	85	53	7	4
50-Sand Creek	12,370	12,370	100	717	717	100	216	216
51-Sandy Draw	2,542	2,542	100	1,021	1,021	100	322	322
52-Sawmill Canyon	33,197	25,576	77	3,420	2,493	73	714	521
53-Seidel	1,757	1,757	100	77	77	100	13	13
54-Seven L	54,626	6,692	12	16,526	3,248	20	570	114
55-Shawnee Creek	2,133	2,133	100	163	163	100	16	16
56-Shawnee Creek 2	2,575	2,575	100	81	81	100	10	10
57-Simpson Draw	1,444	1,444	100	41	41	100	5	5
58-Skunk Creek	11,134	11,134	100	334	334	100	82	82
59-Smith	62,618	62,618	100	8,868	8,868	100	1,518	1,518
60-Staple Three	32,651	995	3	5,190	201	4	40	2
61-Stark	4,936	4,936	100	41	41	100	6	6
62-Turner Divide	1,551	1,551	100	768	768	100	72	72
63-Turner Flats	24,377	24,377	100	2,079	2,079	100	607	607
64-Twentymile Creek	19,413	7,308	38	2,841	1,385	49	250	123
65-Twentymile Creek 2	6,247	5,102	82	653	318	49	93	46
66-Twentymile Creek 3	4,534	4,534	100	327	327	100	42	42
67-Valentine	20,905	20,905	100	4,083	4,083	100	911	911

Table 3.9-1 BLM Grazing Allotments and USFS Range Management Units Intersecting the CCPA

Allotment Name[1]	Total Acreage	Acres within CCPA	Percent in CCPA	Total Federal Acres	Federal Acres in CCPA	Percent of Federal Acres within CCPA	Total Federally Permitted AUMs	Federally Permitted AUMs within the CCPA
68-Walker Creek	32,988	22,839	69	4,673	2,188	47	316	149
69-Watkins Draw	472	470	100	115	115	100	19	19
BLM Total[3]	1,116,674	787,327	71	136,345	88,808		19,229	16,333
USFS Range Management Units								
70-Bell	7,318	7,318	100	1,927	1,927	100	528	528
71-Betty Don	2,385	2,385	100	1,157	1,157	100	241	241
72-Calamity Gulch	18,700	14,958	80	5,024	4,544	90	442	398
73-Dilts	3,658	3,658	100	78	78	100	18	18
74-Downs	7,509	4,003	53	4,089	1,858	45	919	414
75-Fiddleback	70,765	15,491	22	62,777	14,178	23	10,727	2,467
76-Jacobs	10,251	8,619	84	9,687	8,582	89	1,333	1,186
77-Johnson	4,567	4,567	100	1,981	1,981	100	543	543
78-Ketelson	43,211	7,384	17	20,129	2,146	11	3,113	342
79-Manning	5,084	5,084	100	1,717	1,717	100	520	520
80-North Baker	2,834	2,834	100	932	932	100	264	264
81-Pellatz	1,703	1,703	100	1,179	1,179	100	264	264
82-Reed	3,352	3,352	100	2,229	2,229	100	572	572
83-Sheldon Draw	4,991	2,153	43	125	80	64	23	15
84-South Baker	2,574	2,574	100	944	944	100	261	261
85-Spracklen	3,258	3,258	100	2,435	2,435	100	728	728
86-Steinle	2,381	2,381	100	1,997	1,997	100	538	538
87-Stoddard	17,615	13,622	77	10,124	8,738	86	3,896	3,351
88-Tillard	17,451	17,451	100	4,424	4,424	100	1,280	1,280

Table 3.9-1 BLM Grazing Allotments and USFS Range Management Units Intersecting the CCPA

Allotment Name[1]	Total Acreage	Acres within CCPA	Percent in CCPA	Total Federal Acres	Federal Acres in CCPA	Percent of Federal Acres within CCPA	Total Federally Permitted AUMs	Federally Permitted AUMs within the CCPA
89-Weiss	4,032	4,032	100	2,479	2,479	100	562	562
90-Wild Bill	230	230	100	165	165	100	90	90
USFS Total[3]	233,867	127,055	54	135,598	63,768		26,862	14,582

[1] Numbers preceding the allotment names are the reference numbers for Figure 3.9-1.

[2] Allotment administered by the BLM Buffalo Field Office.

[3] Minor discrepancies may be due to rounding.

Source: BLM 2018, 2014d; USFS 2016.

Table 3.9-2 Water Developments on BLM *Grazing* Allotments

Allotment Name	Reservoirs	Springs	Water Wells
Allemand	-	-	1
Boner	-	-	1
Coates 2	1	-	-
Cole Creek	1	-	5
Henrie	1	-	-
Henry	-	-	1
Lightning Creek	-	-	1
Miles Draw	-	-	1
North Fork	-	-	1
North Stinking Water Creek	1	-	2
Sandy Draw	-	1	-
Seven L	7	-	-
Smith	-	-	2
Staple Three	1	-	1
Turner Flats	1	2	-
Twentymile Creek	1	-	1
Valentine	3	-	-
Total	**17**	**3**	**17**

Source: BLM 2014d.

3.9.2.2 USFS Range Management Units

Livestock operators graze cattle within the CCPA on 21 USFS range management units (**Table 3.9-1**). These USFS units provide for a total of 26,862 ***federally permitted*** AUMs. The TBNG LRMP (USFS 2002) and the Thunder Basin Grazing Association Grazing Agreement #TBGA-2012 include guidance and direction for livestock grazing management. LRMP standards and guidelines include ensuring healthy livestock, managing livestock to maintain or improve vegetation communities in and along riparian corridors, and providing adequate periods of rest within allotments.

Management Categories

The CCPA overlaps with two geographic areas identified within the TBNG LRMP, Highlight Bill and Broken Hills. The Highlight Bill geographic area contains approximately 38,000 acres and is managed as rangeland with broad resource emphasis. This allows for low to high levels of livestock developments, rangeland improvements, and vegetation manipulation, and most authorizations are for year-round grazing (USFS 2002). The Broken Hills geographic area contains approximately 26,000 acres and is managed as rangelands with diverse natural-appearing landscapes. ***Within this area, primitive conditions with minimal facility development is emphasized. Mineral development, such as oil and gas wells and pipelines, can be present but visually subordinate to the landscape in the mid- and background. Pastures are large (USFS 2001).***

Within both the Highlight Bill and Broken Hills geographic areas, the TBNG LRMP states the directive of resting one to ten percent of the rangeland annually for the purpose of meeting goals set for the management of fish, wildlife, and vegetation (USFS 2002). The LRMP also establishes goals for managing vegetation by setting objectives for structural and seral stage desired conditions of existing vegetation communities. Based on inventoried pastures within the TBNG, approximately 75 percent of the vegetation communities in the CCPA qualify as early to late-intermediate seral structure. Threats to livestock grazing operations on USFS ***range management units*** are the same as those described for grazing allotments administered by the BLM.

Rangeland Improvements

Rangeland improvements on USFS ***range management units*** include a combination of 58 known water developments including improvements to artesian springs as well as construction of dams, water wells, and windmills. Most of these are within the Highlight Bill geographic area where management goals are more conducive to improvement projects. **Table 3.9-3** lists the existing water developments within USFS ***range management units***.

Table 3.9-3 Water Developments within USFS *Range Management Units*

***Unit* Name**	**Artesian Wells**	**Dams**	**Wells**	**Windmills**
Bell	-	1	-	-
Calamity Gulch	-	2	-	-
Fiddleback	3	24	1	5
Jacobs	4	10	-	3
Spracklen	3	-	-	-
Steinle	-	-	-	1
Tillard	-	-	1	-
Total	**10**	**37**	**2**	**9**

Source: USFS 2014b. USFS TBNG Livestock Grazing Allotment Data.

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3.10 Recreation

The CCPA, the analysis area for recreation, offers a natural setting, which includes a variety of natural panoramic landscapes spanning from open prairies and sagebrush steppe communities to the Rochelle Hills and the enclosed landscapes found along the North Platte River. These landscapes provide a setting for a variety of outdoor recreational activities. The main recreational activities, self-reported in statewide surveys, available within the CCPA include scenic drives, visiting historical sites, wildlife watching, fishing, hunting, hiking or backpacking, camping, and horseback riding. Additional attractions include the TBNG and the historic Bozeman Trail as well as OHV use. Data for the number of hunters and their success rates were provided by the WGFD.

The Converse County Conservation District listed recreational opportunities as one of the most important natural resource priorities for the county. Survey results outlined in the Converse County Conservation District's Long Range and Natural RMP indicated that 30 percent of all respondents placed recreation and access for recreation among the most important issues faced by the community over the next decade.

These survey results are corroborated by increased recreational spending throughout Converse County, which has increased 7.2 percent since 2000, with the highest annual increase of 4.3 percent reported for 2013. The total amount of money spent on destination travel in Converse County has increased from 22.0 million dollars to 54.2 million dollars and accounts for all travel dollars spent during the 13-year period (Dean Runyan Associates 2014). Beyond the economic value, outdoor recreation opportunities provide improvement to the quality of life for those residents living in the vicinity of the CCPA. See Section 3.11.12 for a detailed discussion regarding non-market values.

3.10.1 BLM-administered Lands

In accordance with FLPMA, BLM manages public lands for multiple uses, including recreation. As detailed in the BLM Manual 8320 (BLM 2011f) and BLM Handbook H-8320-1 (BLM 2014f), BLM recreation management classifies land as Extensive Recreation Management Areas or as SRMAs. Guidance in BLM Manual 8320 establishes the commitment to incorporating the framework of outcome-focused management into the recreation management program. Outcome-focused management is a method of managing recreation that focuses on the positive outcomes from engaging in recreational experiences. This approach gives BLM a framework within which to manage recreation on public lands and provide outcomes that benefit individuals, communities, economies, and the environment. BLM Manual 8320, Planning for Recreation and Visitor Services (BLM 2011f) and BLM Handbook H-8320-1 (BLM 2014f) also provide policy, direction, and guidance on managing recreational resources as part of the land use planning process. Manual 8320 addresses the management of recreational settings to provide opportunities that allow visitors and local communities to achieve desired recreational benefits.

There are no backcountry byways or developed recreation sites within the CCPA. NHTs (including the Oregon, California, Mormon and Pony Express; see **Figure 3.2-1**) are managed as SRMAs in the CCPA to provide opportunities for visitors to view and study trail remains and to learn about the history of the area, to achieve a greater respect for cultural resources and better understanding of the pioneer experience. Other targeted benefits that may be derived by local communities include enhanced preservation of these trails and their settings, a sense of ownership and stewardship for cultural remains, and economic values linked to heritage tourism. Heritage tourism is defined as traveling to experience the places, artifacts, and activities that authentically represent the stories and people of the past (Federal Heritage Tourism Summit 2002). Heritage tourism includes commercial and noncommercial use along the NHTs and the Bozeman Trail.

BLM-administered land within the CCPA that is not managed as a SRMA or a special designation is managed as an Extensive Recreation Management Area, which is open to dispersed recreational use with minimal regulatory constraints; however, the RMP does include decisions that protect recreational values within the Sand Hills Management Area, the Bozeman Trail, and on BLM-administered lands along the North Platte River. The objectives set for the CFO Extensive Recreation Management Area include visitor health and safety, the reduction of user conflicts, and resource protection. These objectives are to be realized utilizing environmental education programs to increase awareness and create a sense of public stewardship. BLM's accessible acreage within the CCPA is 43,792 acres (state accessible acreage is unknown). Dispersed recreation on this acreage includes, but is not limited to, sightseeing, touring, photography, wildlife viewing, floating, mountain biking, camping, fishing, and hunting. Portions of the North Platte River also fall within the CCPA boundary. The majority of the recreational activities include big game hunting as well as boating and fishing along the North Platte River.

OHV use is a popular method of exploring public lands within the CCPA. It also provides access for non-motorized dispersed recreational use. Although exceptions do exist, OHV regulations apply to resource uses on public lands including non-recreational uses such as agricultural management activities, geo-physical exploration, silvicultural practices and numerous land management activities.

Legal OHV access in the CCPA is common despite marginal access due to the dispersed land pattern. The existing county road network and the WGFD Walk-In programs provide some access to these lands for recreational purposes. WGFD walk-in areas are not open for OHV access. Access to public lands also can be granted by private landowners who control access to much of the area.

The natural setting commonly associated with public lands enhances the quality of existing motorized and non-motorized recreational opportunities such as hunting, fishing, and driving for pleasure even in areas with minimal access.

Public lands may be designated as open, limited, or closed. The BLM OHV established designations are as follows:

- Open to OHV Use
- Limited to Designated Roads and Trails
- Limited to Existing Roads and Trails
- Closed to OHV Use

The majority of public lands in the CCPA are designated as limited to existing roads and trails. Furthermore, 996 acres, or 0.07 percent of the CCPA, has been designated as closed to OHV use. The Sand Hills Management Area totals 20,090 acres, of which 2,006 acres (10 percent) are located within the boundary of the CCPA (**Figure 3.5-1**). This acreage is designated as limited to designated roads and trails. Surface ownership within the Sand Hills Management Area primarily is administered by the BLM. While there is no legal or reasonable public access, the area is highly valued for its hunting opportunities. Access to public lands is granted almost exclusively by paid professional guide services. Within the management area, 28 miles of primitive roads are open to motorized use, 12 miles of primitive roads are limited to authorized use only, and 8 miles of existing travel routes are closed.

3.10.2 USFS-administered Lands

Recreation in the TBNG is managed by the USFS under Forest Planning Regulation 36 CFR 219.21 and the TBNG LRMP. Forest Planning Regulation 36 CFR 219.21 provides standards for the development and consideration of relevant social and economic information, analyses and range of uses, values, products, and services. This regulation further requires evaluation of resources using the Recreation Opportunity Spectrum and provides oversight for developed recreational facilities, OHV-use opportunities, and scenic integrity objectives.

There are no inventoried trails systems or developed campgrounds on USFS-administered lands within the CCPA, but opportunities for hiking, hunting, and camping exist. Mountain biking and warm-water fishing opportunities also are available, as is wildlife viewing, partly a consequence of the large concentration of golden eagles found in the region. Elk viewing and hunting provide additional recreational opportunities. Most of the recreation within the TBNG occurs in semi-primitive motorized areas.

On USFS-administered lands within the CCPA, the Recreation Opportunity Spectrum offers a framework for defining classes of recreational settings, opportunities and experiences. The majority of the USFS-administered land in the CCPA (91 percent) is designated as roaded natural, while the remainder is designated as rural (USFS 2014d). **Table 3.10-1** provides descriptions for each of these designations.

Table 3.10-1 Recreation Opportunity Spectrum Definitions

Designation	Definition
Roaded Natural	Characterized by predominately natural-appearing environments with moderate evidence of the sights and sounds of people. Such evidence usually is harmonious with the natural environment. Interaction between users may be moderate to high, with evidence of other users prevalent. Resource modification and utilization practices are evident but compatible with the natural environment. Conventional motorized use is allowed and incorporated into construction standards and design of facilities.
Rural	Rural areas are characterized by a natural environment that has been substantially modified by development of structures, vegetative manipulation, or pastoral agricultural development. Resource modification and utilization practices may be used to enhance specific recreational activities and to maintain vegetative cover and soils. Sights and sounds of humans are readily evident, and the interaction between users is often moderate to high. A considerable number of facilities are designed for use by a large number of people. Facilities are often provided for special activities. Moderate user densities are present away from developed sites. Facilities for intensified motorized use and parking are available.

Source: USFS 2014d.

3.10.3 Fishing and Boating Opportunities

The North Platte River provides multiple recreational activities within the CCPA. Approximately 22 miles of the North Platte River transect the CCPA. Common recreational activities include boating and fishing. Popular species of fish that provide recreational opportunities are trout, walleye, and catfish. The North Platte River transitions from cold water species such as trout to mainly warm water species such catfish near the town of Glenrock. Approximately 4 miles of the North Platte River within the CCPA have been designated as a blue ribbon stream and portions of LaPrele Creek have been designated as a red ribbon stream. Streams that are designated as blue ribbon support at least 600 pounds of sport fish per mile and those designated as red ribbon streams support between 300 and 600 pounds of sport fish per mile (WGFD 2006). There are no developed landing sites or WGFD access areas within the CCPA; however, there are numerous landing sites and access areas both upstream and downstream from the CCPA that allow recreational access to North Platte waters that flow through the CCPA. The Bixby Public Access Area is a designated recreation area within the cumulative impact study area (CISA) just outside of the CCPA along the North Platte River (**Figure 3.5-4**). The WGFD did not have estimates of recreational use along the North Platte within or near the CCPA (WGFD 2015a).

3.10.4 Big Game and Small Game Hunting

Hunting throughout the CCPA on federal, state, and private lands is common for mule deer, pronghorn, and to a lesser extent, elk. Some private landowners in the CCPA receive supplemental income from providing hunting and fishing opportunities. In 2001, following evaluation as a trial project, the Walk-in Area program was implemented as a permanent program by the WGFD. The Walk-in Area program allows the WGFD to assist landowners who support wildlife and maintain public hunting and fishing opportunities. The WGFD leases hunting or fishing rights on private land tracts. Participating landowners receive monetary compensation based on the size of the tract of land enrolled in the program. There are Walk-in Area access properties within the CCPA (AECOM 2012a).

Commercial big game outfitting provides another source of supplementary income to many of the local ranchers. Many private landowners have entered into agreements with professional guide services or have established their own business. Qualified professional outfitters are licensed and granted the right to utilize Wyoming State Lands by the Wyoming Board of Outfitters and Professional Guides. All licensed Big Game Outfitters are eligible to apply for Special Recreation Permits granted by the BLM or Special Use Permits by the USFS that authorize the permit holders to conduct business on federal lands. Management objectives for these types of activities are defined in the land use planning documents and include increased public access to federal lands for recreationalists. Revenues collected from Special Recreation Permit fees are maintained at the field office level and are used to enhance public recreation opportunities. There were 18 commercial outfitters authorized to operate in CCPA as of June 2016. The majority of these outfitters are located on private ranches and guide antelope hunts on federal and private lands.

Prior to 2011, the WGFD observed a trend toward a reduction in private land available for public hunting (AECOM 2012a). No detailed analysis was conducted, but the decline was noted in the numbers of deer and pronghorn licenses unsold or still available after the license draw. Also, a reduction in the mule deer population may have caused landowners and outfitters to reduce the numbers of hunters on private guided hunts to ensure good success rates. At that time, the WGFD reduced out-of-state deer licenses to some degree in response to the mule deer decline (AECOM 2012a). Recent WGFD data suggests that declines in deer and pronghorn hunter and harvest numbers have stabilized and increased in most hunt areas.

The CCPA overlaps with seven pronghorn hunt areas, six mule deer hunt areas, and five elk hunt areas. The seven pronghorn hunt areas that transect the CCPA include the Bear Creek, Bill, Lance Creek, Laprele, Ormsby, Rawhide Butte, and Shawnee hunt areas (**Figure 3.10-1**). The Bear Creek hunt area overlaps a large portion of the western half of the CCPA, while the Shawnee hunt area overlaps approximately the eastern third of the CCPA. The remaining 5 units overlap with smaller portions along the edges of the CCPA.

Table 3.10-2 provides pronghorn hunting statistics from 2009 through 2016. The number of hunters in the Bear Creek hunt area rose to a peak in 2011 before declining in 2016 to levels 55 percent lower than those reported in 2009. However, in the Shawnee hunt area, the number of hunters and subsequent pronghorn harvest rose dramatically from 2009 to 2010 before declining sharply to 2013 levels that were 45 percent lower than those in 2009. Hunter and harvest numbers have rebounded since 2013.

The six mule deer hunt areas transected by the CCPA include the Douglas, Lusk, Rochelle Hills, South Converse, Southeast Wyoming, and Twenty Mile hunt areas (**Figure 3.10-2**). The Douglas hunt area lies within a large portion of the western half of the CCPA, while the Rochelle Hills and Twenty Mile hunt areas are within the northeastern portion and the southeastern portion of the CCPA, respectively. The remaining three units overlap with smaller portions along the eastern and southern edges of the CCPA.

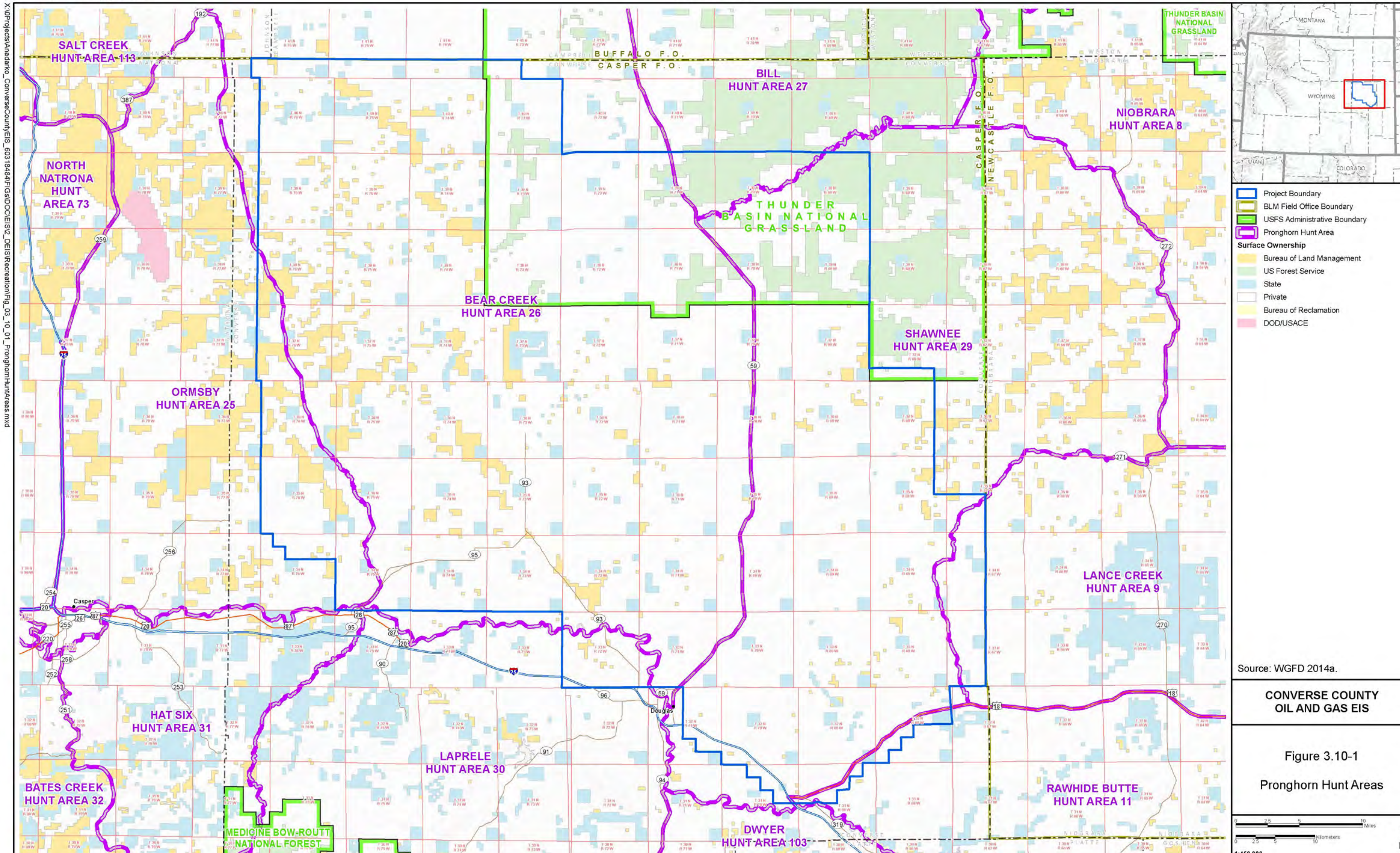

Figure 3.10-1

Pronghorn Hunt Areas

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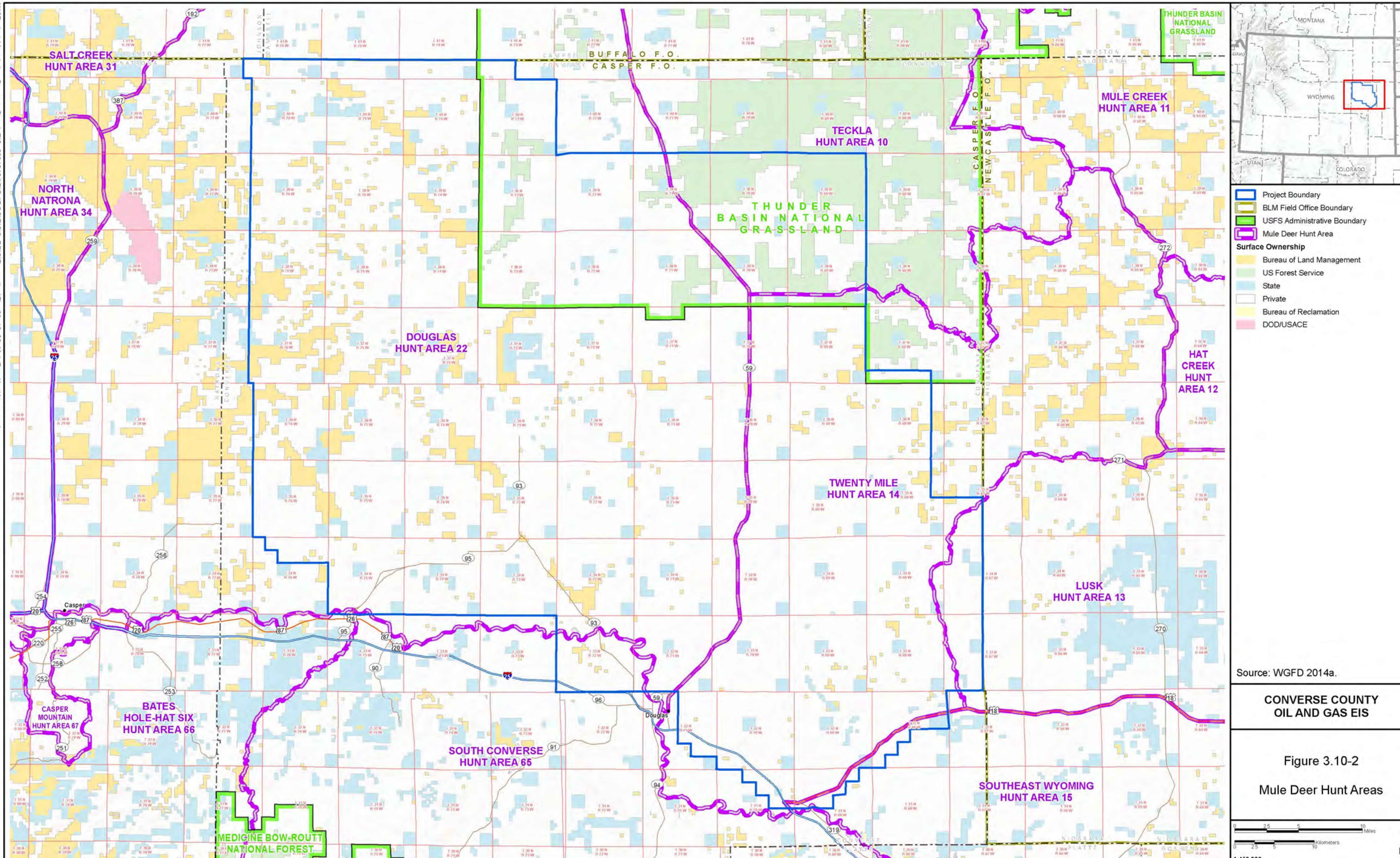

CONVERSE COUNTY OIL AND GAS EIS

Figure 3.10-2

Mule Deer Hunt Areas

Table 3.10-2 Pronghorn Hunting Statistics

Game Management Area/Year	Total Pronghorn Harvest	Total Hunters	Hunter Days/Harvest
Bear Creek (Hunt Area 26)			
2016	901	868	2.2
2015	984	1,062	4.8
2014	989	1,103	3.2
2013	1,463	1,663	3.3
2012	2,039	2,385	3.5
2011	2,235	2,444	3.6
2010	2,149	2,295	3.4
2009	1,798	1,938	3.6
Shawnee (Hunt Area 29)			
2016	676	683	3.1
2015	494	533	4.0
2014	297	627	4.7
2013	762	588	3.9
2012	1,110	1,272	3.9
2011	1,423	1,637	3.9
2010	1,846	2,042	3.9
2009	1,033	1,069	3.6

Source: WGFD 2017e.

As detailed in **Table 3.10-3**, mule deer hunter and harvest numbers began to show consistent declines in the Douglas, Rochelle Hills, and Twenty Mile hunt areas starting around 2011 and 2012. The most dramatic decrease was observed in the Douglas hunt area where harvest numbers decreased 80 percent from 2009 to 2015; however, recent data suggests that hunter and harvest numbers are rising through all three hunt areas. The five elk hunt areas that transect the CCPA include the Laramie Peaks, Lost Springs, Pine Ridge, Rawhide, and Rochelle Hills areas (**Figure 3.10-3**). The Lost Springs area occupies a large portion of the central and southeastern portion of the CCPA. The Pine Ridge area overlaps with the western third of the CCPA and the Rochelle Hills area is located in the northeast corner. The remaining two units overlap with smaller areas along the southern portion of the CCPA.

Table 3.10-4 shows elk hunting statistics from 2009 through 2016. Hunter numbers have steadily increased in the Pine Ridge hunt area, while declining in the Lost Springs hunt area during the 2009 to 2013 timeframe. Hunter numbers have rebounded from 2014 to 2016. The number of hunters in the Rochelle Hills hunt area peaked in 2012 before declining substantially in 2013 to levels relatively consistent with 2009; however, data from 2014 to 2016 details increases in both harvest and hunter numbers.

Table 3.10-3 Mule Deer Hunting Statistics

Game Management Area/Year	Total Mule Deer Harvest	Total Hunters	Hunter Days/Harvest
Douglas (Hunt Area 22)			
2016	213	247	4.0
2015	174	246	4.6
2014	254	359	5.1
2013	323	491	6.9
2012	451	546	4.5
2011	838	655	5.2
2010	820	969	4.6
2009	890	1,004	4.2
Rochelle Hills (Hunt Area 10)			
2016	63	85	4.8
2015	63	88	4.5
2014	103	275	9.4
2013	120	384	14.9
2012	123	343	9.5
2011	168	380	8.5
2010	154	372	8.8
2009[1]	191	376	6.1
Twenty Mile (Hunt Area 14)			
2016	180	281	6.9
2015	117	194	6.1
2014	145	254	7.3
2013	135	280	7.5
2012	227	360	6.4
2011	245	469	8.3
2010	154	372	8.8
2009	414	549	5.3

[1] Includes Dull Center Hunt Area.

Source: WGFD 2017e.

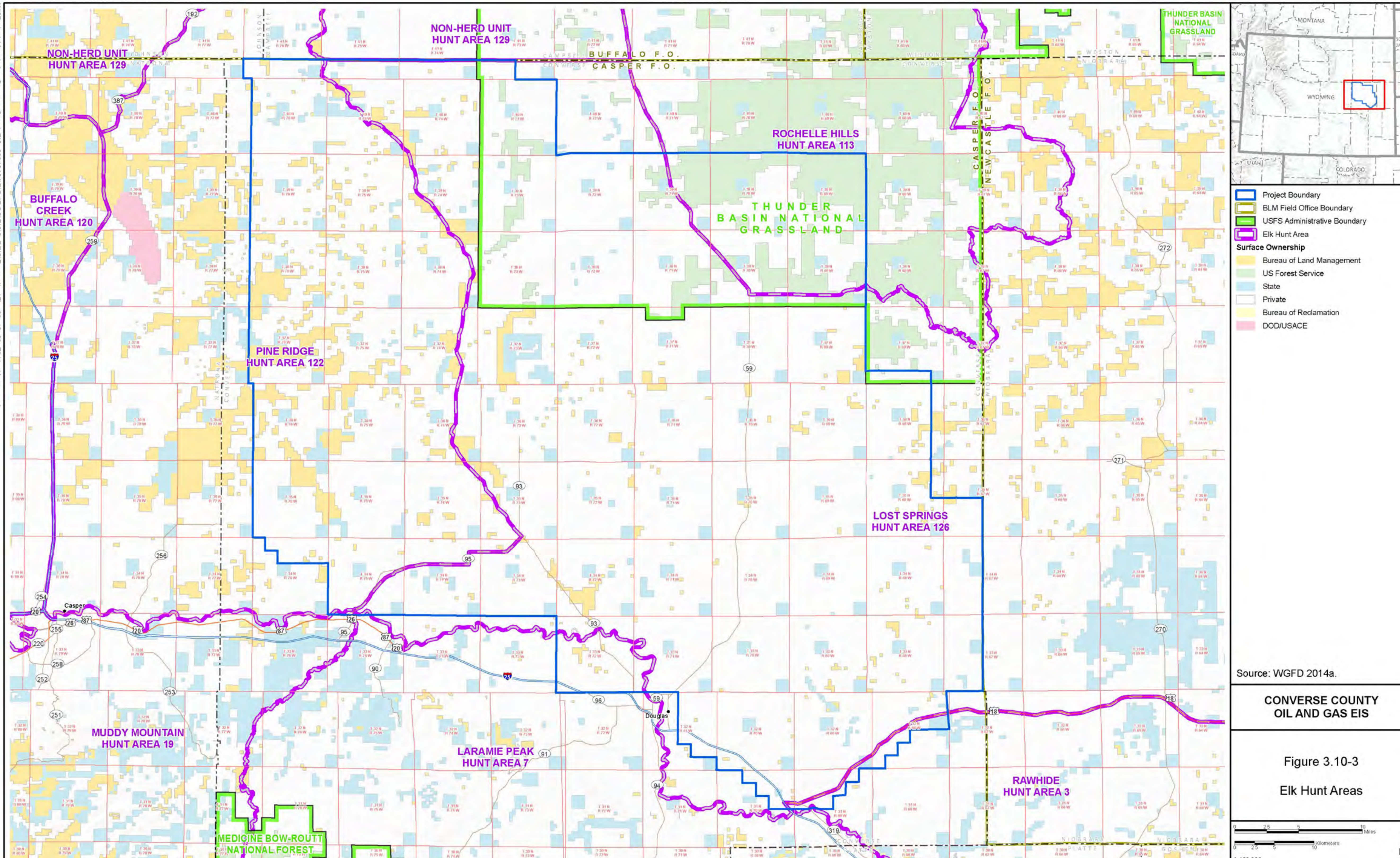

Figure 3.10-3

Elk Hunt Areas

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Table 3.10-4 Elk Hunting Statistics

Game Management Area/Year	Total Elk Harvest	Total Hunters	Hunter Days/Harvest
Lost Springs (Hunt Area 126)			
2016	114	335	18.2
2015	119	290	11.5
2014	88	321	17.7
2013	58	170	19.3
2012	76	190	17.6
2011	76	221	16.9
2010	197	43	31.9
2009	347	1,124	20.0
Pine Ridge (Hunt Area 743)			
2016	126	143	4.2
2015	113	134	4.4
2014	107	136	5.9
2013	95	126	6.3
2012	51	71	6.9
2011	50	64	5.7
2010	45	71	10.0
2009	40	56	6.3
Rochelle Hills (Hunt Area 344)			
2016	49	52	2.2
2015	143	167	5.2
2014	75	98	9.6
2013	21	23	3.0
2012	65	89	6.0
2011	52	71	5.4
2010	66	72	5.4
2009	24	25	12.4

Source: WGFD 2017e.

Small game and upland birds also are commonly hunted within the CCPA. The CCPA is almost entirely within Management Area 3 (**Figure 3.10-4**). The most commonly hunted species within Management Area 3, as determined by harvest totals, are pheasant, mourning dove, gray partridge, sharp-tailed grouse, and blue grouse. Other species hunted within Management Area 3 include chukar, gray partridge, cottontail rabbit, snowshoe hare, and squirrel. The number of hunters of small game and upland birds has remained mostly static, with the exception of a sharp decline in 2013. Hunter numbers rebounded in 2014 and 2015. **Table 3.10-5** provides small game, upland game bird, and mourning dove hunting statistics from 2010 through 2013.

Table 3.10-5 Small Game, Upland Game Bird, and Mourning Dove Hunting Statistics

Management Area/Year	Total Harvest[1]	Total Hunters	Hunter Days/Harvest
Management Area 3			
2016[2]	NA	NA	NA
2015	28,050	4,895	1.6
2014	14,873	4,175	1.3
2013	14,455	3,993	1.1
2012	20,826	5,327	1.3
2011	21,191	5,554	1.2
2010	20,065	5,002	1.1

[1] Harvest totals also include pheasant, chukar, gray partridge, sharp-tailed grouse, ruffed grouse, blue grouse, cottontail rabbit, snowshoe hare, squirrel, and mourning dove.

[2] Data for 2016 not available.

Source: WGFD 2017e.

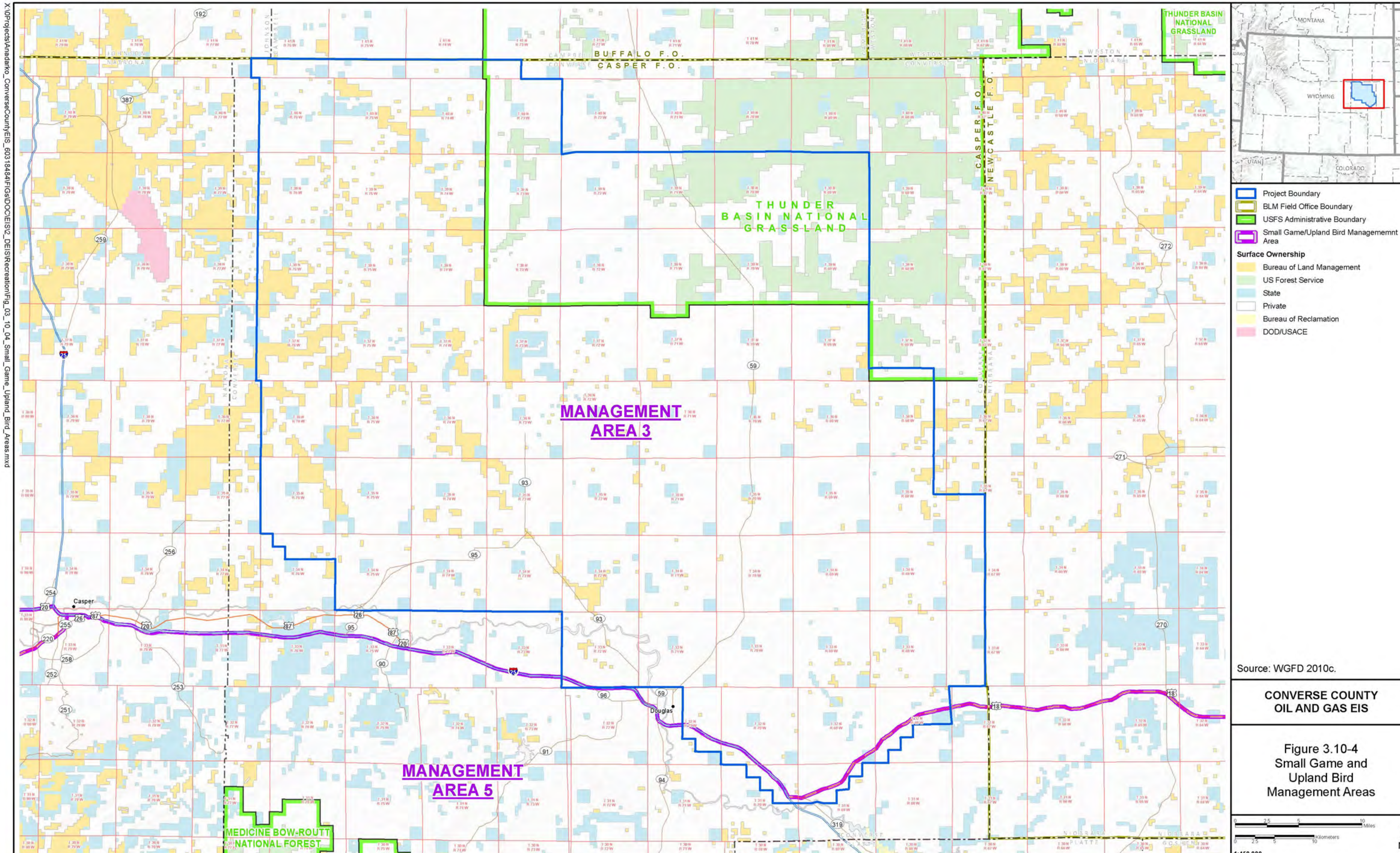

Figure 3.10-4 Small Game and Upland Bird Management Areas

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3.11 Socioeconomics and Environmental Justice

3.11.1 Introduction

The socioeconomic conditions in areas and communities that could be affected by the Project due to development of up to 5,000 new wells over a 10-year period in Converse County, Wyoming are described in terms of economic, population and housing conditions, local government and school district infrastructure, key public services, fiscal conditions, and the social setting. Minority, tribal, and low-income populations also are addressed in the context of potential environmental justice considerations.

Active oil and gas exploration and development activity occurs in Converse County and in neighboring Campbell County. As of November 2014, 18 drilling rigs were operating in Converse County, 13 rigs were drilling in Campbell County, and one rig was active in Natrona County (Baker Hughes 2014). Substantial infrastructure, such as roads, gathering systems, and ancillary production and product transportation facilities has been constructed to support this development, and additional infrastructure is planned or under construction. The recent and ongoing oil and gas activity and its related social and economic effects are part of the socioeconomic baseline conditions described in this section. Additional information and insights into regional socioeconomic conditions is available from the Task 1C Current Social and Economic Conditions report prepared as part of the BLM Powder River Basin Coal Review (AECOM 2012b). Further detail regarding existing infrastructure is provided in Chapter 2.0, Section 3.5 (Land Use), and Section 3.13 (Transportation).

Socioeconomic conditions can be dynamic during periods of active oil and gas exploration and development. Energy companies respond to real and anticipated changes in market prices, as evidenced by the dramatic fall in energy prices in December 2014. As such, local governments and other service providers continually respond to changes in demands and the availability of production and activity related revenues, and the labor market responds to job opportunities and availability that can affect individual household decisions regarding commuting, residency, and local population. The timing, magnitude, and direction of such changes are uncertain, and this uncertainty poses challenges for the socioeconomic assessment in terms of characterizing baseline conditions and assessing the potential socioeconomic effects of the alternatives.

This discussion of the affected environment for socioeconomics and environmental justice draws on information from numerous public sources, much of which is reported and/or updated periodically; although most secondary data is published a year or more after actual events have occurred. Such frequent data releases and revisions of previously published data pose challenges with respect to describing the affected environment. Given the continual data releases, CEQ guidance to rely on best available information for NEPA must be balanced with the data analysis and report preparation time needed to complete an assessment, provided that material changes occurring after that cut-off are considered. Most of the economic, demographic, and fiscal information used to describe the affected environment are current through mid-2014. In many instances the quantitative data was augmented by qualitative information gained through observation, media releases, and interviews with local officials and service providers conducted in 2014. Information obtained from these diverse sources allows a more accurate assessment of socioeconomic conditions, particularly in a dynamic context such as that occurring in Converse County, where available secondary data may not fully reflect evolving socioeconomic conditions due to reporting lags. In the case of Converse County, oil and gas development activity continued through 2014, but the pace of such development then dropped dramatically as oil and gas prices declined. The slowdown resulted in substantial reductions in employment, demand for housing and some public services, retail sales, and local traffic levels. Some effects of these changes were considered in the impact assessment; however, the housing and public infrastructure assessments were conducted at the peak of the development in 2014 and do not reflect effects of the subsequent slowdown in development.

3.11.2 Socioeconomic Analysis Area

Figure 3.11-1 displays the regional map used for socioeconomic analysis. The CCPA is located entirely within Converse County, and Converse County government provides public services within the CCPA and along the various access routes. The assessment area for socioeconomics includes Converse County, Casper ***and*** nearby communities in Natrona County, and the communities of Wright and Gillette in Campbell County. This area encompasses the current locations of most oil and gas service firms and construction contractors that would be expected to support the Project as well as the primary labor pool and largest inventory of temporary and conventional housing for workers that would be directly or indirectly employed by the Project. This area also hosts the consumer retail and service industry base that likely would capture much of the changes in consumer and business demand for goods and services triggered by Project development.

Although the Converse County communities of Douglas, Glenrock, and Rolling Hills are the closest to the CCPA, they have insufficient housing stock to accommodate the large and rapid influx of workers and population that would accompany the proposed development. Consequently, many workers would seek accommodations in the Casper area and in Wright and Gillette.

The Casper area has long been the regional oil and gas service center for North eastern and north central Wyoming. Gillette also is home to many oil and gas service companies. During the third quarter of 2013, over 51 percent of the oil and gas extraction companies in the three-county analysis area were located in Natrona County, approximately 40 percent were located in Campbell County, and approximately 9 percent were located in Converse County (Wyoming Department of Workforce Services 2014a).

Recent population statistics support the designation of the three-county analysis area. Between 2010 and 2014, 525 wells were drilled in Converse County, 541 in Campbell County, and 171 in Natrona County. During that period, Converse County population grew by 398, Campbell County grew by 1,959, and Natrona County grew by 5,983 (U.S. Census Bureau 2018). While not all growth can be attributed to oil and gas development in the Powder River Basin, clearly such development was the key driver during that period. When oil prices subsequently declined, the population also began to decline (U.S. Census Bureau 2018)**.**

Many of the direct effects of development and operation for the Project would be expected to occur in Converse County, particularly in and near the municipalities and communities of Douglas, Glenrock, Rolling Hills, Bill, and to a lesser degree, Lost Springs and Orin. Converse County has experienced substantial population growth in recent years and hosts many temporary residents associated with ongoing oil and gas development and related infrastructure/facility construction projects.

Converse County and the surrounding counties and municipalities provide services to workers and companies. The county itself, Converse County School Districts #1 and #2, and selected special districts presently receive ad valorem taxes, certain fees, and other revenues generated by oil and gas development and production in the county. The county also would receive sales and use taxes from expenditures by oil and gas service companies and on employee expenditures within the county, as well as ad valorem taxes on oil and gas-related commercial and residential properties.

Indirect socioeconomic effects from the Project including work force residency, commercial and industrial activity, and related effects including housing and local government service demand also would occur in Natrona County, principally in the communities of Casper, Evansville, Bar Nunn, and Mills, and to a lesser extent in Campbell County, principally in Gillette and Wright.

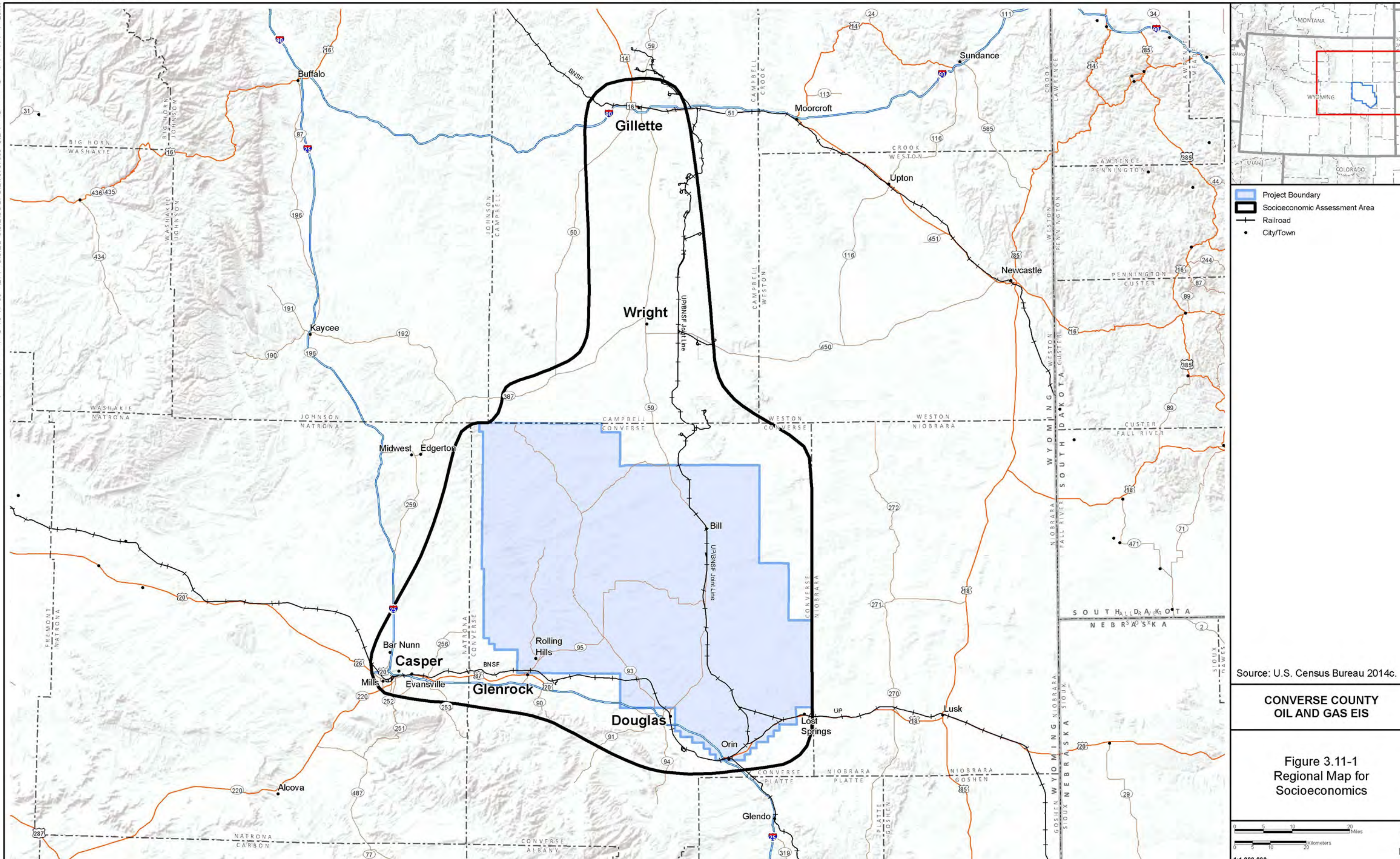

Figure 3.11-1
Regional Map for Socioeconomics

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Local oil and gas workers currently living in the communities of Edgerton and Midwest in Natrona County; Glendo and Wheatland in Platte County; Lusk in Niobrara County; Kaycee and Buffalo in Johnson County; Newcastle and Upton in Weston County; and Moorcroft and Pine Haven in Crook County, may commute to work in oil and gas-related activities within the CCPA. While some non-local oil and gas workers may seek temporary housing in these communities in conjunction with the Project, most would be expected to seek temporary housing in Douglas, Glenrock, Wright, Gillette, and the Casper area due to the current and anticipated concentration of oil and gas service companies, proximity to the CCPA, and substantially larger inventory of housing/lodging and commercial infrastructure. Additionally, the travel distances and locations of these communities relative to the CCPA is such that the temporary population effects would tend to be more diffuse such that no one community likely would experience a large Project-related population influx.

The analysis area for direct environmental justice effects focuses on the CCPA and nearby communities in Converse County. Potentially affected communities in Campbell and Natrona counties are discussed in terms of the assessment of the potential for indirect environmental justice effects. The assessment also considers environmental justice effects on tribal resources (treaty-protected resources, cultural resources, and/or sacred sites) associated with the Native American groups known to have used the CCPA (Section 3.2.3). As noted in Section 3.2.3.1, the analysis area for resources of Native American concern is the CCPA plus their viewshed.

3.11.3 Setting

This section provides a brief orientation to the geographic setting for the Project, the principal economic activities that occur in Converse County, and an introduction to the potentially affected communities. Additional detail on these subjects is provided in later sections.

Converse County is located in east-central Wyoming at the southern extent of the Powder River Basin (**Figure 3.3-1**). At 4,254.7 square miles in area, Converse County ranks eighth in size among Wyoming counties (Equality State Almanac 2010). With an estimated resident population of 14,313 in 2013, Converse County ranked 13th in terms of population among Wyoming counties (***U.S.*** Census ***Bureau*** 2014b). Overall population density of the county was 3.3 persons per square mile; however, this was only 1.2 persons per square mile excluding Douglas and Glenrock. The population of the county is concentrated within a broad east-west corridor generally defined by the North Platte River and I-25 and nearby lands to the north and south. The area encompasses the major communities in the county as well as farms, ranches, and homes on smaller tracts in unincorporated areas and rural subdivisions.

Ranching and associated agriculture activities is the primary land use in the county and is a key sector in the regional economy along with oil and gas development and other energy development. Transportation, electrical energy generation, tourism, and outdoor recreation also are important elements of the Converse County economy.

Table 3.11-1 provides surface ownership information for Converse County. Approximately 76 percent of Converse County surface is in private ownership. Surface ownership information for Campbell and Natrona counties is not displayed because the CCPA is not located in either of these counties.

The CCPA encompasses 1,501,381 acres located wholly within Converse County. The bulk of the CCPA includes most of the northern part of the county and lies north of the I-25 corridor, with relatively small areas to the south of I-25 in the vicinity of Douglas. See Section 3.5 (Land Use) for additional information regarding land use, management, and administration in the CCPA.

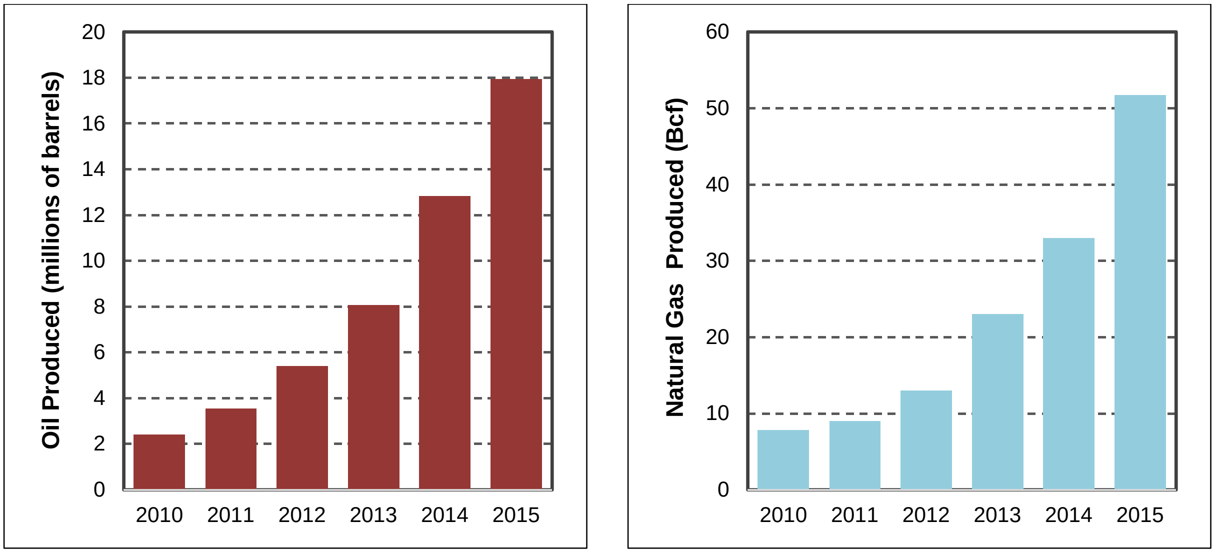
Table 3.11-*1* Converse County Surface Ownership and Status

Ownership/Administration	Converse County	
	Acres	**Percent**
Federal (all agencies)		
Bureau of Land Management	130,048	4.74
Forest Service	259,264	9.45
Bureau of Reclamation	128	<0.01
Total Federal	389,440	14.20
State Government	260,659	9.50
Local Government	NA	NA
Other Lands	3,103	0.11
Private	2,089,284	76.18
Total	**2,742,486**	**100.00**

The majority of the surface area within the CCPA (83 percent) is privately owned. Another 7 percent of the surface area is state owned and just over 10 percent is owned by the federal government (**Table 2.1-1**). In contrast to surface ownership, over 64 percent of the subsurface mineral estate is administered by the federal government, 23 percent is owned by the State, and 13 percent is privately owned. Consequently, approximately 54 percent of the CCPA (812,189 acres) is comprised of federal mineral estate located beneath privately owned surface lands (i.e., split estate). These lands in split estate within the CCPA are among the estimated 11.6 million acres of private land in Wyoming that is in split estate (BLM 2015c). Surface and mineral ownership is shown in **Figure 1.1-1**, and the locations of existing oil and gas development and infrastructure are shown in **Figures 2.3-1** and **2.3-2**, respectively. In split estate situations, the surface rights and subsurface rights (such as the rights to develop minerals) are owned by different parties. In these situations, mineral rights are considered the dominant estate, meaning they take precedence over other rights associated with the property. However, the mineral owner must show due regard for the interests of the surface estate owner and occupy only those portions of the surface that are reasonably necessary to develop the mineral estate (BLM 2015c).

Substantial oil and gas resources are located in Converse County. From 2010 to 2015, Converse County oil and gas production increased dramatically (**Figure 3.11-2**). While the number of producing wells increased by one-third between 2010 and 2015 (from 983 wells to 1,309 wells), oil and gas production increased nearly seven-fold. Over this 5-year period, annual oil production increased from 2,399,432 to 17,942,061 barrels, while annual natural gas production increased from 6,665,768 to 51,693,511 million cubic feet (mcf). Since 2015, oil and gas development and production in Converse County has slowed as a result of low industry prices. The overall number of producing wells and monthly production have fallen. In July 2016, monthly oil production was 51 percent of that produced in May of 2015, and natural gas production was 27 percent lower for that corresponding period (WOGCC 2016a).

There are two major surface coal mines located near the CCPA to the northwest along the Converse/Campbell County line. Many of the employees of these mines live in Douglas and nearby areas and use company-provided bus transportation to work. Additionally, the Dave Johnston coal-fired power plant is located near Glenrock. Converse County also is an important domestic source of uranium and has emerged as a regional wind energy center. See Section 3.3 (Geology and Minerals) for a more detailed discussion of energy development in the CCPA and Converse County.



Source: WOGCC 2016a.

Figure 3.11-2 Annual Oil and Natural Gas Production in Converse County: 2010-2015

The City of Douglas, Converse County's largest community and county seat, is the governmental, commercial and health care center for the county, and has recently become the county's center for the expanding oil and natural gas development. Douglas has a number of hotels, motels, and recreational vehicle (RV) parks. As of November 2014, one new motel was under construction in Douglas, and another two were in the planning stage.

The Town of Glenrock and the nearby community of Rolling Hills are supported by the Dave Johnston power plant, nearby wind farms, the uranium mine, oil and gas workers and service companies, and local government offices and schools. Glenrock has limited temporary lodging and RV/camping capacity. The Town of Lost Springs is located about 30 miles east of Douglas on US 18/20.

The unincorporated community of Bill is 36 miles north of Douglas along Wyoming 59 and the Powder River Basin Joint Rail Line. Jointly owned by the Union Pacific and BNSF railroad companies, the joint line is the major railway serving the southern Powder River Basin, providing capacity to ship 400 million tons of coal per year. The joint rail line also ships oil from recently opened Black Thunder Terminal, and is poised to handle additional oil shipments as additional oil loadout facilities are built and come on line. Bill historically provided lodging for railroad crews and now hosts office and maintenance facilities for the two railroads. Commercial businesses in Bill include a hotel that now hosts both railroad and oil and gas workers.

The unincorporated community of Orin is 15 miles southeast of Douglas, just east of the intersection of I-25 and US 18/20. Founded in the late 1800s to support railroad operations, the community is located adjacent to the BNSF major coal haul routes out of the Powder River Basin. Commercial businesses in Orin include a truck stop/convenience store and a small trailer/RV park.

Natrona County is immediately west of Converse County. The Casper metropolitan area (approximately 50 miles west of Douglas along I-25) includes Casper, Bar Nunn, Evansville, and Mills. It has long been a major service center for oil and gas development throughout the state and is the second largest population center in the state; only Cheyenne, the state capital is larger. Numerous oil and gas service and construction companies have offices and yards located in the Casper area, which also is a regional commercial, professional services (e.g., engineering, legal and accounting) and medical service center for much of the state. The Casper metropolitan area has many hotels, motels, and apartments.

Campbell County is immediately north of Converse County. The City of Gillette (114 miles north of Douglas along Wyoming 59) is the county seat and regional service center for the coal mining and power generation industries in the Powder River Basin. Gillette hosts a number of oil and gas service and construction companies, and the city has numerous hotels, motels, RV and mobile home parks, and apartments. The Town of Wright (76 miles north of Douglas along Wyoming 59) is the nearest Campbell County community to the CCPA. Wright has three motels and a limited number of temporary RV sites.

3.11.4 Plans and Policies

3.11.4.1 Federal

The BLM Casper RMP (BLM 2007b) contains a number of goals for socioeconomic resources. These goals include providing opportunities to develop national energy resources and resources other than those that are energy-related; providing opportunities to sustain the cultural, social, and economic viability of local and regional communities; protecting public health and safety and environmental resources; and reducing potential risks associated with known hazards resulting from human activity. The BLM Casper RMP (BLM 2007b) does not identify specific objectives for socioeconomic resources; however, in addition to decisions and management actions pertaining to abandoned mines, formerly used defense sites, and the Casper airport, the RMP contains a number of decisions and management actions (specifically decisions 8001, 8006, 8007, and 8008) related to socioeconomic resources.

The TBNG LRMP (USFS 2001a) does not contain specific standards for socioeconomic resources; however, the LRMP states that “All goals and objectives (of the LRMP) fall under the overall mission of the Forest Service, which is to sustain the health, productivity, and diversity of the land to meet the needs of present and future generations” (USFS 2001a). Goal 2.b of the LRMP is to improve the capability of wilderness and protected areas to sustain a desired range of benefits and values. One of the rationales for the LRMP ROD is “Contributing to the economic diversity of neighboring communities by implementing a variety of natural resource programs that provide a sustainable output of multiple uses” (USFS 2002).

Federal policies associated with the management of public surface and mineral estate by the BLM and USFS provide for various payments to state and local governments to help those governments provide services such as firefighting, law enforcement, and search-and-rescue operations, as well as to fund construction of public schools and roads that can be impacted by development and use. Federal revenues earned and partially distributed back to local governments include bonus bids and annual rents associated with the leasing of mineral rights as well as royalties collected from the production of leased minerals. In addition to revenue sharing payments, local governments may receive payments associated with the Payments in Lieu of Taxes (PILT) program. The initial leases and bonus bids are paid for the right to explore and develop on federal lands. Royalties are paid on the value of mineral and energy resource production. The PILT program provides federal payments to local governments to help offset property taxes that are foregone due to non-taxable federal lands within their boundaries. PILT payments to counties are calculated using a formula based on the number of acres eligible for PILT payments, the county’s population, prior payments from other specified federal land payment programs, state laws directing payments to specific government purposes, and the Consumer Price Index as calculated by the Bureau of Labor Statistics. Actual PILT payments frequently fall short of authorized amounts due to Congressional appropriation levels that only partially fund the program. PILT payments are not dependent on actual land use (i.e., would not change as a result of future oil and gas development); therefore, royalties would be the major source of future federal revenues associated with this Project.

3.11.4.2 County

The Converse County Land Use Plan, adopted by the Converse County Commissioners on April 7, 2015 (Converse County 2015a) places most of the CCPA within the Agricultural land use category, which includes mineral extraction as a defined use.

One objective of the Converse County Land Use Plan is to “establish a process for Converse County to coordinate with federal and state agencies' proposals that may affect the management of public land, private property rights, and natural resources, so that Converse County citizens may preserve their customs, culture, and economic stability while protecting their environment.” (Converse County 2015a).

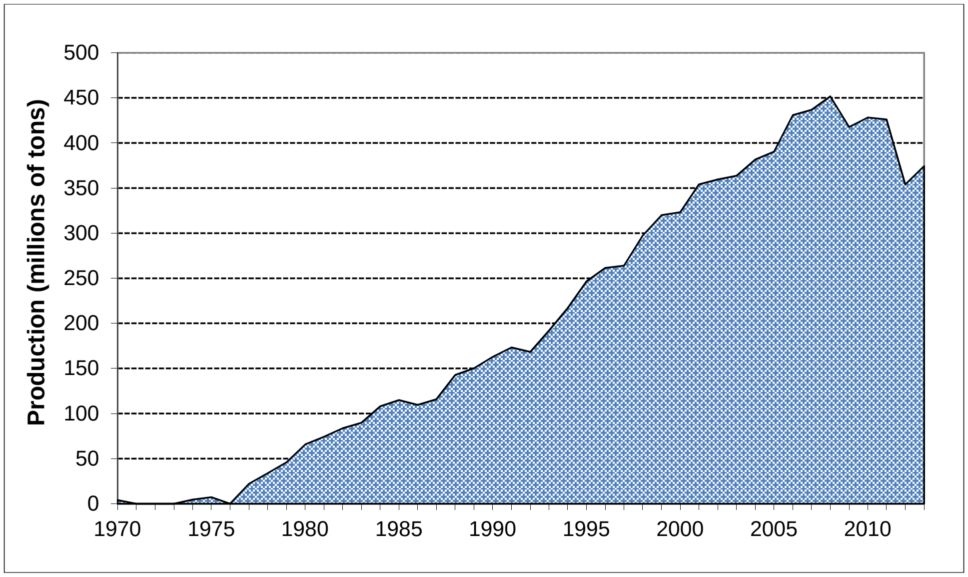
The Converse County Land Use Plan notes that “Federal and state managed lands make up approximately 24 percent of the total surface area of Converse County. However, over 60 percent of the subsurface minerals are federally managed. Thus, the County’s economy is deeply affected and impacted by changes on federal and state managed lands. Local, state, and federal planning decisions may create benefits for a great many state and national citizens outside the county, but may transfer a disproportionate amount of the costs, impacts, and responsibilities to local communities and citizens. Through the land use planning process, Converse County commits to assuring that natural resource planning decisions affecting the County shall be guided by the principles of maintaining and revitalizing various uses of federally managed and state managed lands. These planning decisions must consider impacts to Converse County’s economy, custom, culture and historic use of government-managed ***land*** and private property, and mitigate any negative impacts to the extent allowed by law. The County also commits to the assurance of private property rights, interests, and expectations; protection of the traditional economic structures which form the base for economic stability; and opening of new economic opportunities utilizing those natural resources within the County” (Converse County 2015a).

Converse County general land use policies as well as those related to energy and mineral resources can be found in the Converse County Land Use Plan (Converse County 2015a).

3.11.5 Local Economic Conditions

Energy development and production, including oil, natural gas, coal, and electric power generation and transmission, along with land ownership and use, play pivotal roles in the current social and economic conditions in the socioeconomic analysis area (i.e., including Converse, Natrona, and Campbell counties). Federal land and mineral estate plays an important role in the economy through federal coal, uranium, and oil and gas mineral leasing as well as through livestock grazing and hiking, hunting, camping, watching wildlife, scenic touring and other outdoor recreation use supported by public lands. Cattle ranching and outdoor recreation are important parts of the local economy, heritage, and culture. See Section 3.10 (Recreation) for additional discussion of outdoor recreation activities in and near the CCPA.

Energy development in the region has been ongoing for more than a century, with the first coal mine in the region developed near Glenrock in 1883 (Foulke et al. 2002). Although oil, gas, coal, and other mineral resources are found across much of Wyoming, the extensive surface-accessible coal resources located in Campbell County, majority of which are federally owned, set it apart from other domestic energy-producing areas. In the mid-1970s, Campbell County began its ascent to become the top coal-producing county in the nation, producing more than 450 million tons of coal in 2008, directly employing approximately 6,000 workers, and providing a critical economic and social foundation for the area. More recently coal production has dropped in response to the national economic recession and increases in renewable and natural gas fired electrical generating capacity (**Figure 3.11-3**).



Source: Wyoming State Inspector of Mines 2014.

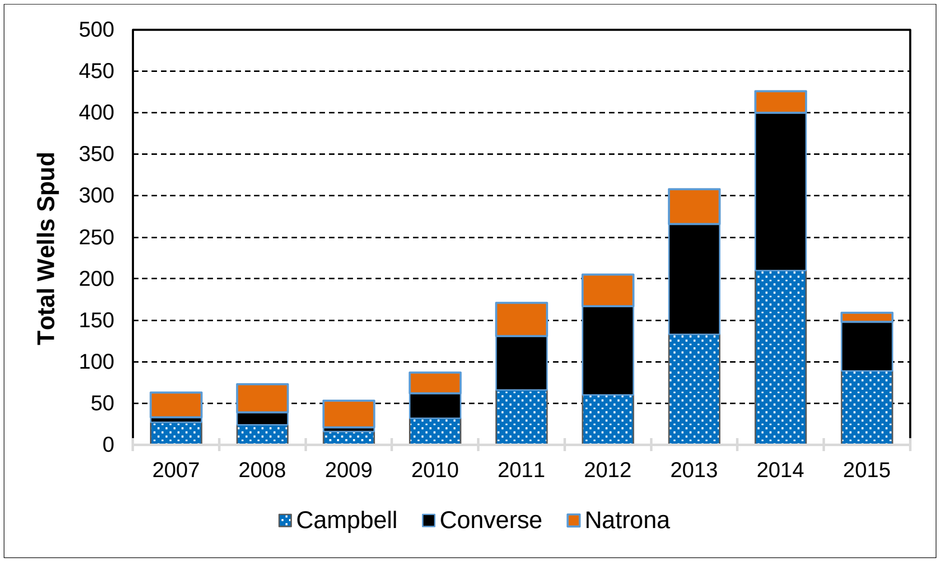
Figure 3.11-3 Annual Coal Production in Converse and Campbell Counties: 1970–2013

The abundance of coal and favorable mining economics in the region factored into the development of coal-fired power generation, including the Dave Johnston power plant near Glenrock, electrical transmission lines, and a rail network that serves as conduits for exporting energy out of the region. Energy development interest evolved as a number of wind energy projects, including three in Converse County, were built to capture another of the region's natural resources and capitalize on the availability of transmission line capacity. Most recently, technological advances in the form of horizontal drilling and hydraulic fracturing precipitated the current thrust in oil development.

The region's diversified energy resource base has enabled it to experience 50 years of economic growth that largely has been void of the severe economic downturns that have followed mineral booms in many other parts of the western U.S. This period of extended growth, and the associated public sector revenues it generated, has been accompanied by substantial benefits including economic growth, employment opportunity, and infrastructure development for local governments across the state. At the same time, periods of rapid growth have stressed communities and their social structures, housing resources, and public infrastructure and service systems. As a result of the combined local and state efforts to accommodate energy-related growth, the three counties in the analysis area now have greater capacity to respond to growth in terms of community infrastructure and the existence of professional service systems.

3.11.5.1 Recent Oil and Gas Development in the Analysis Area

Oil and gas development has occurred in the three counties in the analysis area for some time, contributing to both the economic and social structure of the region. In recent years, that development has been characterized by two distinct elements: extensive coalbed natural gas development from relatively shallow formations in the later 1990s and early 2000s, and more recent interest in oil and gas from deeper tight-shale formations. The area of development interest for coalbed natural gas is defined by the location of coal deposits and initially was focused in Campbell County; however, it later expanded to Converse, Johnson and Sheridan counties. Expressed in terms of number of wells spudded, coalbed natural gas development peaked at more than 3,100 new wells in 2001 and has declined sharply over the ensuing 7 years. The unconventional oil-related plays gained momentum beginning in 2010, with more than 300 wells spudded in the analysis area in 2013 and 426 wells in 2014. In 2015, the combined number of wells spud in the analysis area dropped to 159, the fewest since 2010 (WOGCC 2016b, 2014b). The current play, targeted on deeper formations, is more focused in southern Campbell and northern Converse counties. **Figure 3.11-4** reflects the increase in oil and gas activity in the analysis area in recent years.

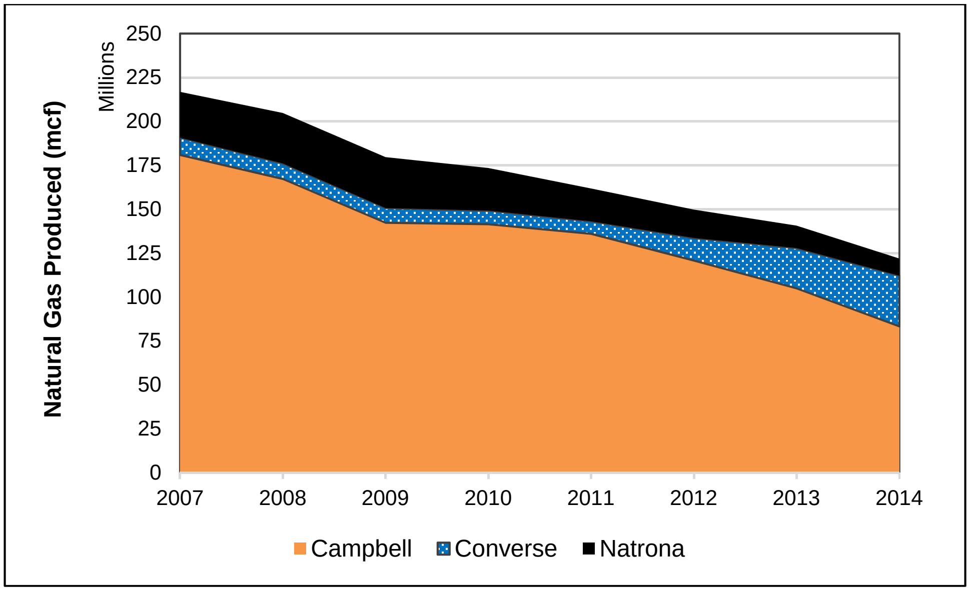


Source: WOGCC 2016b, 2014b.

Figure 3.11-4 Oil and Non-Coalbed Natural Gas Wells Spudded in the Analysis Area: 2007–2014

Besides the locational differences of active plays, development of the various formations differs in the nature, duration, level of development activity, and the productive life of wells. Whereas coalbed natural gas wells often could be completed in a matter of days with relatively small crews, horizontal oil and gas wells such as those that characterize recent and foreseeable development in the region often require weeks of effort and involve many more workers. With respect to production, coalbed natural gas wells have relatively short lives (typically 7 to 10 years) with production increasing over the first several years and then declining sharply. On the other hand, horizontal oil and gas wells often yield peak production within the first 6 months, decline rapidly, but then can continue producing for 20 years or longer.

The combination of resources (oil and gas), drilling activity, and production characteristics of wells underlying recent production are important drivers of economic and fiscal trends in the analysis area. **Figure 3.11-5** depicts annual natural gas production in the analysis area from 2007 through November 2014. Although coalbed natural gas production in Converse County has been increasing, overall production across the region declined considerably between 2007 and 2014. These declines largely are attributable to the passing of the coalbed natural gas development "bubble" in Campbell County and annual production falling by more than 50 percent over this time period.



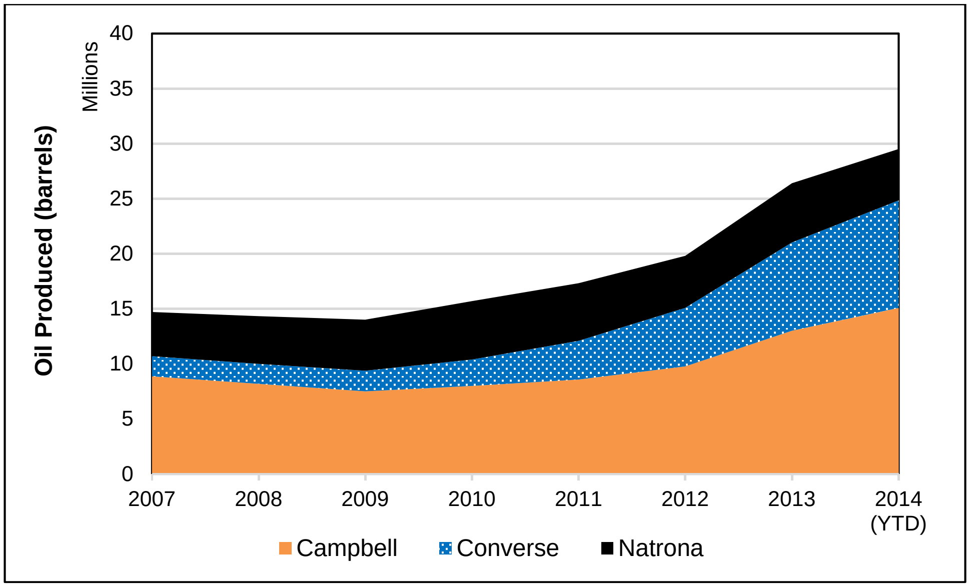
Source: WOGCC 2014c.

Figure 3.11-5 Annual Natural Gas Production in the Analysis Area: 2007–2014

Largely unaffected by past coalbed natural gas development, monthly oil production generally had declined in the analysis area from the mid-1980s through 2009. Relatively few new wells were drilled during that period, while older wells continued to produce but at declining rates. In 2010, annual oil production in the analysis area began rising, increasing by 90 percent between 2010 and 2014. The largest gains in oil production were in Converse County, while oil production from Natrona County declined (**Figure 3.11-6**). Oil production from the three-county analysis area in 2014 accounted for nearly one-half of the statewide total production in that year. In 2010, production from the analysis area had accounted for less than 30 percent of the statewide production. These recent increases in development and production foreshadow important economic and fiscal implications for the communities and local government.

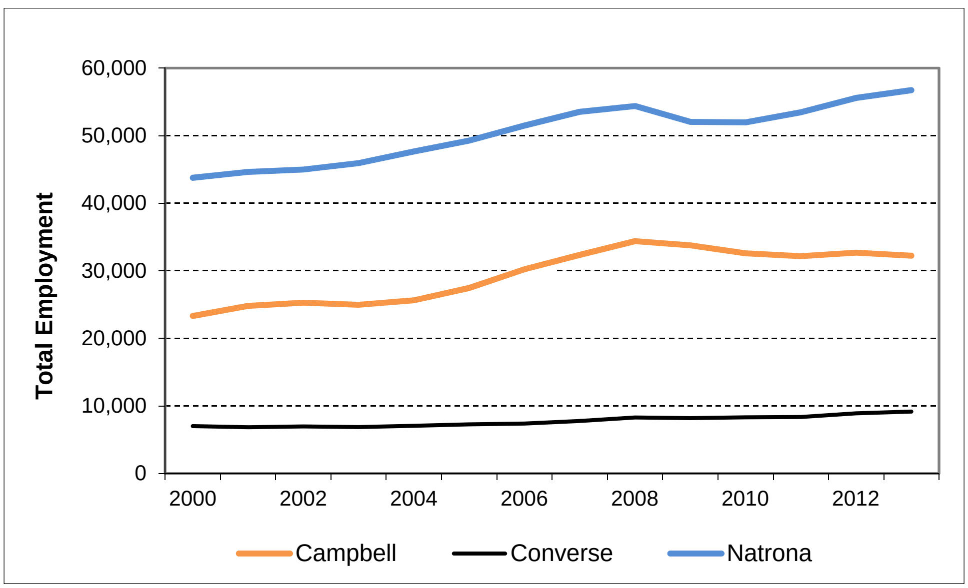
3.11.5.2 Employment

Long-term economic growth has occurred in the analysis area since the mid-1980s, with minor contractions during the recent national recession and following the completion of major construction projects and periods of oil and gas and coal mining expansion. However, the region’s diverse natural resources (e.g., coal mining, electrical generation, transportation, and agriculture) combined with the roles of Casper and Gillette as regional trade and service centers resulted in less severe “busts” during the periods of economic slowdown and contraction than those that occurred in other communities that were reliant on a single industry or mineral. During the period from 2000 to 2013, the three counties experienced a net gain of 24,708 jobs, even after accounting for the loss of 4,227 jobs during the recessionary years 2008 through 2010. The net job gains over the 13-year period were 9,034 jobs in Campbell County; 2,237 jobs in Converse County; and 13,437 jobs in Natrona County (**Figure 3.11-7**). Those gains represented net changes ranging from 32 percent in Converse County to 39 percent in Campbell County.



Source: WOGCC 2014c.

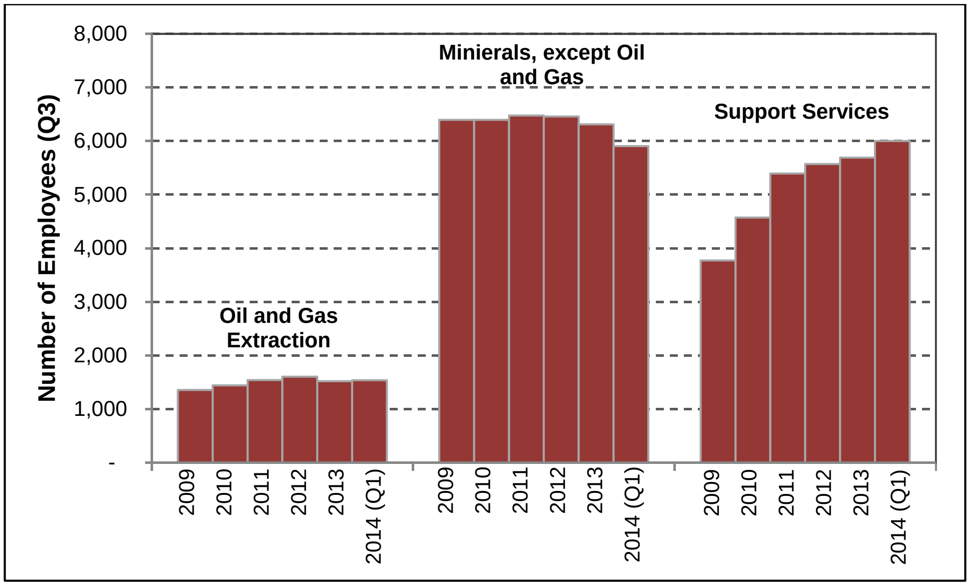
Figure 3.11-6 Oil Production in the Analysis Area: 2007–2014



Source: U.S. Bureau of Economic Analysis 2014b.

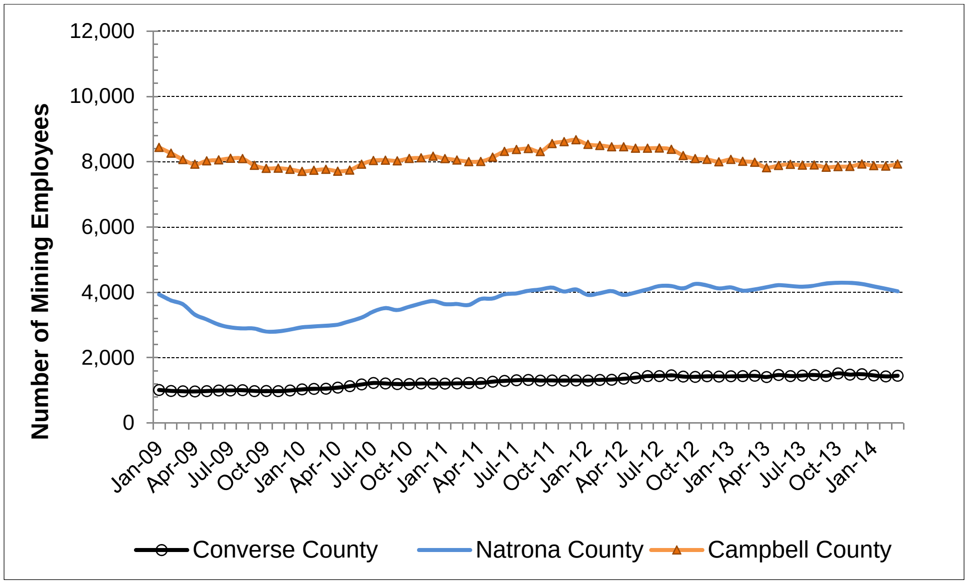
Figure 3.11-7 Total Employment in the Analysis Area: 2000–2013

Information from the Wyoming Department of Workforce Services (WDWS) indicates that recent growth in total employment has continued despite reductions in coal mining and construction employment in Campbell County. Job losses in coal mining have been offset by gains in the support for the mining sub-sector (**Figure 3.11-8**). Most of the net gain has occurred in Natrona County, and more than 500 jobs have been added in Converse County (**Figure 3.11-9**). This data may not fully capture employment associated with contractors working in the area on a short-term basis that do not have local offices reporting to the WDWS. While the number of such workers is unknown and likely varies over time, they could contribute to temporary economic and social effects in nearby communities, including consumer spending and demand on some public facilities and services.



Source: Wyoming Department of Workforce Services 2014c.

Figure 3.11-8 Mining Sector Employment in the Analysis Area by Major Sub-Sector: 2009–2014 (1st Quarter)



Source: U.S. Bureau of Labor Statistics 2014a.

Figure 3.11-9 Mining Sector Employment in the Analysis Area: 2009–2014

The industrial distribution of employees covered by the state's unemployment insurance program provides another measure of the level of mineral development in the region. Employees in the mineral development industry accounted for nearly 18 percent of all employment in the three counties during the first quarter of 2014, and more than 23 percent of employees in Converse County. **Table 3.11-2** provides the number of employees and respective percentage shares by major industry, by county, and for the state. The role Casper plays as a regional trade and services center is demonstrated by the higher than average concentrations of jobs in the trade and health care industries.

There were 415 establishments located in the analysis area that were classified in the oil and gas extraction industry, or the broadly defined "support activities for mining" category (**Table 3.11-3**). These establishments represent 41 percent of all such establishments in Wyoming and do not include the many construction contractors, trucking firms, professional services, and other firms that support mineral development but are classified in other industries based on their primary lines of business. Together, the existence of these firms are indicative of an established capacity to support future oil and gas development in the region without the substantial investment and construction of service industry infrastructure that often accompanies initial development in new regions.

Although not obvious in the data reported in **Table 3.11-3**, local officials indicate increases in the number of active sand and gravel operations in Converse County. Such operations provide critical base material for well pad, road and bridge, and other commercial and industrial construction. These operations do not necessarily have permanent equipment installed and may not operate on a full time basis, but the increase in activity is another indication of an active oil and gas play.

Table 3.11-*2* Distribution of Employment in the Analysis Area: 1st Quarter 2014

Industry Sector	Campbell County[1]		Converse County[1]		Natrona County[1]		Wyoming	
	Number of Employees	Percent of Total	Number of Employees	Percent of Total	Number of Employees	Percent of Total	Number of Employees	Percent of Total
Agriculture, Forestry, Fishing, and Hunting	(D)	--	114	2	113	<0.5	2,311	1
Mining	7,890	**29**	1,444	**23**	4,109	10	26,818	10
Utilities	367	1	(D)	--	143	<0.5	2,455	1
Construction	2,310	8	451	7	3,117	8	20,431	7
Manufacturing	541	2	171	3	1,768	4	9,578	3
Trade	4,007	15	506	8	7,532	**18**	37,861	14
Transportation and Warehousing	939	3	307	5	1,221	3	10,173	4
Health Care	969	4	289	5	5,825	**14**	23,947	9
Accommodations and Food Service	2,098	8	538	9	4,033	10	29,698	11
All Other Private [2]	3,176	12	831	13	7,999	19	43,981	16
Government	4,926	18	1,584	25	5,782	14	66,798	24
Total	**27,223**	**100**	**6,235**	**100**	**41,642**	**100**	**274,050**	**100**

[1] (D) = Data not disclosed due to federal regulations regarding confidentiality; shaded cells highlight sectors in the local economy that account for substantially higher shares of local employment than exists at the state level.

[2] All Other Private includes jobs in the postal service, information, finance and insurance, real estate and rental, professional and technical service, administrative and waster service, education services, arts, entertainment, and recreation, and other services.

Source: Wyoming Department of Workforce Services 2014b.

Table 3.11-*3* Selected Economic Characteristics of the Oil and Gas Industry in the Analysis Area: 3rd Quarter 2013

	Converse County	Natrona County	Campbell County	Wyoming
Number of Employing Units				
Oil and gas extraction	7	40	31	242
Support activities for mining, including both coal mining and oil and gas[1]	48	138	151	768
Average weekly wage – mining	$1,478	$1,872	$1,636	$1,746
Average weekly wage – all non-mining private	$698	$816	$895	$750
Average weekly wage – all government	$804	$927	$862	$871

[1] Excludes many construction contractors, trucking firms, and professional services firms that are classified in other industries but also provide some support for oil and gas development.

Source: Wyoming Department of Workforce Services 2014a.

Compared to other local industries, employment in oil and gas development and coal mining tend to pay higher-than-average wages and salaries. In the first quarter of 2014, the average weekly wages in mining in the analysis area ranged from $1,478 (Converse County) to $1,872 (Natrona County). The statewide average for the same period was $1,746. The average weekly wages for the mining industry were as much as ***133*** percent higher in Natrona County than the average wage across all private non-mining sectors. The corresponding differential in Converse County was 112 percent higher. The average weekly wage differentials between the mining sector and average governmental wages ranged from 84 percent higher in Converse County to 102 percent higher in Natrona County. The high wages in the mining sector contribute to higher personal incomes for residents as well as consumer purchases supporting local trade and services establishments.

The mean and median wages of occupations associated with oil and gas development in Converse County in September 2015, and the comparable values for all occupations, are shown in Table 3.11-4. The higher wages would provide higher incomes for workers, including already employed local residents who change jobs attracted by higher wages, full-time work, overtime, and access to benefits, which all tend to be more prevalent in the oil and gas industry than many other private sector industries. Higher wages would create upward pressures on wages in other industries and contribute to challenges for employers to recruit and retain employees.

Table 3.11-4 Average Wages for Selected Occupations associated with Oil and Gas Development in Converse County, September 2015

Occupation	*Occupation Code*	*Mean Wage*		*Median Wage*	
		Hourly	*Annual*	*Hourly*	*Annual*
Total All Occupations		***$21.62***	***$44,970***	***$18.79***	***$39,073***
Construction Managers		***$36.98***	***$76,912***	***$35.68***	***$74,198***
Operating Engineers and Other Construction Equipment Operators	***47-2073***	***$23.24***	***$48,340***	***$22.85***	***$47,520***
Construction Laborers	***47-2061***	***$16.31***	***$33,928***	***$16.95***	***$35,269***
Electricians	***47-2111***	***$25.61***	***$53,271***	***$26.51***	***$55,142***
Pipelayers [1]	***47-2151***	***$21.02***	***$43,733***	***$19.68***	***$40,948***

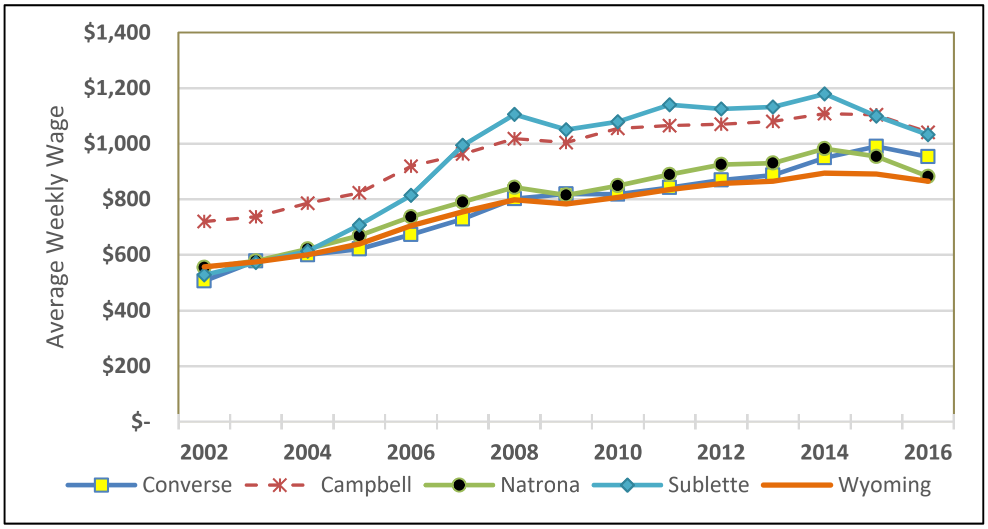
Table 3.11-4 Average Wages for Selected Occupations associated with Oil and Gas Development in Converse County, September 2015

Occupation	*Occupation Code*	*Mean Wage*		*Median Wage*	
		Hourly	*Annual*	*Hourly*	*Annual*
Derrick Operators, Oil and Gas[1]	*47-5011*	*$28.26*	*$58,784*	*$31.72*	*$65,973*
Rotary Drill Operators, Oil and Gas[1]	*47-5012*	*$29.38*	*$61,110*	*$30.44*	*$63,332*
Service Unit Operators, Oil, Gas, and Mining	*47-5013*	*$22.31*	*$46,405*	*$20.14*	*$41,896*
Roustabouts, Oil and Gas	*47-5071*	*$24.07*	*$50,069*	*$24.85*	*$51,679*
Helpers - Extraction Workers	*47-5081*	*$14.45*	*$30,073*	*$14.16*	*$29,447*
Bus and Truck Mechanics and Diesel Engine Specialists	*49-3031*	*$20.98*	*$43,633*	*$21.55*	*$44,841*
Electrical and Electronic Equipment Assemblers	*51-2022*	*$15.14*	*$31,509*	*$14.32*	*$29,789*
Assemblers and Fabricators, All Other	*51-2099*	*$13.98*	*$29,085*	*$13.68*	*$28,454*
Machinists	*51-4041*	*$23.87*	*$49,654*	*$22.98*	*$47,801*
Welders, Cutters, Solderers, and Brazers	*51-4121*	*$27.43*	*$57,049*	*$27.72*	*$57,660*
Heavy and Tractor-Trailer Truck Drivers	*53-3032*	*$27.71*	*$57,619*	*$27.45*	*$57,103*
Light Truck or Delivery Services Drivers	*53-3033*	*$23.81*	*$49,517*	*$19.05*	*$39,629*

[1] Data reported for Natrona County due to insufficient data for Converse County.

Source: Wyoming Department of Workforce Services. Research and Planning Division, Labor Market Information, Occupational Employment Statistics, Wyoming Occupational Employment and Wages, September 2015.

The pattern of upward pressures on wages during periods of major oil and gas development was evident in Sublette County during the rapid growth in natural gas development that began in the mid-2000s and also in the three-county study area in 2012 through 2014 (see Figure 3.11-10). In Sublette County, average weekly increase by more than $400 between 2005 and 2008, an increase of 56 percent. Average weekly wages in Sublette County have remained above $1,000 since that time, reaching a recent peak of $1,179 in 2014. Average weekly wages in Converse County climbed during the recent period of strong exploration and development, climbing to a peak of $990 per week. Since 2008, average weekly wages in Converse, Natrona and Campbell Counties have consistently been above the statewide average.



Source: U.S. Bureau of Labor Statistics, 2017.

Figure 3.11-10 Average Weekly Wages in Wyoming, Sublette County, the Three-Counties in the Study Area: 2002–2016

3.11.5.3 Local Agriculture Sector

The employment data presented in Section 3.11.5.3 provide insights and perspectives into the economic structure of the three counties in the analysis area. Although the economic importance of agriculture may not be reflected on a strict accounting basis, farming and ranching has played an important role in the settlement and economic development of the Mountain States region, and it continues to be viewed as an economic and social cornerstone of many local communities. Agriculture also is important from a land use perspective due to the high percentage of surface area that is privately held. **Table 3.11-*5*** characterizes the local agriculture industry using information from the 2012 Census of Agriculture (U.S. Department of Agriculture [USDA] 2014).

Agricultural pursuits provide livelihoods for many households, support local government and public education by contributing to the local tax base, and indirectly support other local businesses through purchases of farm equipment, fuel, veterinary services, and other goods and services. It also is not uncommon for households dependent on agriculture to derive income from multiple sources (e.g., one member engaged in farming/ranching and another working in education, government, or mining). In fact, the volatility of farm income over time suggests that having an “off-the-ranch” income may be economically imperative for some owners, particularly when agricultural production and income are adversely affected by extended drought.

Table 3.11-5 **Selected Characteristics Of The Local Agriculture Sector**

Parameter	Converse County	Natrona County	Campbell County
Number of Agricultural Operations			
Total number: 2012	410	397	744
Change in total number: 2007 to 2012	-25	-16	111
Number with 1,000 acres or more	165	113	296

Table 3.11-5 **Selected Characteristics Of The Local Agriculture Sector**

Parameter	Converse County	Natrona County	Campbell County
Land Area in Agricultural Operations (acres)			
Total land: 2012	2,447,448	1,691,017	2,878,017
Total cropland	60,858	43,818	140,702
Average size: 2012	5,969	4,259	3,868
Median size: 2012	596	160	300
Other Statistics: 2012			
Farming/ranching as primary occupation (percent)	57.8	49.4	36.4
Inventory of cattle, calves, sheep and lambs (head)	113,755	73,388	107,267
Aggregate market value of products sold	$48,588,000	$42,923,000	$67,160,000
Total farm labor and proprietor's income	$8,945,000	$7,792,000	$8,067,000

Source: USDA 2014.

The National Agricultural Statistics Service reported a total of 1,551 ranches and farms in the three counties in 2012, with 410 of these based in Converse County. Together, these operations encompass more than 7.0 million acres, more than 2.44 million acres of which are in Converse County. Many of the ranches in the region are large; there are 574 ranches of at least 1,000 acres. The average (mean) size of agricultural operations in Converse County is nearly 6,000 acres, with a median size of 596 acres. There are a total of 655 farms of less than 180 acres in the 3 counties, including 97 in Converse County. By comparison, the average and median sizes for farms and ranches in Natrona and Campbell County are both lower.

Nearly 58 percent of farmers and ranchers in Converse County consider agriculture their primary occupation. In Natrona and Campbell counties, more than half of the agricultural operations have principal operators who consider something other than farming and ranching their primary occupation. The overwhelming majority of the agriculture land base surrounding the CCPA is used for grazing, with only 245,378 acres (or 3.5 percent) of all agricultural lands, used to raise crops. More than half of the total cropland in the analysis area is located in Campbell County, and approximately one-quarter of the total cropland is in Converse County. In 2012, local ranchers and farmers reported a total inventory of 294,410 cattle, calves, sheep, and lambs. Cattle and calves accounted for two-thirds of the total. However, ranchers and farmers in Converse County reported nearly an equal number of cattle/calves and sheep/lambs (59,177 and 54,578, respectively). Operators in the two other counties reported substantially more cattle than sheep.

Energy costs, including gasoline, diesel, propane and electricity, are among the major production expenses for farmers and ranchers. These costs have risen sharply in recent years, both in terms of direct commodity costs and indirect transportation and shipping costs. Energy costs have contributed to the rising costs of fertilizers, other chemical products, and feed. Rising feed costs is in part a reflection of shifts in production patterns and markets related to the interest in ethanol production.

Many local ranchers use grazing on public lands to help sustain their operation. The CCPA encompasses part or all of 83 grazing allotments on public lands. Together these allotments provide more than 44,000 AUMs ***of grazing on public lands in the CCPA*** (see Section 3.9, Range Resources).

The combined revenues derived from sales of livestock, crops, and other products in 2012 were $158.7 million; $48.6 million of that total was reported by agricultural operations based in Converse

County. Those revenues were augmented by receipts from participation in various governmental programs, as well as imputed and miscellaneous income.

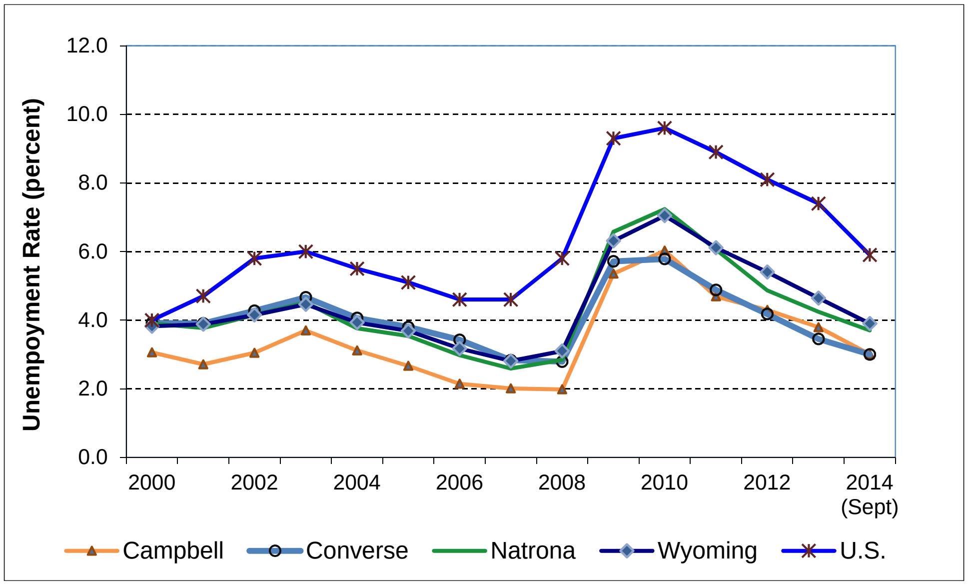
After accounting for production expenses and the value of inventory changes, local farmers, ranchers, and their workers realized combined income of $24.8 million. Despite the differences in the number of agricultural operations and the land area involved in each of the three counties, the income of farm labor and proprietors was relatively comparable in all three counties, ranging from $7.7 million in Natrona County to $8.9 million in Converse County.

In recent times, agriculture has faced challenges beyond those related to markets and production. Such challenges include changes in federal land management affecting grazing, changes in consumer attitudes and consumption patterns, and the effects of drought. Energy resource development also can pose challenges for ranchers and farmers such as land use and transportation access issues associated with split estate, pressures or opportunities to sell land at prices above those supportable as an ongoing agricultural enterprise, and opportunities to receive surface use payments from oil and gas companies.

3.11.5.4 Labor Market Conditions

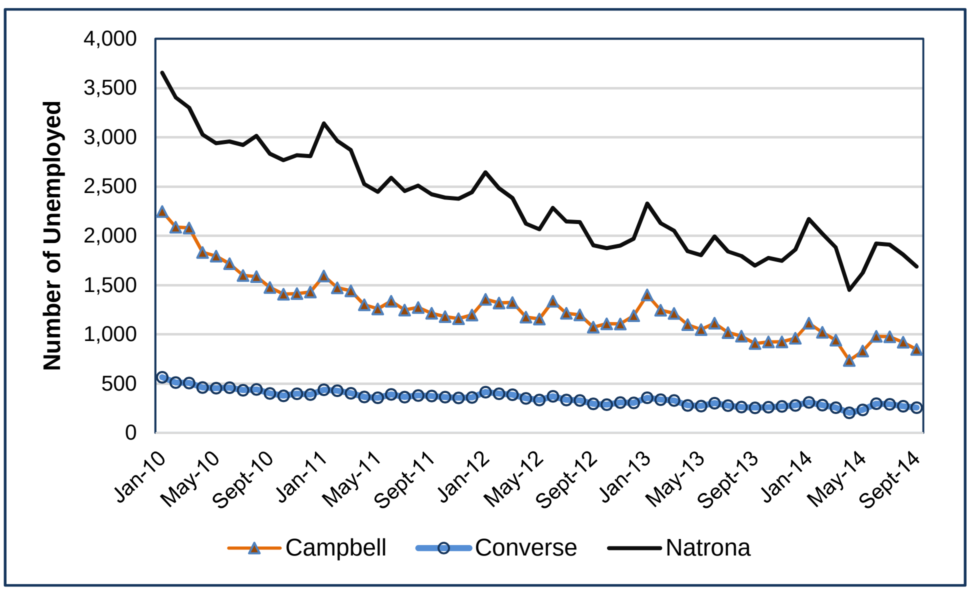
Although not immune to the effects of national recession or economic cycles, a byproduct of Wyoming's economic dependency on energy and mineral resource development is a dynamic labor market that can be generally characterized by unemployment rates below the national average. This is particularly true when considered in combination with the ready mobility of workers in the oil and gas and construction industries and the state's relatively small population. Available labor can be quickly absorbed by increased demand, and many unemployed workers are relatively quick to move in order to take advantage of job opportunities elsewhere. During the national recession that ended in 2010, local unemployment climbed but still remained three-to-four percentage points below the national average (**Figure 3.11-*11***). Combined with rising unconventional oil and gas development in the analysis area and the Bakken Shale play in eastern Montana and western North Dakota (approximately 400 miles northeast of Douglas), the broader economic recovery precipitated dramatic declines in local unemployment in central Wyoming as workers pursued high paying jobs to the north (**Figures 3.11-*11*** and **3.11-*12***). In September 2014, local unemployment rates were 3.0 percent in Converse and Campbell counties, and 3.7 percent in Natrona County. Unemployment rates in the 2.5 to 3.0 percent range correspond to levels that many economists consider as full employment, the situation when all eligible job seekers are employed.

In September 2014, more than 500 unfilled job openings were posted with the Wyoming Workforce Services office in Converse County, with an even larger number posted in Natrona County. The scarcity of job hunters and competition for labor resulted in shortages of labor to meet local needs, particularly for entry level and lower paying positions. The competition for and shortage of workers impinges on the ability of employers to retain and recruit workers to sustain existing operations and expand to meet new opportunities. This also results in upward pressures on wages and salaries. Shortages of construction labor are reportedly slowing progress on many commercial and public sector construction projects, and both public and private sector employers in Douglas have reported having difficulty in hiring and retaining employees.



Source: U.S. Bureau of Labor Statistics 2014a.

Figure 3.11-11 Average Annual Unemployment Rates: 2000–2014 (September)



Source: U.S. Bureau of Labor Statistics 2014a.

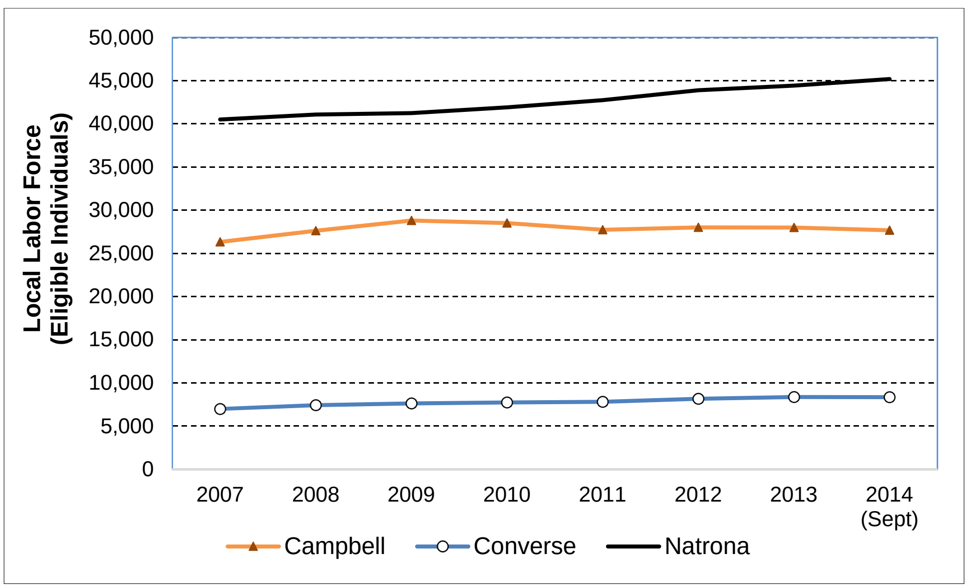
Figure 3.11-12 Monthly Unemployed in the Analysis Area: January 2010–September 2014

The strength of the local labor market is further evidenced by the fact that the declines in unemployment occurred concurrently with expansion of the local labor force, particularly in Converse and Natrona counties (**Table 3.11-*6*** and **Figure 3.11-*13***). Between 2010 and September 2014, the net total labor force in the region expanded by 3,018 individuals, despite declines in Campbell County.

Table 3.11-6 **Local Labor Force in Analysis Area by County: 2010–2014**

Year	Converse County	Natrona County	Campbell County
2010	7,747	41,913	28,504
2011	7,808	42,742	27,723
2012	8,160	43,900	28,007
2013	8,374	44,434	27,986
2014 (Sept)	8,358	45,187	27,637
Net Change: 2010-2014	611	3,274	-867
Net Change (percent)	7.9	7.8	-3.0

Source: U.S. Bureau of Labor Statistics 2014b.



Source: U.S. Bureau of Labor Statistics 2014a.

Figure 3.11-13 **Local Labor Force in Analysis Area: 2007–2014**

This dynamic of the current labor market implies that the labor shortages are likely to prompt additional labor immigration to the region to satisfy existing demand. Nonetheless, a lack of skilled labor may constrain development activity in the short term. Further expansion of oil and gas development activity in the region likely would trigger even more labor migration over the long term.

3.11.5.5 Personal Income

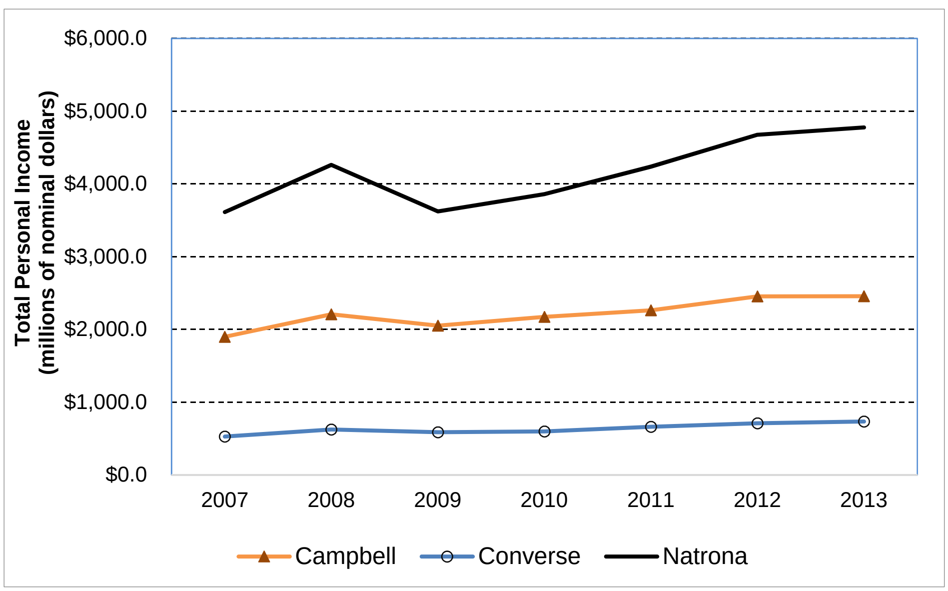
Total personal income in the analysis area (in nominal dollars) was estimated at $7.96 billion in 2013, which is the last year for which data are available. The total was an increase of 17 percent compared to 2010, and approximately 30 percent over the $6.0 billion accruing to area residents in 2007 (**Table 3.11-*7***). Accounting for inflation over those periods would reduce the net changes to 12 percent compared to 2010 and 17 percent compared to 2007. The net increases occurred despite a single-year decrease of more than $700 million between 2008 and 2009 during the national recession (**Figure 3.11-*14***). Along with the upward pressure of compensation rates, the upswing in oil and gas development activity and the resulting stimulus for local construction and transportation industries have contributed to gains in personal income.

Table 3.11-7 **Total Personal Income in Analysis Area: 2007–2013**

Year	Campbell County	Converse County	Natrona County
2007	$1,898.0	$525.9	$3,613.3
2008	$2,207.5	$624.3	$4,262.7
2009	$2,052.0	$585.9	$3,621.5
2010	$2,171.5	$596.8	$3,859.3
2011	$2,262.1	$661.7	$4,237.4
2012	$2,453.9	$708.7	$4,676.0
2013	$2,455.5	$732.9	$4,776.0

Note: Personal income in millions of nominal dollars.

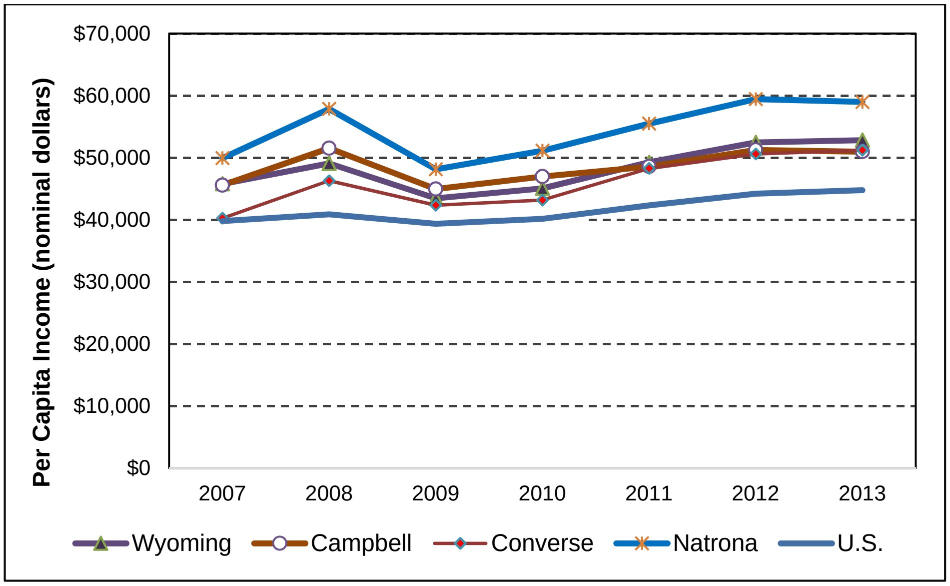
Source: U.S. Bureau of Economic Analysis 2014b.



Source: U.S. Bureau of Economic Analysis 2014b.

Figure 3.11-14 **Total Personal Income in Analysis Area by County: 2007–2013**

Residents in the analysis area generally realize higher income on a per capita basis than many other residents of the state and the nation as a whole. In 2012, per capita income in the analysis area ranged from $48,872 in Campbell County to $57,522 in Natrona County. Statewide per capita income for the same period was $50,567, and the national average was $43,735. Per capita income in all three counties and the state as a whole declined between 2008 and 2009 (**Figure 3.11-*15***). More recent gains have largely offset those declines in Natrona County and contributed to a net nominal increase of more than $4,000 per capita in Converse County. In 2013, Campbell, Converse, and Natrona counties ranked eleventh, tenth, and third highest, respectively, among the 23 counties in Wyoming in terms of per capita income.



Source: U.S. Bureau of Economic Analysis 2014b.

Figure 3.11-15 **Per Capita Income: 2007–2013**

Real per capita income between 2007 and 2013 (i.e., after accounting for inflation during the period) effectively was unchanged in Campbell County, while that in Natrona and Converse counties had increased by approximately 5 and 13 percent, respectively. Real per capita incomes were derived using nominal income data published by the U.S. Bureau of Economic Analysis (2014b) and Consumer Price Index data published by the U.S. Bureau of Labor Statistics (2015a).

Household income distributions vary across the analysis area (**Table 3.11-*8***). In general, the percentages of households in Converse and Natrona counties with incomes of less than $50,000 were comparable to the statewide averages, as were the shares of households in Natrona County with incomes of $75,000 or more. The shares of Converse County households with incomes between $75,000 and $149,999 were considerably higher than the statewide average. The share of households in Campbell County with incomes below $50,000 was considerably below the statewide average, while that with incomes of $75,000 or more was substantially above the statewide average. Median household incomes in Converse and Campbell counties were both above the statewide median income.

Table 3.11-8 **Annual Income: All Households (2014 dollars)**

Income Range	Percent of Households			
	Converse County	**Natrona County**	**Campbell County**	**Wyoming**
Less than $25,000	18.4	18.8	11.4	19.4
$25,000 to $49,999	24.0	25.0	16.9	23.6
$50,000 to $74,999	16.3	20.5	19.7	19.4
$75,000 to $99,999	16.6	13.3	16.3	14.1
$100,000 to $149,999	18.2	14.2	23.3	15.7
$150,000 or more	6.5	7.2	12.4	7.8
Median Household Income	$61,820	$56,759	$78,609	$58,252

Source: U.S. Census Bureau 2015***b***.

Important differences in the structural composition of income, including the relative contributions of income from major sources and the role of commuting in regional income, are not apparent in trends and differences in per capita income in the CCPA. The high levels of labor force participation and employment result in current earnings accounting for higher shares of income than occurs at a statewide level (**Table 3.11-*9***). A corollary difference is that non-labor income such as dividends, withdrawals from 401(K) accounts, and personal current transfers account for smaller shares of personal income. This may be indicative of the strong labor market encouraging older residents to remain in or re-enter the work force.

Work force commuting plays an important role in regional income, affecting both the geographic distribution of income and per capita incomes reported for individual counties. Temporary migration and commuting for work in another county result in outflows of labor earnings from the county in which the job is based. Commuting between two counties typically occurs in both directions; therefore, the U.S. Bureau of Economic Analysis reports the net adjustment for residence, with the adjustments based on income tax records and records provided by employers.

Table 3.11-9 **Source of Personal Income by Major Category: 2013**

Personal Income Category	Percent of Personal Income			
	Converse County	**Natrona County**	**Campbell County**	**Wyoming**
Net Current Earnings	65	63	72	62
Dividends, Interest and Rents	22	26	20	26
Personal Current Transfers	13	11	8	13

Source: U.S. Bureau of Economic Analysis 2014b.

As shown in **Table 3.11-*10***, residency adjustments affect a substantial portion of the personal income in the analysis area. In Converse County, a net inflow in excess of $71 million occurred in 2013, which is equivalent to more than 15 percent of the total labor earnings paid by Converse County establishments in that year. A substantial portion of the inflow is thought to be attributable to residents of the Douglas area who work at coalmines in southern Campbell County. The net outflows and inflows in Natrona County are virtually comparable at approximately $100 million, yielding a net outflow of $5.5 million. In Campbell County the predominant flow of more than $200 million was outward in 2013. The net flows were not necessarily just between the three counties in the region, but also could involve other nearby counties in Wyoming, Montana, South Dakota, or other states to the extent that they are associated with energy or construction workers who reside in the area during extended work shifts but maintain a permanent residence elsewhere.

Table 3.11-10 Net Residence Adjusted Income as a Share of Total Labor Earnings: 2013

County	Earnings (thousands)				
	Place Of Work Labor Earnings (A)	Inflows Of Earnings (B)	Outflow Of Earnings (C)	Net Residence Adjusted Earning (B–C)	Net Residence Adjusted/Labor Earnings ((B-C)/D)
Converse	$464,735	$126,757	($55,145)	$71,612	15.4%
Natrona	$3,434,755	$101,506	($106,970)	($5,464)	-0.2%
Campbell	$2,252,704	$29,407	($233,331)	($203,924)	-9.1%

Source: U.S. Bureau of Economic Analysis 2014a.

3.11.5.6 Cost of Living

The Wyoming Comparative Cost of Living Index compares each county's cost of living to the statewide average at a specific time. The statewide average, assigned a value of 100, represents a population-weighted average of prices for a "market basket" of 140 consumer items in 28 of the state's largest communities. In addition to an overall, or all items cost of living index, statewide averages are reported for six broad categories of items. These categories and their weightings in developing the all items index are: housing (49.2 percent), transportation (15.3 percent), food (13.7 percent), recreation and personal care (9.4 percent), medical (8.5 percent), and apparel (3.8 percent).

Table 3.11-11 shows comparative cost of living index values for Converse, Campbell and Natrona counties from 2008 through 2016. Values are shown for all items, housing, food, and transportation. Housing, food, and transportation comprise 79.2 percent of the total index. Changes in the index values are a direct measure of the changes in costs relative to the statewide average.

For many years, the cost of living in Converse County was below the statewide average. The accelerated pace of oil and gas development resulted in the local cost of living rising above the statewide averages; from an overall value of 95 over the 3-year period 2009 to 2011 to a high of 109 in 2014. Higher relative costs for housing, food, and transportation were the primary contributors to the changes in Converse County's cost of living during the period 2012 to 2014; relative costs for food and transportation both changed from below the statewide averages in 2008 to above the statewide averages in 2013 and 2014.

Primarily due to higher housing costs, the cost of living in Campbell County was substantially higher than the statewide average. Since 2008, declines in relative housing costs have contributed to a decline in the county's cost of living, from 111 in 2008 to 103 in 2012. Relative food prices rose during the same period. The comparative cost of housing in Campbell County, which historically had been higher than that in Converse County, was lower than that in Converse County in 2013 and 2014, although still above the statewide average. More recently, relative housing and food prices have declined such that the cost of living in Campbell County is on par with the statewide average.

Table 3.11-11 4th Quarter Comparative Cost of Living Index for the Analysis Area, 2008 - 2016

	Converse County				Campbell County				Natrona County			
Year	All Items	Housing	Food	Trans.	All Items	Housing	Food	Trans.	All Items	Housing	Food	Trans.
2008	93	89	92	97	111	122	101	98	101	104	99	99
2009	95	91	99	99	110	118	103	100	100	103	95	101
2010	95	91	94	99	108	114	104	100	101	103	98	100
2011	95	90	97	101	106	112	104	101	101	103	99	101
2012	101	106	94	101	103	106	100	99	100	104	98	99
2013	105	109	104	102	104	107	106	99	101	105	91	100
2014	109	118	102	105	105	107	109	97	102	106	95	103
2015	101	102	102	100	105	107	105	99	98	100	92	98
2016	96	91	101	98	100	98	100	100	95	94	97	99

Trans. = Transportation.

Source: Wyoming Department of Administration and Information, Economic Analysis Division 2017.

Prices in Natrona County have a strong influence on the statewide averages partially because it is the state's most populous county. Consequently, the all items cost of living in Natrona County has generally been comparable to the statewide average, ranging between 98 and 102 between 2008 and 2015. In 2015 and 2016 the cost of living in Natrona County was below the statewide average. Higher than average housing costs were recorded in Natrona County during the period of accelerated oil and gas development in the analysis area. These costs, along with those for food and transportation, are now below the statewide average.

As noted above, housing costs comprise the single largest component of the comparative cost of living index. In Converse County, the housing cost index rose from 90 in 2011 to 118 in 2014. The change is indicative of increased housing demand pushing housing costs from approximately 10 percent below the statewide average in 2011 to 18 percent above the statewide average in 2014. Housing costs in Campbell and Natrona counties ranged between 103 and 112 during the period. As a result, Converse County's comparative ranking with respect to housing rose from 13th in 2011 to 2nd in 2014, supplanting both Campbell and Natrona counties which had previously always ranked above Converse County (Table 3.11-12). In 2014, Teton County recorded the highest housing cost index value at 157.

Table 3.11-12 4th Quarter Comparative Cost of Living Index for Housing: 2011-2014

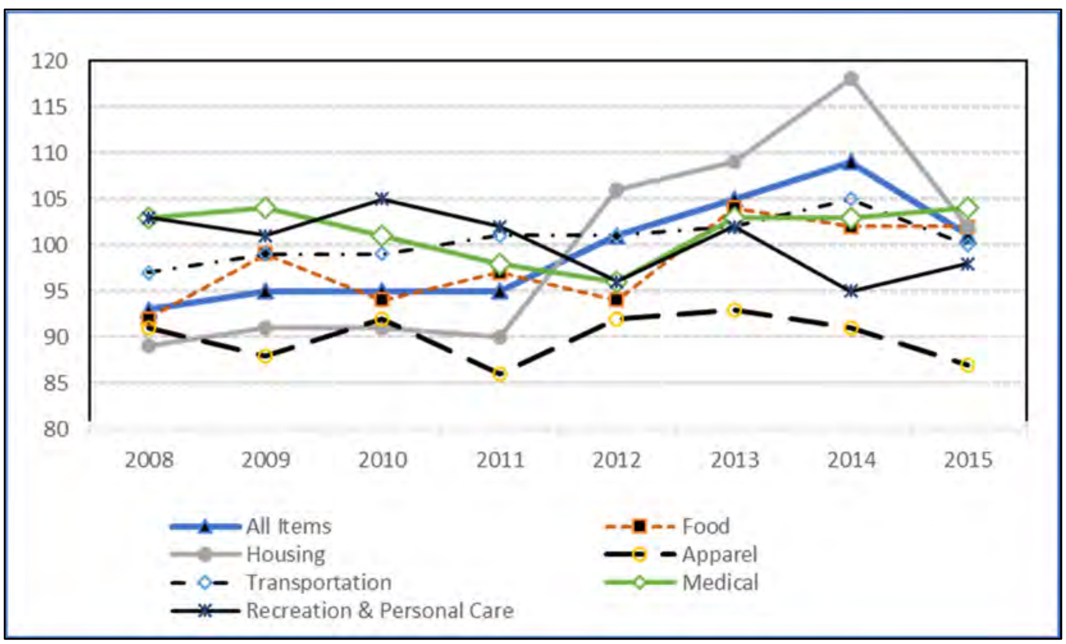
Period	Converse County		Natrona County		Campbell County	
	Index Value[1]	Statewide Rank[2]	Index Value[1]	Statewide Rank[2]	Index Value[1]	Statewide Rank[2]
4th Quarter 2011	90	13th	112	4th	103	3rd
4th Quarter 2012	106	4th (tie)	104	5th	106	4th (tie)
4th Quarter 2013	109	3rd	105	5th	107	4th
4th Quarter 2014	118	2nd	106	5th	107	4th

[1] Statewide average = 100. The index value represents the local costs of living compared to the statewide average. Therefore, changes in the value are not a direct measure of changes in housing costs.

[2] The statewide rank is based on a total of 24 county/sub-county entities.

Source: EAD 2015.

Figure 3.11-16 shows the comparative cost of living index values for all items as well as the six categories of items for Converse County from 2008 through 2017. The dominant role of housing costs in the all items index is apparent in the correlation in changes between those two items from 2011 through 2016. Also apparent is the comparative costs for apparel, recreation and personal care, and medical costs. Apparel costs have been consistently below the statewide average. Local recreation and personal care costs have fluctuated between 95 and 105, while the relative medical costs climbed after 2012 following several years of declines.



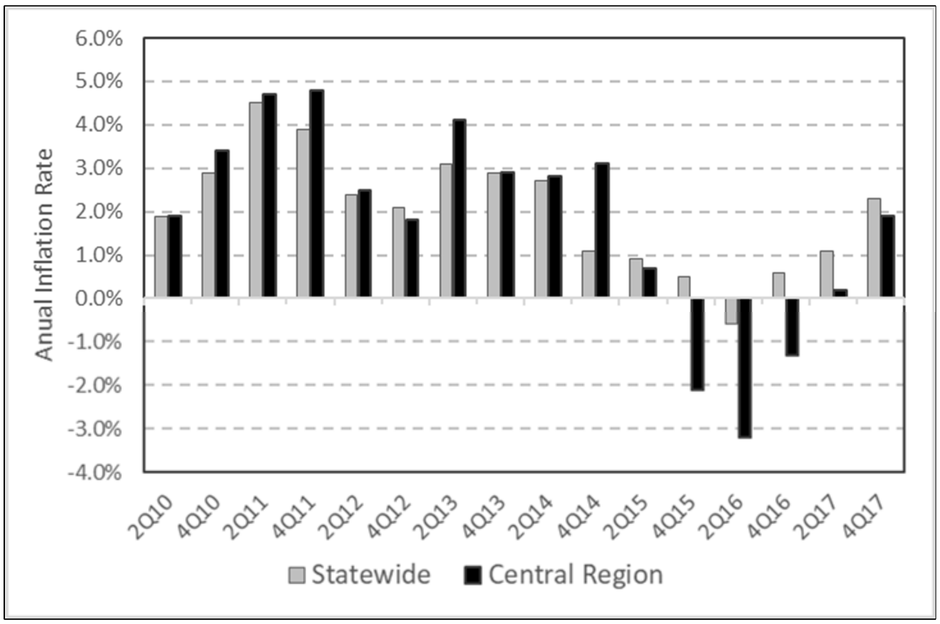
Source: Wyoming Department of Administration and Information, Economic Analysis Division 2017.

Figure 3.11-16 Comparative Cost of Living Index Trends in Converse County 2008 - 2015

The slowdown in oil and gas development activity brought about a reversal in the comparative cost of living in Converse County. In the 2-year period 2014/2015, relative housing costs declined 13 points compared to the statewide averages. These declines, coupled with smaller scale

declines in apparel and food prices, resulted in the overall decline in the cost of living below the statewide averages. The overall cost of living index values for Campbell and Natrona counties also fell below the statewide averages (Table 3.11-12).

Figure 3.11-17 shows the statewide annual inflation rates since 2010, along with those for the three-county central region as defined by the Wyoming Economic Analysis Division. The central region includes Converse, Natrona, and Fremont counties. Inflation rates measure year-over-year changes in prices. As shown, inflation outpaced the statewide rates in all but one period between 2010 and 2014. During the 2nd quarters of 2011 and 2013, and again during the 4th quarter of 2014, local inflation was more than 0.5 percent higher than the statewide rate. The slowdown in oil and gas development in the region that resulted in lower demand for housing triggered reductions in the comparative cost of housing in Converse County and contributed to a period of deflation (i.e., lower prices in 2015 and 2016 in the central region).

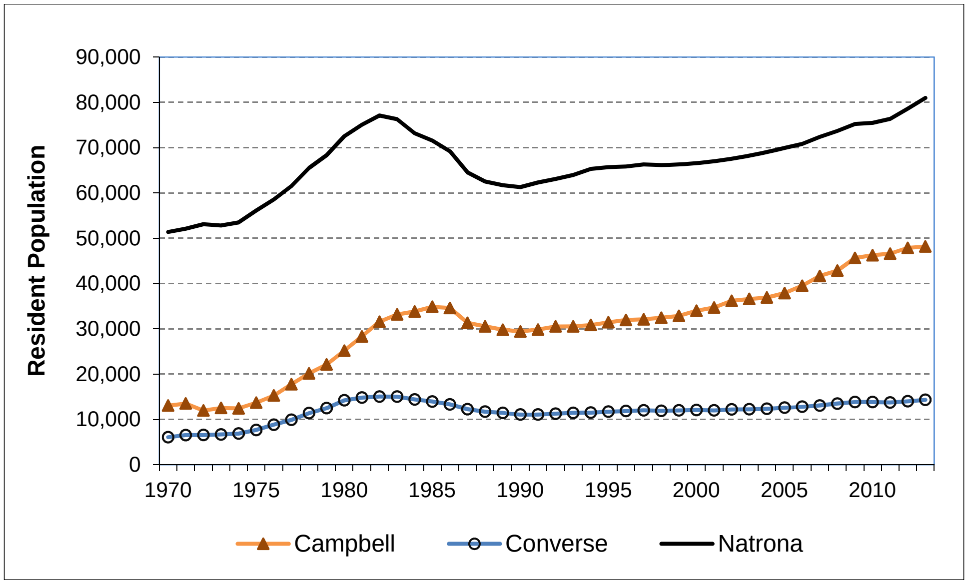


***Source:** Wyoming Department of Administration and Information, Economic Analysis Division 2017.*

Figure 3.11-17 Annual Inflation Rates 2008 - 2016

3.11.6 Population and Demographics

Population change in the analysis area over the past 40 to 50 years has been driven largely by the energy development described in Section 3.11.5. A surge in energy development in Campbell, Converse, and Natrona counties resulted in rapid growth that peaked in the mid-1980s. The peak was followed by a period of population decline as oil prices fell, and construction at area coal mines and power plants was completed. Population growth resumed in all three counties in the early 1990s and accelerated in the mid-2000s period, particularly in Campbell County in conjunction with the coalbed natural gas mini-boom, expansion in coal mining, and power plant construction. The national recession from late 2007 into 2010 ushered in a period of little growth, but population growth resumed in all three counties during 2012. Over the 43-year period of 1970 through 2013, the population in Campbell County increased 269 percent, Converse County grew by 136 percent, and Natrona County grew by 58 percent. **Figure 3.11-*18*** displays population estimates for Campbell, Converse, and Natrona counties from 1970 through 2013. **Table 3.11-*13*** provides a summary of the annual resident population estimates reported by the EAD for Campbell, Converse, and Natrona counties as well as their incorporated municipalities from 2000 through 2013.



Source: EAD 2014a; U.S. Bureau of Economic Analysis 2013.

***Figure 3.11-18* Population by County: 1970–2013**

Resident population in the analysis area increased substantially between 2000 and 2013. The population in Converse County increased by 18 percent during this period, with the majority of the increase occurring in Douglas. The population in Natrona County increased by 22 percent, with the population of Casper, the largest community within the analysis area, increasing by 9,586 residents or 19 percent. The population in Campbell County increased by 42 percent, with most of that increase occurring in the City of Gillette, which grew by 10,858 residents. The City of Gillette Planning Department prepares its own population estimates, based on annexations, demolitions, average vacancy rates, and certificates of occupancy. Gillette estimated that its January 1, 2012 population was 30,121, in contrast to the EAD estimate of 31,442, which was a July 1, 2012 estimate (City of Gillette 2013).

Local officials and service providers in communities experiencing rapid growth related to energy development commonly observe that the Census estimates do not reflect temporary workers residing in local motels, RV parks and temporary worker housing facilities. This is particularly true in oil and gas development where rig crews, completion crews, and pipeline crews are formed in other parts of the state or country and may work in the area for weeks or months at a time, returning to their place of residence during their days off. These workers typically do not establish formal residence in counties or communities where they are working, yet they often comprise a substantial population that must be served with county and community infrastructure and services.

Table 3.11-13 **Estimated Population for Counties and Communities: July 1, 2000–July 1, 2013**

	Converse County					Campbell County				Natrona County							
Year	**Total**	**Douglas**	**Glenrock**	**Rolling Hills**	**Balance of County**	**Total**	**Gillette**	**Wright**	**Balance of County**	**Total**	**Bar Nunn**	**Casper**	**Edgerton**	**Evansville**	**Midwest**	**Mills**	**Balance of County**
2000	**12,083**	5,316	2,257	440	4,070	**33,979**	20,939	1,362	11,678	**66,603**	980	50,042	168	2,251	384	3,195	9,583
2001	**11,996**	5,284	2,239	430	4,043	**34,699**	21,449	1,387	11,863	**66,978**	1,096	50,187	170	2,263	383	3,195	9,684
2002	**12,196**	5,374	2,275	431	4,116	**36,193**	22,435	1,443	12,315	**67,554**	1,216	50,480	171	2,282	383	3,207	9,815
2003	**12,232**	5,395	2,281	426	4,130	**36,586**	22,742	1,454	12,390	**68,246**	1,336	50,863	173	2,304	384	3,224	9,962
2004	**12,350**	5,449	2,303	424	4,174	**36,907**	23,002	1,463	12,442	**69,035**	1,459	51,315	176	2,330	386	3,247	10,122
2005	**12,595**	5,560	2,348	427	4,260	**37,888**	23,670	1,498	12,720	**69,922**	1,583	51,844	179	2,359	387	3,273	10,297
2006	**12,801**	5,654	2,385	428	4,334	**39,497**	24,728	1,558	13,211	**70,806**	1,706	52,370	181	2,387	389	3,298	10,475
2007	**13,071**	5,776	2,436	431	4,428	**41,651**	26,128	1,640	13,883	**72,365**	1,848	53,392	186	2,440	395	3,357	10,747
2008	**13,486**	5,960	2,513	439	4,574	**42,846**	26,931	1,684	14,231	**73,682**	1,986	54,235	190	2,485	399	3,404	10,983
2009	**13,839**	6,121	2,577	444	4,697	**45,650**	28,742	1,791	15,117	**75,238**	2,131	55,255	194	2,537	405	3,462	11,254
2010	**13,817**	6,116	2,571	437	4,693	**46,224**	29,940	1,807	14,477	**75,463**	2,206	55,282	195	2,624	403	3,455	11,298
2011	**13,712**	6,095	2,547	434	4,636	**46,575**	30,425	1,808	14,342	**76,374**	2,245	56,173	193	2,756	400	3,412	11,195
2012	**14,006**	6,280	2,587	442	4,697	**47,882**	31,442	1,855	14,585	**78,665**	2,418	57,933	197	2,811	409	3,461	11,436
2013	**14,313**	6,469	2,637	450	4,757	**48,176**	31,797	1,852	14,527	**80,973**	2,646	59,628	201	2,850	418	3,568	11,662
Increase	**2,230**	**1,153**	**380**	**10**	**687**	**14,497**	**10,858**	**490**	**2,849**	**14,370**	**1,666**	**9,586**	**33**	**599**	**34**	**373**	**2,079**
Percent Increase	**18**	**22**	**17**	**2**	**17**	**42**	**52**	**36**	**24**	**22**	**170**	**19**	**20**	**27**	**9**	**12**	**22**

Source: EAD 2014a; U.S. Census Bureau 2014b.

In 2013, the three counties in the analysis area had a combined resident population of 143,462. Between 2010 and 2013, total net immigration (i.e., more people moving into an area than moving out) of 4,849 residents occurred in the three counties. Such immigration accounted for the most of the population growth in Converse and Natrona counties. **Table 3.11-*14*** provides a summary of the components of recent population change in the analysis area, contrasted with the components of statewide change. As shown, natural increase (i.e., the number of births compared to the number of deaths) accounted for the overwhelming share of population growth in Campbell County, and more than 60 percent of the net change statewide.

Table 3.11-14 **Components of Population Change for the Analysis Area: 2010–2013**

Geographic Area	Total Population Change	Natural Increase	Net Migration	Percent Net Migration
Converse County	480	220	272	56.7
Natrona County	5,523	1,243	4,210	76.2
Campbell County	2,043	1,659	367	18.0
Three-county Total	**8,046**	**3,122**	**4,849**	**60.3**
Remainder of the state	10,986	6,766	4,079	37.1
Wyoming	19,032	9,888	8,928	46.9

Source: U.S. Census Bureau 2014a.

Table 3.11-*15* provides a summary of the Census Bureau median age, sex, household size, and family household data for Campbell, Converse, and Natrona counties from 2000 and 2010. During 2010, there were slightly more males than females in both counties. In 2010, the average age of the Campbell County population was approximately 5 years younger than the State of Wyoming as a whole, while the average age of the Natrona County population was the same as the statewide average, and the Converse County population average was approximately 2 years older. The 2010 average household sizes in Campbell and Converse counties were slightly larger than the statewide average, while the Natrona County average was slightly smaller than the state as a whole.

Table 3.11-15 **Selected Demographic and Household Characteristics: 2000 and 2010**

Year / Location	Male (percent)	Female (percent)	Median Age (years)	Under 18 Years (percent)	Average Household Size (persons)	Family Households (percent)
2000						
Campbell	51.4	48.6	32.2	31.0	2.73	73.8
Converse	49.8	50.2	37.5	28.5	2.55	72.6
Natrona	49.4	50.6	36.4	26.0	2.42	66.2
Wyoming	50.3	49.7	36.2	26.1	2.48	67.4
2010						
Campbell	52.6	47.4	31.9	28.1	2.66	69.5
Converse	50.7	49.3	39.0	25.4	2.42	68.0
Natrona	50.3	49.7	36.8	23.9	2.41	64.4
Wyoming	51.0	49.0	36.8	24.0	2.42	64.6

Source: U.S. Census Bureau 2011a, 2001.

Table 3.11-*16* provides the EAD population forecasts for Converse, Natrona, and Campbell counties and their municipalities through 2025. The population in Campbell County and its municipalities is forecast to grow by 33 percent between 2010 and 2025, while the population in Converse and Natrona counties is forecast to grow at slower rates of 20.1 and 12.9 percent, respectively. The combined population is forecast to climb to 163,150 by 2025, which would be an increase of more than 27,700 (20 percent) compared to the 2010 population. Although the most current forecasts available, these estimates were prepared prior to the upswing in oil development interest in Converse County and southern Campbell County.

Table 3.11-16 **Forecasted Population: 2010–2025**

	Population				
Location	**2010**	**2015**	**2020**	**2025**	**2010 to 2025 Change**
Converse County					
Glenrock	2,576	2,803	2,970	3,093	517
Douglas	6,120	6,658	7,057	7,349	1,229
Rolling Hills	440	479	507	528	88
Balance of County	4,697	5,110	5,416	5,640	943
Converse County Total	***13,833***	***15,050***	***15,950***	***16,610***	***2,777***
Natrona County					
Casper	55,316	57,933	60,477	62,457	7,141
Bar Nunn	2,213	2,318	2,419	2,499	286
Evansville	2,544	2,664	2,781	2,872	328
Mills	3,461	3,625	3,784	3,908	447
Balance of County	11,916	12,480	13,029	13,454	1,538
Natrona County Total	***75,450***	***79,020***	***82,490***	***85,190***	***9,740***
Campbell County					
Gillette	29,087	32,654	35,869	38,681	9,594
Wright	1,807	2,029	2,228	2,403	596
Balance of County	15,239	17,107	18,793	20,266	5,027
Campbell County Total	***46,133***	***51,790***	***56,890***	***61,350***	***15,217***
Three-county Total	**135,416**	**145,860**	**155,330**	**163,150**	**27,734**

Source: EAD 2011.

Douglas also prepares population forecasts. The most recent forecast, prepared in conjunction with the 2013 Douglas Master Plan, contained population forecasts for three growth scenarios. Under those scenarios, the population of Douglas ranged from 6,472 to 6,596 in 2015 compared to 6,658 in the EAD forecast and between 6,715 and 7,274 in 2020 compared to 7,057 in the EAD forecast (City of Douglas 2014a).

3.11.7 Housing

This section describes conventional and temporary housing resources and conditions in the analysis area as of mid-2014. Conventional housing includes single and multi-family homes and mobile homes. Temporary housing resources include motels, hotels, and RV parks.

3.11.7.1 Conventional Housing

Table 3.11-*17* provides a summary of the 2000 and 2010 U.S. Census housing counts for the analysis area. The increase in housing stock that occurred in communities in the area during that period reflects the population increases discussed in Section 3.11.6. The combined housing stock of the three-county region expanded by 10,326 units, or 21 percent, during the decade. However, more than half of that total is located in Campbell County.

In Converse County, the housing stock in Douglas grew by almost 17 percent, representing more than half of the overall housing stock increase of 734 units in Converse County. A substantial portion of this growth occurred in 2007 and 2008. In Natrona County, the housing stock in Casper grew by 12 percent or 2,664 units. The housing stock in Bar Nunn grew by 124.5 percent or 422 units. In Campbell County, the majority of the increase in housing stock occurred in the City of Gillette, which grew by just over 53 percent. Some of the housing increase in Gillette was accomplished through annexation of areas adjacent to the city.

Table 3.11-17 **Housing Units: 2000–2010**

Location	Number of Units		2000–2010 Change	
	2000	**2010**	**Number of Units**	**Percent**
Converse				
Douglas	2,385	2,788	403	16.9
Glenrock	1,131	1,201	70	6.2
Balance of County	2,153	2,414	261	12.1
Converse County Total	***5,669***	***6,403***	***734***	***12.9***
Natrona				
Casper	21,872	24,536	2,664	12.2
Bar Nunn	339	761	422	124.5
Evansville	918	1,109	191	20.8
Mills	1,272	1,654	382	30.0
Balance of County	5,481	5,747	266	4.9
Natrona County Total	***29,882***	***33,807***	***3,925***	***13.1***
Campbell				
Gillette	7,931	12,153	4,222	53.2
Wright	544	813	269	49.4
Balance of County	4,813	5,989	1,176	24.4
Campbell County Total	***13,288***	***18,955***	***5,667***	***42.6***
Three-county Total	**48,839**	**59,165**	**10,326**	**21.1**
State of Wyoming	**223,854**	**261,868**	**38,014**	**17.0**

Source: U.S. Census Bureau 2011a, 2001.

<u>Residential Building Permits</u>

Building permit activity provides information regarding recent increases in housing stock and an indication of the capacities of a community and the local construction industry to respond to an increase in housing demand. As shown in **Table 3.11-*18***, Converse County issued 523 residential building permits between 2005 and 2013, Natrona County issued 4,446 permits, and Campbell County issued

3,271 permits. During the period from 2011 to 2013, the counties issued a total of 152 residential building permits in Converse County, 1,512 in Natrona County, and 502 Campbell County.

Table 3.11-18 **Residential Building Permits: 2005–2013**

Year	Residential Building Permits (number)		
	Converse County	**Natrona County**	**Campbell County**
2005	58	444	273
2006	34	423	479
2007	115	429	1,002
2008	103	419	349
2009	38	412	349
2010	23	807	317
2011	47	402	201
2012	54	507	179
2013	51	603	122
2005–2013 TOTAL	**523**	**4,446**	**3,271**

Source: EAD 2014b.

Mobile Home Parks

Mobile homes are an important element of the local housing stock. While many mobile homes are located on individual lots/parcels, many are located in mobile home parks. **Table 3.11-*19*** provides a summary of the number of mobile home parks and pads in Converse, Natrona, and Campbell counties as reported in the Nationwide Directory of Mobile Home Communities (MHPS 2014). Although this directory does not include all mobile home parks, it is thought to cover the majority of all such parks and pads/sites. Nearly half of the total pads are located in and near Gillette, 15 percent (524 pads) are located in Douglas, and more than 380 pads are located in Wright. While mobile home pads represent a substantial portion of the housing resource, little availability was reported during the fall of 2014, particularly in Converse County (Chaffin 2014).

Homes for Sale

Average sales price for homes in Converse County during 2013 was $204,742, which was a 9 percent increase over 2012 average sales prices. The average sales price in Natrona County in 2013 was $217,761, and in Campbell County it was $238,489. Average sales prices in in Natrona and Campbell counties each represented a less than one percent increase over 2012 prices. The average home sales price in Wyoming as a whole in 2013 was $281,345, which was a 5.6 percent increase over 2012 (Wyoming Community Development Authority 2015).

As is the case for mobile home pads, the housing market was extremely tight across the region during 2014, and housing prices remained high. **Table 3.11-*20*** provides a summary of the market area and listing prices of the homes listed on Realtor.com during December 2014. The vast majority of the listings are located in Casper and Gillette. Only 106 units were listed in Converse County, and not all of those were available for immediate occupancy. The total number represented just slightly over 1 percent of the total housing inventory. Although this total did not include houses listed for sale by owners, some homes that were under construction or awaiting a buyer before initiating construction were included. Median prices for homes listed for sale in the analysis area during December 2014 ranged from $277,300 in Douglas to $183,700 in Wright.

Table 3.11-19 **Mobile Home Parks: 2014**

Location	Number of Mobile Home Parks	Total Number of Pads/Sites
Converse County		
Douglas	8	524
Glenrock	1	n/a
Rolling Hills	0	0
Natrona County		
Casper	24	782
Bar Nunn	0	0
Evansville	2	198
Mills	0	0
Campbell County		
Gillette	18	1,604
Wright	1	382
Total	**54**	**3,490**

Source: MHPS 2014.

Table 3.11-20 **Houses Listed for Sale in Analysis Area Communities: June 2014**

Community	Number of Units Listed for Sale	Median Price of Listed Homes
Converse County		
Douglas	87	$277,300
Glenrock	18	$190,400
Rolling Hills	1	$185,000
Natrona County		
Casper	242	$248,800
Evansville	20	$235,950
Bar Nunn	25	$245,500
Mills	8	$216,900
Campbell County		
Gillette	268	$234,500
Wright	10	$183,700
Total Units Listed	**679**	

Source: Realtor.com 2014.

The scarcity and rising cost of housing was cited as contributing to staff recruiting challenges for the local school district, hospital, the City of Douglas, and Converse County during the peak period of development. Housing availability, selection, and location were cited as contributing to difficulties in employee recruitment and retention.

Rental Housing

According to Wyoming Community Development Authority (WCDA) semiannual surveys of rental housing vacancies for Converse, Natrona, and Campbell counties from December 2010 through June 2014, the availability of rental housing was limited across the three-county analysis area. Based on a survey of rental property managers, vacancy rates in June 2014 declined to approximately 1.9 percent of rental units (14 units) in Converse County approximately 2.7 percent (160 units) were vacant in Natrona County, and approximately 3.2 percent (120 units) were vacant in Campbell County (Table 3.11-21). Converse County officials reported few vacancies and a tight rental market in both May and December of 2014 (Blanchard 2014; Blanton 2014; Chaffin 2014; Kindt 2014; Morell 2014; Willox 2014). Although Gillette has a relatively large number of apartments, including some built to accommodate the construction of the Dry Fork power plant, a survey conducted by the City of Gillette estimated a 1.3 percent vacancy rate for apartments and other buildings in the second quarter of 2014, and a 6.3 percent vacancy rate in mobile and manufactured homes (City of Gillette 2014; Surface 2014).

Table 3.11-21 **Rental Housing Vacancy, 2010–2014**

	Vacancy Rates (percent) and Number of Units[1]					
	Converse County		Natrona County		Campbell County	
Period	**Rate**	**Units**	**Rate**	**Units**	**Rate**	**Units**
December 2010	5.1	31	4.6	214	8.0	271
June 2011	2.1	14	3.7	176	8.0	256
December 2011	2.1	13	7.4	340	7.2	262
June 2012	2.4	17	2.1	106	5.5	231
December 2012	3.0	22	2.1	91	9.8	363
June 2013	2.2	17	3.6	202	9.3	372
December 2013	1.7	16	3.5	196	6.2	224
June 2014	1.9	14	2.7	160	3.2	120

[1] The reported vacancies *were* based on a survey of rental property managers. The survey response vari*ed* over time and may not *have* captur*ed* units rented by individual owners; therefore, the number of vacant units reported does not represent all vacant rental units in the county.

Source: *WCDA* 2015.

Table 3.11-22 provides a summary of the 4th quarter 2013 and 2014 average monthly rents for apartments, mobile home lots, mobile homes, and houses in Converse, Natrona, and Campbell counties as well as statewide. At that time, average monthly rents for apartments and houses were substantially higher than the statewide average except for Campbell County apartment rents, which were only slightly higher. Mobile home rents were substantially above the statewide average in Converse and Campbell counties, but lower in Natrona County. Mobile home lot rents were substantially higher than the statewide average in Campbell County. Fourth quarter 2014 rents in Converse County were sharply higher compared to 2013. Average monthly apartment rents had increased on a year-over-year basis in both Natrona and Campbell counties, while rents for other types of housing had remained relatively unchanged.

Table 3.11-22 Average Monthly Rents: 4th Quarter 2013 and 2014

Location	***Apartments***		***Houses***		***Mobile Homes***		***Mobile Home Lots***	
	2013	***2014***	***2013***	***2014***	***2013***	***2014***	***2013***	***2014***
Converse County	***$802***	***$925***	***$1,142***	***$1,393***	***$833***	***$946***	***$203***	***$204***
Natrona County	***$806***	***$880***	***$1,174***	***$1,208***	***$606***	***$600***	***$305***	***$322***
Campbell County	***$707***	***$778***	***$1,170***	***$1,164***	***$899***	***$891***	***$430***	***$437***
Wyoming	***$691***	***$730***	***$1,011***	***$1,050***	***$711***	***$700***	***$302***	***$315***

Source: EAD 2015; WCDA 2015.

Strong demand for rental housing was viewed locally as the primary factor driving the increases in rental costs. The increased reportedly resulted in the displacement of some current residents, including some seniors whose incomes had not kept pace with the rising costs or were on fixed incomes.

Average monthly rents declined dramatically, especially in Converse County, following the cutbacks in oil and gas development in the analysis area and the associated declines in housing demand. The declines in monthly rents, particularly for apartments and single family homes in Converse County, are shown in Figure 3.11-19.

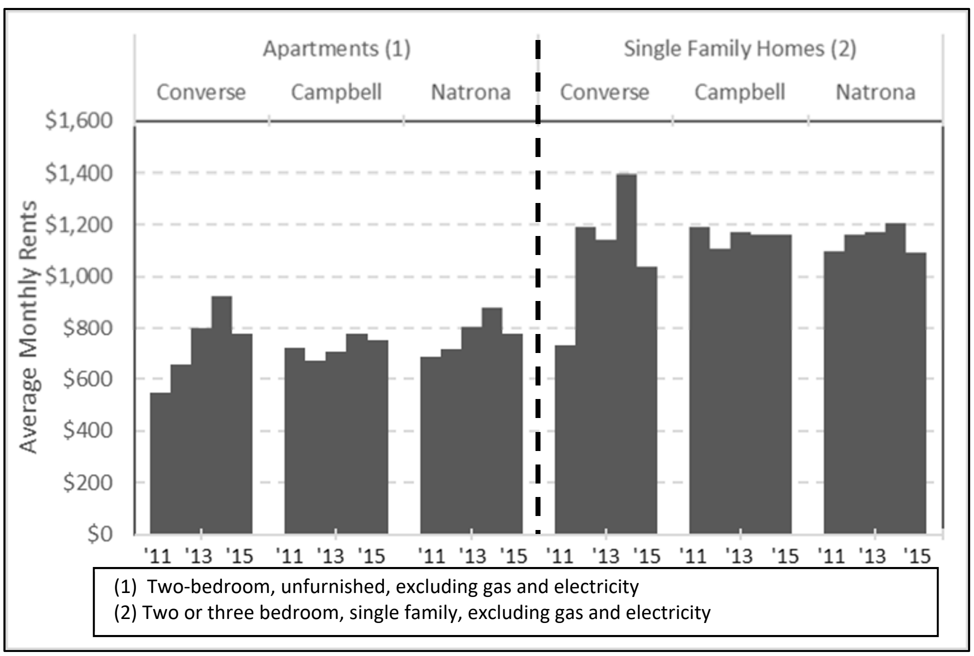


Figure 3.11-19 4th Quarter Average Monthly Rents for Apartments and Single Family Homes

Comparative Housing Cost

Housing costs in the analysis area (expressed in terms of a cost of living index) have been above the statewide average for the 3-year period from 2012 through 2014 (**Table 3.11-*23***). Housing costs in

Campbell and Natrona counties ranged between 104 and 107 during the period. In Converse County, the housing cost index rose from 106 in 2012 to 118 in 2014. The change is not a direct measure of the changes in housing costs, but rather, indicative that local housing costs had risen from 6 percent (106-100) in 2012 to 18 percent (118-100) above the statewide average (i.e., 100 percent) in 2014. The rising differential is indicative of increased demand in Converse County. Campbell and Natrona counties consistently ranked fourth and fifth highest in terms of comparative rankings to the rest of the state, while Converse County rose from fourth to second highest. In 2014, Teton County recorded the highest housing costs index value at 157.

Table 3.11-23 **Wyoming Comparative Cost of Living Index for Housing: 4th Quarter 2012 to 4th Quarter 2014**

Period	Converse County		Natrona County		Campbell County	
	Index Value[1]	Statewide Rank[2]	Index Value[1]	Statewide Rank[2]	Index Value[1]	Statewide Rank[2]
4th Quarter 2012	106	4th (tie)	104	5th	106	4th (tie)
4th Quarter 2013	109	3rd	105	5th	107	4th
4th Quarter 2014	118	2nd	106	5th	107	4th

[1] Statewide average = 100. The index value represents the local costs of living compared to the statewide average. Therefore, changes in the value are not a direct measure of changes in housing costs.

[2] The statewide rank is based on a total of 24 county/sub-county entities.

Source: EAD 2015.

Comparative cost burden provides another perspective on housing costs and affordability. A common guideline is that gross housing costs should be below 30 percent of gross household income. Estimates prepared by the Wyoming Community Development Authority in 2015 as part of its annual housing needs assessment for Wyoming reported higher percentage shares of households in all three counties with cost burdens of less than 30 percent compared to the statewide average (**Table 3.11-*24***). These estimates are based on the 2010-2014 American Community Survey (U.S. Census Bureau ***2015a***) likely reflected some of the increased housing costs in Converse County associated with oil and gas development in the analysis area. The estimated number of households in Converse County with housing cost burdens of 31 to 50 percent also was below the statewide average, whereas the percentage shares of such households in Natrona and Campbell counties exceeded the statewide average.

Table 3.11-24 **Housing Cost Burden: 2014**

Cost Burden (percent)	Percent of Households			
	Converse County	Natrona County	Campbell County	State of Wyoming
Less than 30	77.9	73.1	77.8	72.1
31 to 50	10.6	15.7	14.7	14.4
Above 50	6.0	8.6	6.4	9.8
Not Determined	5.5	2.7	1.1	3.7

Source: Wyoming Community Development Authority 2015.

Review of housing conditions during major oil and gas development in Wyoming and other western states reveals a strong correlation between housing demand created by an influx of workers and rising housing prices, particularly in the short-term. When strong demand is

sustained over a sufficiently long period of time, new residential construction for the rental and ownership markets tends to ease pressures on housing and stabilize housing costs. At the same time, sudden or long-term slowing in the pace of energy development and declining employment leads to stabilized or declining housing costs. An example of these patterns was evident in Sublette County, Wyoming in recent years (Appendix C, Section 4.1 provides additional detail regarding the changes in housing costs).

Sublette County has been a center of major natural gas development activity since the early 2000's. The pace of development accelerated rapidly between 2003 and 2008, with the number of new wells spud increasing from 212 to 705. The pace of development slowed, averaging 439 wells per year over the following three years. Fewer than 400 new wells per year have been developed since 2012 (WOGCC 2018). The combined number of jobs in the mining, construction and transportation industries in Sublette County, those most directly correlated with energy development and new real estate development, increased from 1,364 jobs in 2003 to a peak of 3,551 jobs in 2011. Since that time, the number of jobs in those industries has fallen by nearly 50 percent to 1,869 jobs in 2016 (the latest year for which data are available) (U.S. BEA 2017).

New residential development increased during the period of oil and gas development in Sublette County, stimulated by strong demand, housing shortages, and rising sales prices and rents. More than 1,200 additional units were added in the 4-year period 2006 through 2009, a net expansion of 29 percent in the total Sublette County housing stock (U.S. Census 2012, 2018). The average sales prices of single family homes more than doubled in the County between 2002 and 2007. After peaking at $334,073 in 2007, average sales prices declined as the pace of new well development slowed and the completion of new homes eased pent up demand and housing shortages. In 2012, 5 years after the average sales prices had peaked, the average sales price had declined by more than $92,000, or 27 percent (WCDA 2018).

Average monthly rents for apartments and single-family houses in Sublette and Converse Counties followed similar patterns during the same period; rising dramatically during periods of strong demand, then stabilizing or falling as new construction expanded the supply or demand eased in response to slowing levels of exploration and development. Average monthly rents in Sublette County peaked at $1,056 in 2011 but have since decreased by nearly 20 percent. Figure 3.11-20 shows the average sales prices and average monthly rents in Sublette County from 2002 through 2017 (WCDA 2018).

Figure 3.11-20 Average Annual Home Sales Prices and Monthly Rents for Apartments and Single-family Homes in Sublette County, 2002 through 2017

3.11.7.2 Temporary Housing

Temporary housing resources include motels, hotels, and RV parks. **Table 3.11-*25*** provides a summary of temporary housing resources in Campbell, Converse, and Natrona counties during 2014.

Table 3.11-25 **Temporary Housing Resources: 2014**

Location	Hotels and Motels		Recreational Vehicle Parks	
	Establishments	**Rooms**	**Parks**	**Pads**
Converse County				
Douglas	9	459	5	122
Glenrock	3	52	2	60
Bill	1	101 (1)	0	0
Natrona County				
Casper	26	2,254	5 (2)	173
Bar Nunn	0	0	1	74
Evansville	5	419	1	50
Mills	1	10	0	0
Campbell County				
Gillette	20	1,469	4	1,815
Wright	3	117	1	76
Total	**67**	**4,881**	**19**	**2,370**

[1] 70 rooms are reserved for Burlington Northern/Santa Fe (BNSF) Railroad crews.

[2] Does not include Casper Mountain Parks.

Source: Wyoming Travel and Tourism 2014, contacts with lodging proprietors.

In 2014, temporary housing resources in Converse County included a total of 612 hotel/motel rooms and 182 RV pads. There were 2,683 hotel/motel rooms and 297 RV pads in the Casper area of Natrona County and 1,586 hotel/motel rooms and 1,891 RV pads in Campbell County. Additionally, a new mid-size hotel (approximately 100 rooms) was under construction in Douglas, four hotels/motels were in development in Casper, and several other hotels and motels were under consideration for Gillette and Wright (Blanchard 2014; Chaffin 2014; Lehman 2014; Surface 2014).

According to local sources, occupancy of hotels/motels and RV parks in the Douglas, Glenrock, and Casper areas was high during 2014 due to the large number of temporary oil and gas workers in the area (Blanton 2014; Kindt 2014; McCreight 2014; Morell 2014; Neverve 2014; Sonesen 2014; Wyoming Lodging and Restaurant Association 2013). In Douglas, demand for RV park spaces prompted the administrators for the Wyoming State Fair to allow extended stays in RV park spaces at the fairgrounds and relocated some extended stay RVs to temporary quarters near the Douglas race track during the fair.

Motel and RV park occupancy rates in the analysis area typically are higher in the summer and fall and lower in the winter and spring. Occupancy rates generally are lower in Casper and Gillette than in Converse County. Casper has an estimated occupancy rate of approximately 70 percent during the workweek in summer months. Weekend occupancy can be higher due to sporting events and conventions (McCreight 2014; Morell 2014; Wyoming Lodging and Restaurant Association 2013).

Residential and Lodging Development Plans

The housing shortages, low vacancy rates, and high temporary lodging occupancy rates in the communities in the analysis area have generated new construction and development initiatives in many communities. Douglas approved two new hotels and a new approximately 50-unit extended-stay RV park (Chaffin 2014). A development company proposed a 1,500-acre annexation to the city, which would include plans for up to 1,800 homes as well as commercial, recreational, and other amenities (Douglas Budget 2014a).

Casper approved a 228-unit market rate apartment complex, the 134-unit third phase of a multi-family rental project, a 36-unit apartment complex that includes some low-income units, and the rehabilitation of an existing apartment complex that includes 50 to 60 low-income units. The city also approved five single-family developments with a total of over 400 lots and several additional large tracts for future development. Four hotel/motel projects with a total of 300 to 400 units were under construction in the city (City of Casper 2013a; Collins 2014).

During 2013, Gillette approved permits for 129 housing units and issued 140 permits for certificates of occupancy. By the end of the second quarter of 2014, Gillette had an additional 83 units that were eligible for a building permit and a number of subdivisions with a total of 648 units in the review process. Additionally, five motel chains had contacted the planning department about potential construction of new motels (City of Gillette 2014a; Surface 2014).

3.11.8 Public Infrastructure and Services

This section describes the 2014 availability and capacities of key public infrastructure and services for two geographies: the area within and along access roads to the proposed CCPA and the area in the socioeconomic and environmental justice analysis area, which includes counties and communities where oil and gas service workers may reside.

3.11.8.1 Converse County Project Area

Converse County and several special districts and volunteer organizations provide a limited range of services in the unincorporated area of the county that includes the CCPA. These services primarily include law enforcement, emergency response (fire and emergency medical), road maintenance, and weed and pest control.

Law enforcement services in the CCPA are provided by the Converse County Sheriff's Department.

Fire suppression in the CCPA is provided by the Douglas Volunteer Fire Department, which responds to structure fires; the Glenrock Fire Department; and the Converse County Rural Fire Control Association, which responds to grass and wildland fires. Converse County is divided into nine rural fire protection zones. The Rural Fire Control Association is staffed by volunteers who live in the zones and fire equipment (primarily wildland attack trucks) is stationed at different locations within the zones.

Ambulance response for medical emergencies in the CCPA is provided by the ambulance service from Memorial Hospital of Converse County. Wyoming Life Flight, based at Wyoming Medical Center in Casper, can provide medivac emergency response and transport to the CCPA.

Converse County provides road maintenance and weed and pest control services on and along county roads within and providing access to the CCPA.

3.11.8.2 Counties and Communities

This section describes essential public infrastructure and services in the ***analysis*** area, and where available, describes the capacity of those systems to accommodate additional demand.

Law Enforcement

Law enforcement services within the analysis area are provided by the Wyoming Highway Patrol; the Converse, Natrona, and Campbell county sheriff's departments; and the Douglas, Glenrock, Casper, Evansville, Mills, and Gillette police departments.

Wyoming Highway Patrol officers are assigned to divisions in Douglas, Casper, and Gillette. **Table 3.11-*26*** provides a summary of the 2013 staffing for county and municipal law enforcement agencies within the analysis area.

Table 3.11-26 **Law Enforcement Personnel Per 1,000 Population and Index Crimes Per Officer: 2013**

County/Agency	Employees			Officers Per 1,000 Population	Index Crimes Per Officer
	Total	Officers	Civilian		
Converse County					
Sheriff	42	33	9	2.3	1.9
Douglas	22	14	8	2.2	15.5
Glenrock	12	7	5	2.7	5.3
Converse County Total	76	55	22	3.8	5.9
Natrona County					
Sheriff[1]	162	120	42	1.2	1.9
Casper	146	98	48	1.7	21.7
Evansville	12	10	2	3.5	4.9
Mills	15	12	3	3.4	11.5
Natrona County Total	335	240	95	3.0	10.6
Campbell County					
Sheriff	61	46	15	1.0	5.2
Gillette	83	53	30	1.7	20.0
Wright	NA	NA	NA	NA	NA
Campbell County Total	144	99	45	2.0	13.2

[1] From Natrona County employee data from 2013.

Source: Wyoming Office of Attorney General 2014.

Converse County

The Converse County Sheriff's Office had a 2013 staffing level of 42, including 33 sworn officers and nine civilian employees. The Sheriff's Office also provides dispatch services and operates the Converse County Detention Center, which is a 34-bed facility that is the oldest jail in the state. Fall 2014 detention center occupancy averaged 28 to 30 detainees; however, an additional 10 to 15 detainees were routinely housed in the Platte County Detention Center in Wheatland or in treatment facilities. The Converse County Commissioners funded a transport officer position for the 2014–2015 fiscal year to facilitate detainee transfers. The detention center administrator observed an increase in detainee's length of stay in the detention center due to the more serious nature of offenses (Stoneking 2014).

The Converse County Commission and the City of Douglas are in the process of developing a new justice center at the old airport site in the southeastern portion of Douglas. The center is anticipated to be built in two phases. The first phase would include administrative and other offices for the Sheriff and Douglas Police departments, new county detention facilities, and a joint dispatch center that would provide dispatch services for the two departments and countywide emergency services. The second phase would include the district, circuit, and Douglas municipal courts as well as offices for prosecuting and county attorneys (Becker 2014; Converse County Board of Commissioners 2014e; Willox 2014).

The Converse County Sheriff's Office experienced increased demand associated with the influx of workers and increased traffic associated with the oil and gas development occurring in the county during 2014. As a result of the increased oil and gas development, the sheriff's office responded to increasing numbers of calls for heavy truck accidents, traffic management, and illegal dumping. Increases in calls for service averaged approximately 20 to 25 percent annually during the 3-year period ending in 2013. Crashes on public roadways (i.e., federal and state highways and county roads) increased by 39 percent between 2010 and 2013, from 392 to 546 total crashes (Carpenter 2014). The sheriff's office also experienced increases in the number of crimes reported and investigated. Primary factors contributing to the increase included oil and gas and other industrial development and construction activity, general population growth, and changes in enforcement patterns. In response to the increased demands, the county increased the sheriff's office staff, including adding two deputies in 2014 (the transport officer described above and a weights and measures officer for county roads) and one investigator in 2013 (Becker 2014; Douglas Budget 2014b).

The Douglas Police Department had a 2013 staff level of 22, including 14 sworn officers and 8 civilian personnel. In 2014, the number of officers was increased to 17 and the police department foresaw the need to add one or two additional officers to accommodate the increase in law enforcement calls associated with the increased temporary worker population (City of Douglas 2014a).

The Glenrock Police Department employed 12 personnel in 2013, including 7 sworn officers and 5 administrative staff. The Glenrock Dispatch Center provides 24-hour emergency dispatch of law enforcement, fire, medical services, and animal control to Glenrock, Rolling Hills, and the remainder of western Converse County (Glenrock Police Department 2014b).

<u>Natrona County</u>

The Natrona County Sheriff's Office employed a total of 162 employees in 2013; of those, 120 were sworn officers and 42 were civilian personnel. The sheriff's office has resident deputies at Alcova Lake, Casper Mountain, and Midwest, and also provides law enforcement services for the Town of Bar Nunn on a contract basis. The Natrona County Sheriff's Office operates the Natrona County Detention Center, which has capacity to accommodate 476 detainees (Natrona County Sheriff's Department 2014a). Recent detention center occupancy has averaged between 250 and 300 detainees (Holbrook 2014).

The Casper Public Safety Communications Center is a 24-hour, 365-day-a-year operation and is responsible for answering 9-1-1 emergency calls that originate from within Natrona County. The Casper center primarily dispatches calls for service for the Casper Police Department, Natrona County Sheriff's Office, Mills and Evansville police departments, Natrona County Fire District, and the Wyoming Medical Center medical services units. Additionally, the Center dispatches for the Mills, Bar Nunn, and Evansville fire departments as well as Salt Creek Emergency Services (Midwest/Edgerton). The Casper Public Safety Communications Center employed 19 full-time dispatchers and five part-time dispatchers in 2014. All dispatchers receive training in Emergency Medical Dispatching as well (Casper Public Safety Communications Center 2014).

The Casper Police Department had 146 employees during 2013, including 98 sworn officers and 48 civilian staff. The Evansville Police Department had 12 employees, including 10 sworn officers and 2 administrative staff, and the Mills Police Department had 15 employees, including 12 sworn officers and 3 administrative staff.

Campbell County

The Campbell County Sheriff's Office is headquartered in Gillette and provides law enforcement, detention, court security, and animal control services for the county. The sheriff's office maintains a substation in the Town of Wright and provides law enforcement services for Wright under a contract between the town and the county. In 2013, the Campbell County Sheriff's Office had 46 sworn officers, including 5 deputies in Wright. The Campbell County Sheriff's Office operates a dispatch center, staffed by 11 communications employees on a round-the-clock basis. The dispatch center also provides dispatch services for the Campbell County Fire Department and Campbell County Emergency Medical Services.

Originally constructed in 1985, the Campbell County Detention Center has undergone several expansions, the most recent of which increased the maximum housing capacity at the facility to 306 detainees. The expansion included a 16-bed juvenile detention facility and kitchen and laundry facilities capable of serving 500 detainees. The detention center was staffed by 57 detention officers and 11 civilian staff during 2014 (Campbell County Sheriff's Office 2014e). Average daily occupancy during 2013 was 137 detainees; by late June 2014, average daily occupancy was 163, with a peak day of 191 detainees (Cheairs 2014).

The Gillette Police Department, the third-largest department in the state in terms of number of officers, has primary responsibility for law enforcement within the city's corporate limits (AECOM 2012b). The 2013 staffing level of the Gillette Policy Department was 83, including 53 sworn officers and 30 civilian employees.

3.11.8.3 Emergency Response (Fire and Emergency Medical)

Fire suppression, emergency medical services (EMS), and ambulance services within the analysis area are provided by a variety of agencies and organizations using paid and volunteer staff.

Fire Suppression Services

Table 3.11-*27* provides a summary of the public fire suppression agencies within the analysis area, along with information about agency staffing.

Table 3.11-27 **Public Fire Protection Agencies Within the *Analysis* Area**

	Number of Fire Stations	Fire Fighters (number)		EMS Services (number)		
		Full/Part Time Paid	Volunteer	EMS Services	Basic EMTs	Advanced EMTs
Converse County						
Converse County Rural Fire Control Association	1	0	105	No	0	0
Douglas Volunteer Fire Department	1	0	45	Yes	14	2
Glenrock/Converse County Volunteer Fire Department	2	0	40	No	3	0
Converse County Total	4	0	190		17	2

Table 3.11-27 Public Fire Protection Agencies Within the *Analysis* Area

	Number of Fire Stations	Fire Fighters (number)		EMS Services (number)		
		Full/Part Time Paid	Volunteer	EMS Services	Basic EMTs	Advanced EMTs
Campbell County						
Campbell County Fire Department	10	30	150	No	0	0
Gillette/Campbell County Airport Fire Department	1	4	0	No	0	0
Campbell County Total	11	34	150		0	0
Natrona County						
Bar Nunn Volunteer Fire Department	1	0	24	Yes	11	0
Casper Fire Department	5	76	0	Yes	71	38
Casper Mountain Fire Department	1	0	40	No	0	0
Evansville Fire Department	1	16	34	Yes	21	11
Mills Volunteer Fire Department	1	9	12	Yes	5	11
Natrona County Fire Protection District	2	19	0	Yes	9	9
Natrona County International Airport Fire Department	1	10	0	N	1	0
Salt Creek Emergency Services Stations 16 and 17 (Edgerton)	2	0	21	Yes	12	0
Natrona County Total	14	130	131		130	69
Three-county Total	29	164	471		147	71[1]

EMT = emergency medical technician.

Source: Wyoming State Fire Marshal 2014.

Converse County fire protection agencies are exclusively staffed by volunteers. The Douglas Volunteer Fire Department typically has 45 volunteers and is the lead responder for structure fires in Douglas and throughout Converse County. The Douglas Volunteer Fire Department has identified a future need for satellite fire stations on the east and west sides of Douglas (City of Douglas 2014a).

The Glenrock Volunteer Fire Department had 40 volunteers during 2012. The Converse County Rural Fire Control Association, which has nine zones that cover all rural areas of Converse County, responds to wildland and grass fires. Each zone has a fire warden and limited fire suppression equipment. The Converse County Rural Fire Control Association is staffed by 105 volunteers (Reed 2014).

The Natrona County Fire Protection District and Casper Fire Department have paid staff only. Other Natrona County protection agencies are staffed by a combination of paid and volunteer staff. The Campbell County Fire Department is governed by a Joint Powers Fire Board representing the City of Gillette, the Town of Wright, and Campbell County. The department provides fire, rescue, EMS, and hazardous materials response services from 10 fire stations and 11 wildland support stations. Campbell County Fire Department Station 1 in Gillette is staffed 24 hours per day. In 2013, the Campbell County

Fire Department had approximately 30 paid staff and 150 volunteers. The Wright Station has both paid staff (two) and volunteers (Shank 2014). The Campbell County Sheriff's Department provides dispatch services for the fire department (Campbell County Fire Department 2014d; Izatt 2014).

Emergency Medical Services

Ambulance response for medical emergencies in the CCPA and along access routes from the south and east are provided by the Memorial Hospital of Converse County Ambulance Service. Ambulance response to medical emergencies along proposed CCPA access routes in Natrona and Campbell counties are provided by the Wyoming Medical Center in Casper and by Campbell County Memorial Hospital EMS, with ambulance stations in Wright and Gillette.

The Memorial Hospital of Converse County Ambulance Service provides emergency medical response and ambulance services from its Douglas and Glenrock stations. The ambulance service operates six ambulances countywide; three ambulance units are stationed in Douglas at the Memorial Hospital of Converse County along with a staff crew and a back-up crew. All ambulances in Douglas are staffed with an EMT and a paramedic. The Glenrock ambulance station has two ambulances (AECOM 2012b; Memorial Hospital of Converse County 2014b).

The Wyoming Medical Center in Casper also provides ambulance and EMT services across central Wyoming, responding to more than 10,000 calls for service and transports over 7,000 patients each year (Wyoming Medical Center 2014a). In the event of serious injuries, helicopter-based medivac and emergency transport services are available via Life Flight dispatched from the Wyoming Medical Center.

In 2014, Campbell County Memorial Hospital EMS had a staff of 48, including: 16 EMT–paramedics, 7 EMT–intermediates, 21 EMT–basic attendants, 1 EMT–paramedic/registered nurse, 1 EMT/registered nurse, 1 EMT/pharmacist, and 1 registered nurse (Campbell County Memorial Hospital 2014a).

3.11.8.4 Water Supply and Treatment

This section covers municipal water systems administered by municipalities, water and sewer districts, and regional joint powers boards within the socioeconomic analysis area. See Section 3.16, Water Resources, for a more detailed discussion of the affected environment for surface water and groundwater resources. **Table 3.11-*28*** provides a summary of the water systems within the analysis area, their system and treated water storage capacities, and peak daily use.

Douglas

The Douglas water system served a population of 6,120 in 2013, including 2,076 residential households and 275 commercial service connections within the City of Douglas and an additional 33 residential households and 19 commercial connections in unincorporated areas outside the city. The system relies on water from a spring, a well, and from the North Platte River during May through September. The Douglas water system has total treated storage capacity of 6.1 million gallons, functional treated storage of 4 million gallons, and maximum water delivery capacity of 5.6 mgd. However, seasonal restrictions on the groundwater well and limitations on the treatment plant has resulted in a reliable system delivery capacity of 3.8 mgd during certain times of the year. The water system had an average daily demand of 1.7 mgd in 2012 and experienced a peak use of approximately 3.6 mgd in July 2012.

Table 3.11-28 **Water System Capacities and Utilization: 2013**

Community	Population Served	System Delivery Capacity (mgd)[1]	Treated Water Storage Capacity (million gallons)	Peak Daily Usage (mgd)
Douglas	6,120	5.6	6.1	1.7
Glenrock	2,550	3.5	2.05	1.7
Casper (Central Wyoming Regional Water System)	62,000 (56,000 in Casper)	39.0	26.0	29.2
Bar Nunn (Wardwell Water and Sewer District)	3,857		Receives water from the Central Wyoming Regional Water System	
Evansville[2]	2,500	0.002	3.0	0.8
Mills	3,300	3.2	5.0	1.55
Gillette	>37,000	14.4	22	13.35
Wright	>2,500	1.9	1.5	1.3

[1] mgd = million gallons per day.

[2] 2007 data.

Source: Wyoming Water Development Commission 2013a.

The Douglas water system has the capacity to accommodate some growth, although improvements to the transmission and distribution systems would be required at some point. The water department sells bulk water for use in oil and gas development, and these sales could be reduced or discontinued to accommodate more residential growth. Another option considered by the water department to substantially reduce peak demands on the treated water system would be through the development of a raw water distribution system to selected areas of the city that would support the distribution of raw water for seasonal irrigation purposes. Douglas plans to submit an application to the Wyoming Water Development Commission for a Level II water study to identify possible locations for a new well (City of Douglas 2014a; Newton 2014; Wyoming Water Development Commission 2013b).

Glenrock

Glenrock provided water services to a population of approximately 2,550 in 2013. The water system capacity is 3.5 mgd, and 2013 peak daily use was 1.7 mgd. The town has 2.05 million gallons of storage capacity (Wyoming Water Development Commission 2013). Although the town has adequate water supply to accommodate a population of up to 10,000, the conveyance system from the source to the town is constrained, and additional transmission capacity would be required when the town reaches a population of 3,000 (Andrews 2014).

Casper

The Casper municipal water system receives water from the Central Wyoming Regional Water System, which is managed by a joint powers board that includes representatives from Casper and other Natrona County local governments (Central Wyoming Regional Water System 2014). In the mid-1990s, the Central Wyoming Regional Water System was formed to serve the water supply needs of all the communities in the greater Casper area. The system obtains water from a series of wells, augmented by water pumped from the North Platte River during periods of peak summer demand (Gollnitz et al. 2006). While normally adequate to accommodate existing demand with some unused capacity, peak flows on the North Platte River have resulted in periods when the wellfields were shut down because the high river flows threatened the integrity of the wells, and the subsequent drop in stored water resulted in lawn watering restrictions (Casper Star Tribune 2010).

The Casper water system served a population of 62,000 in 2013, including 56,000 residents of Casper. Total 2013 system delivery capacity was 39 mgd, and treated water storage capacity was 26 million gallons. Peak 2013 water use was 29.2 mgd (Wyoming Water Development Commission 2013a).

The Wardwell Water and Sewer District, which serves Bar Nunn, also receives its water from the Central Wyoming Regional Water System. The Evansville water system served 2,500 residents in 2007. The treated water storage capacity was 3 million gallons, and peak use was 0.8 mgd (Wyoming Water Development Commission 2013a). Mills served 3,300 residents in 2013. System capacity was 3.2 mgd, treated water storage was 5 million gallons, and peak use was 1.55 mgd (Wyoming Water Development Commission 2013a).

Gillette

The City of Gillette provides water services in the city and to some portions of the surrounding Gillette Urban Service Area. The Gillette Water Division produces and distributes potable water to Gillette's residents, businesses, public facilities, and parks. In 2013, peak water production was 11.3 mgd, delivery capacity was 14.4 mgd, total treated water storage was 22 million gallons, and peak use was 13.35 mgd (Wyoming Water Development Commission 2013a).

To better serve recent population growth and accommodate anticipated growth in Gillette and other areas of northeast Wyoming, Gillette and Campbell County entered into the Gillette Regional Water Supply System Joint Powers Agreement in December 2010. The primary purpose of the Gillette Regional Water Supply Project was to provide a new water supply, install regional extensions to serve local water districts, and make improvements to internal distribution systems of participating water districts. The Gillette Regional Water Supply Project is intended to serve regional needs for the next 30 years, based on a design regional population of approximately 57,000 (the population of Gillette and the immediate regional area surrounding Gillette currently exceeds 37,000) (City of Gillette 2014b).

Wright

Water supply and treatment services in and near Wright are provided by the Wright Water and Sewer District. Currently, the district provides water to over 2,500 residents. The 2013 water system capacity was 1.9 mgd, total treated water storage was 1.5 million gallons, and peak water use was 1.3 mgd (Wyoming Water Development Commission 2013a). The recently completed 20-year plan for the district water and wastewater systems is to develop capacity to serve 5,000 residents. The district has state permits for two additional wells and plans to construct a second storage tank. These improvements will provide water system capacity to serve the target population of 5,000 residents (AECOM 2014b).

3.11.8.5 Wastewater Treatment

The Douglas wastewater system has a treatment capacity of approximately 1.5 mgd. In 2011, the system averaged from approximately 0.6 mgd in January to almost 0.8 mgd in August (City of Douglas 2014a). The Douglas Public Works Department treats some wastewater from oil and gas temporary living facilities (Newton 2014).

The Town of Glenrock provides wastewater treatment services to over 2,500 residents. With recently completed upgrades to the lagoon system, the wastewater utility could accommodate a population of 3,300 (Andrews 2014).

The Sam Hobbs Regional Wastewater Treatment Facility, which treats the effluent from approximately 67,000 people in Casper and the surrounding communities, has a design capacity of 10 mgd. From 2010 to 2012, the facility had an average daily flow of approximately 7 mgd (City of Casper 2013b) approximately 70 percent of design capacity. The facility may require up to $29 million in upgrades within the next decade to meet USEPA discharge standards (Casper Star Tribune 2014a).

The Gillette Wastewater Division collects and treats the sewage produced by the citizens and businesses of Gillette. The Gillette wastewater system served approximately 30,000 residents and associated commercial, industrial, and municipal demand in 2013. Improvements to the wastewater treatment plant completed in 2007 increased the plant capacity from 3.85 mgd to 5.12 mgd. These improvements should allow the system to accommodate approximately 35,000 people (Mulder 2012).

Wastewater collection and treatment services in Wright are provided by the Wright Water and Sewer District. In 2013, the district provides wastewater services to over 2,500 residents. The district recently completed renovation and expansion of the wastewater lagoon system, which now provides capacity to accommodate the target population of 5,000 residents (Kingan 2012).

3.11.8.6 Solid Waste Disposal

The City of Douglas operates a landfill for both municipal solid waste and construction/demolition waste. Upon completion of a transfer station, Douglas will begin transporting municipal solid waste to the Casper Regional Landfill for disposal. The Douglas landfill will continue to accept construction/demolition waste until the city council approves development of a new cell at the landfill (Newton 2014).

Glenrock and all Natrona County municipalities within the analysis area transport municipal solid waste to the Casper Regional Landfill for disposal. Municipal solid waste is collected by a variety of municipal and private trash haulers and transported to transfer stations or hauled directly to the Casper Regional Landfill. The City of Casper is permitted to operate the regional landfill on a 1,750-acre site. Phase I of the landfill included 88 acres with an estimated capacity of 11,920,000 cubic yards and has an estimated lifespan of 50 years. Five future cells also have estimated life spans of 50 years (Inberg-Miller Engineers 2009).

All Campbell County municipalities and unincorporated areas transport their municipal solid waste and construction/demolition waste to the Campbell County landfill west of Gillette. The landfill also is licensed to accept drilling mud and oil-contaminated waste. As of 2014, the Campbell County landfill had capacity for another 45 years at current fill rates and was in the process of becoming a regional landfill so that it could accept waste from surrounding counties (Giffin 2014).

3.11.8.7 Converse County Road and Bridge Department

This section addresses the operations of the Converse County Road and Bridge Department. The Natrona County and Campbell County road and bridge departments are not addressed because they are unlikely to be substantially affected by development and operation of the Project. See Section 3.13, Transportation, for a broader discussion of transportation.

The Converse County Road and Bridge Department had 20 employees as of November of 2014, including 15 equipment operators. Two of the employees were hired in response to the increased demand, and the department increased its working week to include mandatory overtime every other Friday (Converse County 2015b).

In 2014, Converse County had 650 miles of roads, including 130 miles of paved roads and 520 miles of gravel or dirt roads. Most county roads were designed for agricultural use. Some county roads have accommodated prior oil and gas exploration and uranium mining, but in general, these roads were not designed to accommodate the traffic volumes or truck weights associated with the recent levels of oil and gas development (McWilliams 2014). Volumes of traffic (primarily heavy truck traffic) have increased dramatically on county roads that provide access to well pads and ancillary facilities such as disposal sites, oil load out facilities, and gas plants. For example, traffic on the Bill Haul Road increased from an average of fewer than 10 vehicles per day in 2008 to over 1,000 vehicles per day for the period counted in 2013. Even after wells are drilled and completed, hauling of oil and produced water generates high truck traffic volumes on county roads. Dust also is a major problem on unpaved county roads.

The high volumes of heavy truck traffic substantially displace the gravel on county roads, necessitating more frequent replacement on more miles of road at substantial cost to the county. Rig moves and increased volumes of heavy truck traffic, coupled with the use of roads when muddy, has resulted in filled-in cattle guards, damages to barrow pits, and requirements for more frequent maintenance. The county also has needed to replace many culverts as a result of overweight loads. The county tries to blade roads that serve oil and gas development every several weeks. Prior to the development, some roads were bladed only once or twice per year.

The county has reconstructed and paved many miles of roads to accommodate the increased volume of heavy trucks associated with oil and gas development. Road construction and maintenance is funded through a combination of county funds and revenues from companies obtained through road use agreements. Converse County Road and Bridge Department expenditures have increased from $2.2 million in fiscal year 2009 to a budgeted $25.8 million in fiscal year 2015. Road use agreements typically are negotiated for roads leading to high traffic facilities. They require companies to fund or improve some roads, perform maintenance activities to county standards, and return roads to original condition.

The proliferation of gravel pits in the county, developed primarily to support well pad, access road, and other oil and gas infrastructure demand, has generated additional heavy truck traffic on county roads that previously had seen relatively little traffic. Some of the affected roads are located south of I-25, outside of the CCPA.

The county also has expended considerable funds to substantially improve roads leading to new oil and gas facilities such as rail transfer facilities and gas plants, and they typically negotiate road use agreements with the operators of these facilities.

Converse County requires permits for oversize/overweight vehicles. The County Commissioners funded a weights and measures enforcement officer for the sheriff's department starting in early 2015. Some oil and gas companies have provided gravel for improving roads to a few locations, and some companies blade certain county roads in winter.

Although Converse County has increased road expenditures, staff, and equipment, the Road and Bridge Department was still unable to keep up with road maintenance demand during 2014 (McWilliams 2014; Willox 2014).

3.11.8.8 Health Care

Hospitals and health clinics serve as the foundation for health care in the analysis area. Each county has a hospital located in the county seat. Services provided reflect the service area population for each facility, fiscal resources, and distances to other healthcare facilities. Individual and group medical and dental practices partner with these institutions to meet the healthcare needs of the community.

Hospitals and clinics located within the analysis area include:

- Memorial Hospital of Converse County in Douglas and associated clinics located in Douglas and Glenrock;
- Glenrock Hospital District Glenrock Clinic;
- Wyoming Medical Center and clinics located in Casper;
- Mountain View Regional Hospital located in Casper;
- Campbell County Memorial Hospital and associated clinics in Gillette; and
- Campbell County Memorial Hospital clinic located in Wright.

Other specialized private medical clinics and practices are located in Gillette, Douglas, and Casper.

Memorial Hospital of Converse County

The Memorial Hospital of Converse County is a 25-bed critical access, acute care hospital with 2 ICU beds, 2 labor/post-partum suites, and 4 nursery cradles. All other rooms are semi-private. All attending physicians at the hospital are board-certified. Memorial Hospital of Converse County opened a medical office building in March of 2014 that houses doctors and providers, a wellness clinic, and an urgent care clinic. The average inpatient daily census for 2013 was 6.5 patients. During the summer of 2014 the average daily census increased to 9.5. The hospital added several hospitalists (on-staff physicians specializing in the care of hospitalized patients) and other physicians to the staff in response to increased demand from oil and gas development in the county. During 2014, the Memorial Hospital of Converse County experienced a substantial increase in visits to its emergency room and urgent care facility, which was attributed to the population associated with oil and gas development and the fact that temporary oil and gas workers typically do not have local primary care physicians (Dugger 2014; Memorial Hospital of Converse County 2014a, 2013).

The Oregon Trail Rural Health Clinic located in Glenrock, Wyoming, is an extension of Memorial Hospital of Converse County. In addition to healthcare providers, the clinic also is home to Glenrock EMS services, offering advanced cardiac life support, trauma support, and other EMS services (Memorial Hospital of Converse County 2014b).

Glenrock Health Center

The Glenrock Health Center is a certified Rural Health Clinic staffed by full-time physician assistants, registered nurses, local dentists, and a lab/X-ray technician, all on-site on a rotating basis. The Glenrock Health Center only provides outpatient services (i.e., there are no inpatient beds). Minor to moderate injuries are stabilized and transferred to an inpatient facility if needed (Glenrock Health Center 2014a).

Wyoming Medical Center

The Wyoming Medical Center in Casper is a Joint Commission Accredited regional medical center and Level 2 Trauma Center with over 200 beds, 150 physicians on staff, and 194 other physicians with admission and practice privileges at the hospital. The center offers a complete range of health care services including 75 medical specialties, complete emergency facilities, surgical accommodations, and rehabilitative services (Wyoming Medical Center 2014c). The average daily inpatient census for fiscal year 2014 was 90.5 patients (Cepeda 2014). In 2013, Wyoming Medical Center served 8,941 inpatients and had 37,657 emergency room visits (Wyoming Medical Center 2014a). The center provides a Life Flight helicopter and fixed-wing medivac and transport services (Wyoming Medical Center 2014b). A $42.5 million, 100,000-square-foot expansion of the McMurry West Tower, which houses an orthopedic/spine surgical floor; a new labor and delivery area; private patient suites; waiting and admitting rooms; a wellness center; and a number of other facilities opened in September of 2014 (Wyoming Medical Center 2014d).

Casper has two urgent-care facilities, several outpatient/day surgical centers, and a private, physician-owned hospital called Mountain View Regional Hospital (Wyoming Medical Center 2014c). A new private hospital, Summit Medical Center, is scheduled to open in Casper in early 2015 with 16 private rooms, four operating rooms and radiological services (Casper Star Tribune 2014b).

Campbell County Memorial Hospital and Clinics

The Campbell County Memorial Hospital in Gillette operates a 90-bed acute-care hospital, the 150-bed Pioneer Manor Long-term Care Facility, an ambulatory surgical center, and 14 specialty clinics. Hospital inpatient services include medical, surgical, emergency room, an intensive care unit, Wyoming Orthopedic and Rehabilitation Institute, maternal child, and hospice. The average daily inpatient census at the Campbell County Memorial Hospital for fiscal year 2014 was 25 patients (Long 2014). Outpatient services include behavioral health services, cancer care, cardiopulmonary services, home healthcare, laboratory, pediatric specialty clinic, and a variety of other clinics and services.

The Campbell County Memorial Hospital completed a 3-year, $68 million expansion project that included a surgical service department; main lobby and administration areas; extensive interior remodeling; a 3.5-level, 273-space parking structure; and an unfinished second floor to accommodate future growth. Future expansion plans include the construction of a new long-term care facility, renovation and expansion of radiology services, and construction of additional physician clinic space (Campbell County Memorial Hospital 2014b).

Wright Walk-In Clinic

Campbell County Memorial Hospital also operates the Wright Walk-in Clinic, which provides family health care services, laboratory, x-ray, physical therapy, visiting physician, and counseling services to the Town of Wright and the surrounding area of Campbell County (Campbell County Memorial Hospital 2014c).

3.11.8.9 Social Services

The Wyoming Department of Family Services offers human services in four main program areas: public assistance (i.e., nutrition support and home heating help), child support enforcement, juvenile services, and protective services. Wyoming Department of Family Services offices are located in Douglas, Glenrock, Casper, and Gillette. The Glenrock office is staffed on a regularly scheduled basis from the Douglas office.

Wyoming Department of Family Services receives its funding from the State of Wyoming and the federal government. The total operating budget for fiscal year 2015-2016 was $295 million. Of that, $171 million was provided by the state general fund. Another $114 million was from federal sources, and $10 million was from special revenue funding.

Public assistance caseloads in Converse County decreased from 2011 through 2014, in large part due to the availability of jobs. For example, the Supplemental Nutritional Assistance Program caseloads at the Douglas and Glenrock offices for the month of August decreased by 24 percent between 2011 and 2014, from 327 households to 251 households (Herb 2014).

Converse Social Services intakes (reports of abuse and neglect for children and adults, and juvenile probation referrals) for 2013 were 3 percent higher than 2010 intakes, and 2012 intakes were 16 percent higher than 2010 intakes; however, other social services program caseloads have declined since 2010. For example, the number of substantiated child/adult abuse or neglect allegations fell from 83 in 2010 to 28 in 2013; the number of open Department of Family Services cases fell from 1,037 to 966, and the number of placements (i.e., the average monthly number of children in placement due to abuse/neglect or juvenile probation) fell from 48 to 35. However, the latter category may have been affected by the national requirement to place children with relatives rather than in foster care. Although the number of ongoing social services cases in Converse County decreased, the number of cases involving drugs increased substantially (Lebsack 2014).

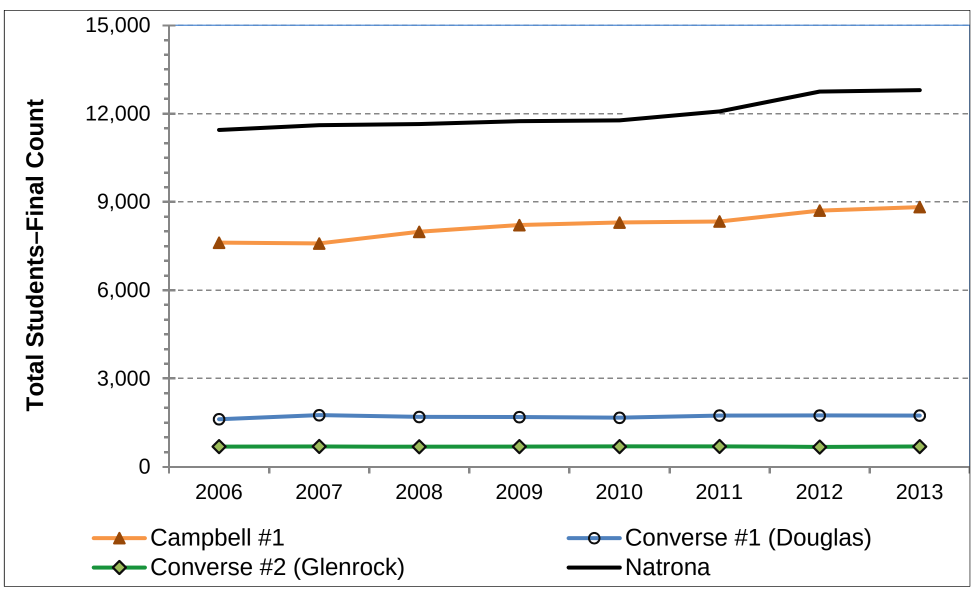
3.11.9 Public Schools

School districts in the analysis area serve students associated with energy and mineral development in Campbell, Converse, and Natrona counties. These school districts, the Wyoming School Foundation Program, and the Wyoming School Finance Department (WSFD) derive revenues from taxes on the mineral and energy industries. These state programs are intended to provide Wyoming school districts a guaranteed level of funding and adequate educational facilities, regardless of the local tax base.

3.11.9.1 Overview and District Summaries

Four school districts serve the analysis area: Converse County School District #1 (Converse #1) is based in Douglas and serves the eastern portion of Converse County, Converse County School District #2 (Converse #2) is based in Glenrock and serves the western portion of Converse County, Natrona County School District #1 (Natrona #1) is based in Casper and serves all of Natrona County, and Campbell County School District #1 (Campbell #1) is based in Gillette and serves all of Campbell County. Public school enrollment across the analysis area generally mirrored economic trends in recent years, climbing during periods of oil and gas development, rising coal production, and power plant, pipeline, and wind farm construction but moderating during the national economic recession between 2007 and 2010.

Table 3.11-*29* and **Figure 3.11-*21*** provide an overview of the school districts in terms of the number of schools in operation and recent enrollment trends. Of the four districts, Natrona #1 is the largest in terms of enrollment with 12,796 students in the fall of 2013. Campbell #1 had 8,826 students, while Converse #1 and Converse #2 registered 1,742 and 690 students, respectively. District-wide enrollment in Campbell County climbed by 16 percent in the 8-year period from the 2006/2007 to the 2013/2014 school year. Converse #1 and Natrona #1 also saw increases in enrollment, while enrollment in Converse #2 remained relatively constant. All four districts have opened one or more new schools in recent years. Although fall school enrollments for the 2014/2015 school year were not available at the time of this assessment, Converse County #2 enrollment remained relatively flat while Converse #1 enrollment increased by approximately 30 students. Superintendents of both Converse County school districts report modest enrollment gains associated with the current oil and gas development, but also report a high degree of transiency and incidence of special and remedial education needs among those students (Espeland 2014; Hughes 2014).



Source: Wyoming Department of Education 2014a.

Figure 3.11-21 **Total Fall Enrollment for Public School Districts**

Table 3.11-29 **Selected Characteristics of Public School Districts in Analysis Area**

School District	District Office Location	Number of Schools in Operation	Total Staff 2012/2013 (Full-Time Equivalent)	Student Enrollment			
				2006/2007 School Year	2013/2014 School Year	Change	Percent Change
Converse #1	Douglas	10	357.6	1,617	1,742	125	8
Converse #2	Glenrock	5	136.2	687	690	3	0
Natrona #1	Casper	35	2,130.5	11,445	12,796	1,351	12
Campbell #1	Gillette	21	1,571.8	7,617	8,826	1,209	16

Source: Wyoming Department of Education 2014a,b.

Converse County School District #1

Converse #1 covers Douglas, Shawnee, and the remainder of eastern Converse County. The district operates five schools in Douglas, organized as follows: primary (kindergarten through grade 2), two intermediate schools (grades 2 through 5), middle (grades 6 through 8), and high school (grades 9 through 12). One of the intermediate schools was completed in 2012, allowing some reconfiguration of classes to alleviate pressures at the primary and intermediate schools due to high enrollments. The district also has five rural kindergarten through grade 8 schools, including the newer Walker Creek School. These schools are used on an as-needed basis (AECOM 2012b; WSFD 2014).

The City of Douglas currently relies on school district facilities to support indoor community recreation, although Converse County is assessing the feasibility of constructing and operating a separate community recreation center. For a number of years, the community has paid an optional 1.0-mill property tax (a mill is $0.001 [i.e., 1/1000 of dollar] and is applied to the assessed valuation to derive the amount of taxes levied) to operate recreation programs and facilities.

Converse County School District #2

Converse #2 operates four schools in the Town of Glenrock and a remote school south of Glenrock (the Boxelder School) in the western part of the county. The schools in Glenrock include an elementary school (kindergarten through grade 4), an intermediate school (grades 5 and 6), a middle school (grades 7 and 8), and a high school (grades 9 through 12). The Boxelder School is used on an as-needed basis. Total district enrollment was 690 in the fall of 2013.

School facilities had been underutilized due to declining enrollment associated with demographic changes and cutbacks in local mining and utility employment. To address this issue, the district built a new elementary school in 2008 and closed an older, larger school that was in need of major maintenance. The district plans to maintain and upgrade the other schools as funding permits (AECOM 2012b; WSFD 2014).

Community use of schools in Converse #2 is concentrated in the intermediate/middle school building, which had previously been used as the high school. The facility houses an indoor swimming pool that doubles as a public pool and an auditorium that is used for town meetings and social gatherings.

Natrona County School District #1

Natrona #1 provides public primary and secondary education services throughout Natrona County. The district is the second largest in the state in terms of enrollment; only Laramie County School District #1 based in Cheyenne has more students. The district operates two traditional high schools and an alternative high school in Casper. Additionally, the district operates one K-12 school, five junior high/middle schools, and 26 elementary schools. Eight of the elementary schools are located in smaller communities outside of Casper. Over the past decade, total enrollment in the district has climbed by 1,250.

Natrona #1 is in the midst of a multi-year capital facilities improvement program, which as presently outlined by the WSFD includes: four new elementary schools, several of which would replace existing schools; a new high school and major renovation of another; a new alternative high school; and a new elementary/middle/high school (WSFD 2013).

Campbell County School District #1

Campbell #1 provides public primary and secondary education services throughout Campbell County. This district operates 2 high school campuses in Gillette under a single administration, 1 junior-senior high school in Wright, 2 junior high schools in Gillette, 15 elementary schools (including 6 in the outlying rural areas of the county), and 1 alternative high school in Gillette. The district is in the final stages of a multi-year capital facilities program, which included completion of four elementary schools and major renovations of several others. The school district also joined with Campbell County and the City of Gillette in the completion of a major new recreation center (AECOM 2012b; WSFD 2013).

Campbell #1 experienced a decade-long decline in total enrollment between 1993 and 2003. However, while the elementary grades were declining, high school enrollment increased. Those patterns have since changed, with a net gain of more than 1,100 elementary-aged students and an influx of 260 students in grades 6 through 8 during the past decade.

Campbell #1 has an extensive vocational technical program focused on educating and training students for jobs in the energy and related industries in the county. Related industries include diesel mechanics and computer and robotics mechanics, as well as operation of computer assisted milling machines. This vocational program provides local industries with a pool of entry-level employees in critical trades and helps stabilize the community by providing employment opportunities for local youth.

Campbell #1 anticipated continued enrollment growth prior to the recent fall in energy prices. According to a capacity study published in 2013, the district faced shortages in elementary and middle school capacity. To address these needs, the district planned construction of three additional elementary schools to replace existing facilities and to be sized to facilitate reconfiguration of grades by school to help optimize capacity to serve the anticipated growth in enrollment. A new high school also was planned, as was a new facility to house the alternative high school (WSFD 2013).

3.11.9.2 School District Fiscal Conditions

The Wyoming School Foundation Program (Title 21, Chapter 13 of Wyoming Statutes) is intended to provide local school districts a solid funding basis for operations, irrespective of differences in the local revenue-generating capacities of the individual districts. Revenue for school funding comes from taxes on minerals production, real estate, taxable personal property, and various other local, state, and federal program funds and grants. The Wyoming School Foundation Program is a statewide school finance system that guides operating revenues and expenditures for public educational services delivered at the local level. The system is structured to achieve equalization in educational opportunities across the state. The northeastern part of the state plays an important role in the system due to its large energy and minerals-related tax base. Campbell County alone accounted for more than 24 percent of the state's entire assessed valuation in 2012/2013. Property tax revenues are derived from a mandated levy. Revenues from a district that are in excess of authorized operating expenditures for that district flow to the state to support education in districts with fewer resources.

Public education funding also functions under the rules, policies, and procedures of the WSFD (Title 21, Chapter 15, of Wyoming Statutes). The WSFD was originally established as the Wyoming School Facilities Commission during the 2002 Legislative session with a charge to oversee all aspects of construction and maintenance of school facilities and physical plants. Its mission is to provide adequate educational facilities for all children in Wyoming, mirroring the mission of the Wyoming School Foundation Program, which focuses on operations. The impetus for establishing the WSFD was a 2001 State Supreme Court decision (the State of Wyoming et al., v. Campbell County School District et al., Wyoming 19, 19, P.3d 518) requiring the legislature and school districts to remedy facilities in immediate need and inadequate condition. As a result of that court decision, school facility capacity, basic design, and condition are subject to review and approval by the WSFD. The ongoing reviews prioritize statewide construction plans, and in some cases, result in directives for districts with surplus capacity to consolidate/close facilities. Construction is now funded through a statewide tax or from other revenues imposed equally on all taxpayers rather than from locally derived revenues. As noted in Section 3.11.9.1, all four districts have opened new schools and have substantial capital improvement priority projects approved by the WSFD for funding over the next 4 to 5 years.

Tables 3.11-*30* and **3.11-*31***, as well as **Figure 3.11-*22*** provide an overview of selected financial characteristics of the school districts in the analysis area. The total assessed valuation of real and personal property and mineral production within the districts for the 2013/2014 school year ranged from $328.1 million in Converse #2, which has had relatively modest mineral or energy production in recent years, to over $5.5 billion in Campbell #1, a large portion of which is attributable to coal and oil production. Increases in oil production and commodity prices in recent years contributed to increases in assessed valuation of more than $1.0 billion in Campbell #1 and $564 million in Converse #1; the latter representing more than a tripling of the district valuation compared to that for the 2006/2007 school year.

Table 3.11-30 **Overview of Public Education Finance by School District**

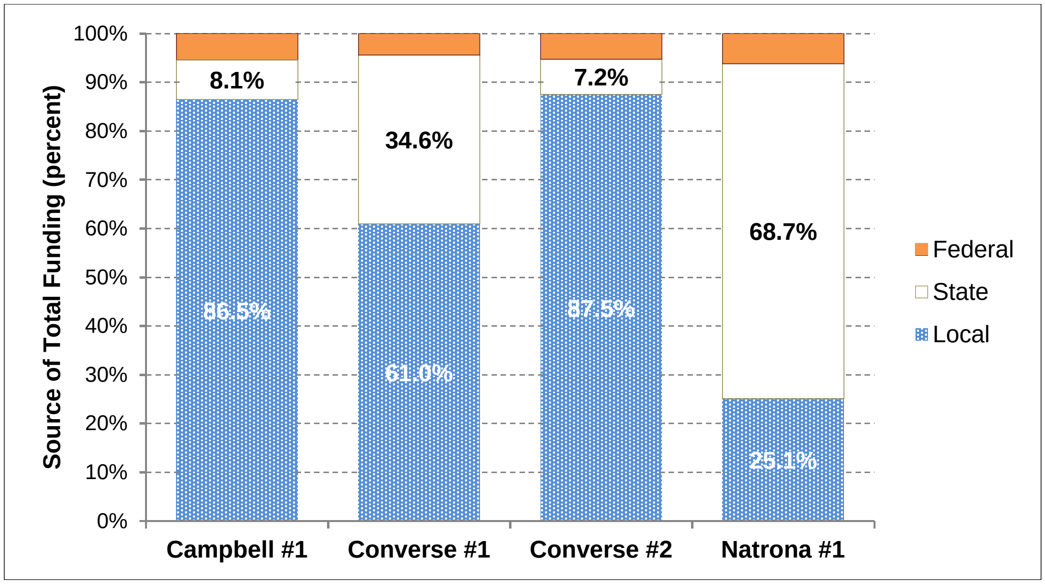
District	District Assessed Valuation (millions of nominal dollars)			Percent Change
	2006/2007	2013/2014	Change	
Converse #1	276.4	840.8	564.4	204
Converse #2	181.0	328.1	147.1	81
Natrona #1	944.1	1,255.3	311.2	33
Campbell #1	4,553.1	5,559.4	1,006.3	22

Source: Wyoming Department of Education 2014a.

Table 3.11-31 **Financial Characteristics of Public School Districts in Analysis Area**

Parameter	Converse #1	Converse #2	Natrona #1	Campbell #1
General Fund Expenditures 2012/2013 (millions)	$27.3	$10.3	$166.8	$121.0
Operating Costs / Average Daily Membership	$17,092	$17,639	$15,349	$16,324
Bonded Debt	$ 0.0	$ 0.0	$ 0.0	$ 0.0
Percent of Students Transported	56	33	43	56
Recapture (sent to the State)	$0.0	$0.0	$0.0	$61.6 million

Source: Wyoming Department of Education 2014b,c.



Source: Wyoming Department of Education 2014a.

***Figure 3.11-22* Revenue Sources for Public School Districts**

Despite the substantial differences in the local tax base among the districts, all enjoy a relative degree of parity with respect to their budgets, at least on a per-student basis. This reflects the function of the state's funding equalization program. As shown in **Table 3.11-*31***, the overall expenditures of the districts tend to parallel their enrollments, ranging from Converse #2 at $10.3 million to Natrona #1 at $166.8 million. Per-student operating costs on an average daily membership basis, which reflects enrollment and attendance, ranges from $15,349 to $17,639 and is relatively comparable among districts. Those differences reflect the local cost of living (particularly housing), number of small schools, percent of students transported by a district bus system, and other factors that affect the cost of operation for a district.

None of the four districts currently have any outstanding bonded debt, largely a reflection of the role played by the WSFD with respect to new school construction. Since its inception, the WSFD has provided nearly $2.6 billion in funding to maintain, improve, and build schools in Wyoming. The vast majority of the revenue supporting that program has been derived from mineral development. Such revenues also provide major support for the Wyoming School Foundation Program, effectively augmenting locally derived resources to achieve funding equalization. As noted above, per-student operating costs are relatively comparable across the districts; however, the sources of revenues to fund those costs vary dramatically (**Figure 3.11-*22***). As shown, locally derived revenues in resource-rich Campbell #1 and Converse #1 account for more than 86 percent of district total revenues, but only account for 25 percent in Natrona #1. State revenues offset the differences, using other revenues derived from mineral production including more than $61 million in revenues derived in Campbell County that were in excess of the allowable funding.

The Wyoming School Foundation Program does provide local school districts a degree of assurance regarding funding to offer public education across the state. However, the level of approved funding tends to be heavily weighted to the previous year's enrollment and past increases in the cost of living. Consequently, districts that experience extraordinary year-to-year increases in enrollment and escalating salary costs in response to added staffing and the rising cost of living, often in conjunction with rapid changes in oil and gas development or industrial construction projects, may face budgetary constraints until/unless supplemental funding is approved. However, even when supplemental funding is available it tends to lag behind the increased costs that such districts incur. Such is the case in Converse #1 where local housing costs have risen dramatically due to strong demand and limited availability, which has necessitated higher salaries in order to recruit and retain teachers and other staff. Even then, some staff must commute from the Casper area. School staff incur other rising costs tied to energy development as well. For instance, day care costs in Douglas rose substantially during the 2013/2014 school year in response to labor shortages and rising rental expenses due to the demand for commercial and industrial space (Espeland 2014).

3.11.10 Local Government Fiscal Conditions

County and municipal governments and special services districts in Wyoming rely on a variety of revenues to fund operations and build and maintain infrastructure. Such revenues include ad valorem taxes levied on real property, taxable transactions and other economic activities, such as wind energy generation. Other important revenue sources can include fees, licenses, fines, grants and other intergovernmental transfers, including Payments in Lieu of Taxes (PILT) received from the Federal government to help offset the costs of providing public services to public lands. Enterprise operations, including many local water, wastewater and solid waste enterprise operations are funded largely through user fees and charges.

Some of the above revenue sources are sensitive to local economic activity, while intergovernmental transfers are generally more dependent on statewide activity levels, legislatively established distribution formulas, and population. This section describes recent trends in the most important public sector revenue streams associated with mineral development and characterizes public sector fiscal conditions for selected county and municipal governments in the analysis area.

Federal mineral royalties, combined with state and local taxes levied on mineral production, are major sources of public revenue in Wyoming. Through revenue-sharing and intergovernmental transfer mechanisms, these revenues benefit the jurisdiction within which the activity occurs as well as ***the*** federal treasury, state coffers, school districts, and local governments across the state.

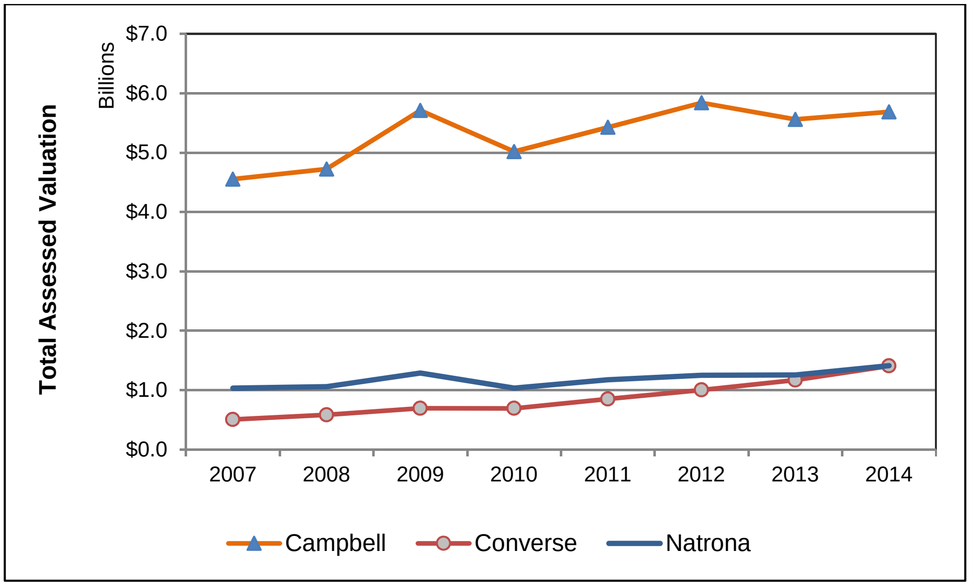
3.11.10.1 Key Public Sector Revenues

The four primary sources of revenue that accrue in conjunction with mineral development are ad valorem excise taxes (applicable to improvements, real estate, and value of production), federal mineral royalties (only applicable to federal mineral interests), state severance taxes (applicable to the value of production), and state and local sales and use taxes (applicable to value of most purchased goods and services by companies and employees). Each of these is discussed in further detail below.

Ad Valorem (Property Taxes)

Oil and natural gas, coal, and other minerals produced in Wyoming, regardless of ownership, are subject to ad valorem taxation by local taxing entities and a statewide levy to support public education. Although all privately owned real estate and improvements are subject to taxation, they are assessed at fractional rates (e.g., 9.5 percent of fair value for residential property) in comparison to the 100 percent valuation applied to mineral production.

Each of the three counties in the analysis area has seen gains in assessed valuation between 2007 and 2014 (**Figure 3.11-*23***). The gains in Converse County during this period exceeded $902 million (178 percent), largely due to increased valuation attributable to rising oil production. As a result of those gains, Converse County's valuation topped $1.0 billion for the first time in 2012, reaching $1.4 billion in 2014 and essentially equaling the valuation of neighboring Natrona County.



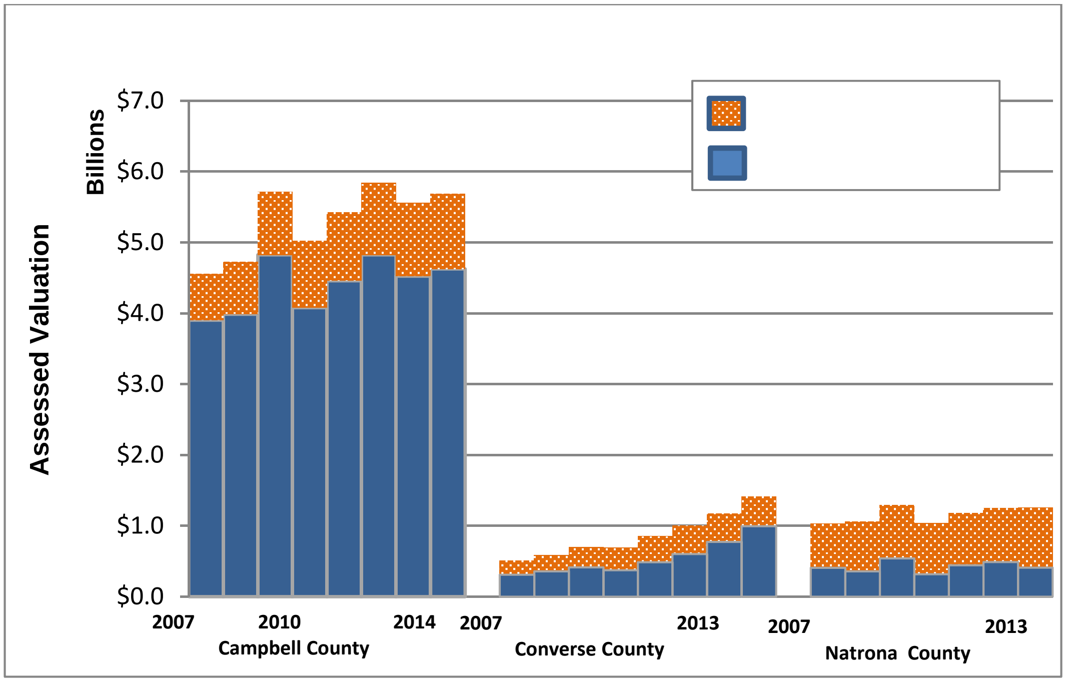
Source: Wyoming Department of Revenue 2008-2014; Wyoming State Board of Equalization 2014.

Figure 3.11-23 **Total County Assessed Valuation: 2007–2014**

The net gain in assessed valuation in Natrona County was $378.4 million (37 percent), but virtually the entire gain was attributable to valuation on residential, commercial, and industrial property. Total valuation increases of $1.1 billion (25 percent) were registered in Campbell County despite a substantial reduction in coal production volumes (**Figure 3.11-3**). The changes in mineral and non-mineral valuation, along with the comparative levels of valuation for each county, are shown in **Figure 3.11-*24***.

As noted, oil and gas production has increased dramatically in Converse County in recent years. The valuation of this increased production accounted for more than 75 percent of Converse County's total increased valuation in 2014. Similar gains in oil production have occurred in Campbell County, although the increase represented a smaller change due to the large base of valuation associated with coal production.

The average property tax rates in 2014 for property owners in the three counties (**Table 3.11-*32***) ranged from 59.588 mills in Converse County to 63.245 mills in Natrona County, the latter reflecting more than a 10 percent decline in tax rates compared to the preceding year. The respective tax rates reflect differences in the number and respective tax levies by taxing entities in each county. For example, countywide levies support the hospital district in Campbell County and a community college in Natrona County in addition to the county, local municipalities, and school districts levies.



Source: Wyoming Department of Revenue 2008–2014; Wyoming State Board of Equalization 2014.

Figure 3.11-24 **Mineral and Non-mineral Valuation by County: 2007–2014**

Table 3.11-32 **Average Property Tax Rates and Total Property Taxes Levied: 2013-2014**

Parameter	Campbell County	Converse County	Natrona County
2014 Tax Rates (average mills)	60.111	59.588	63.245
Total Property Taxes Levied[1]			
2013	$334,156,581	$70,127,477	$88,205,189
2014	$341,777,346	$83,899,403	$99,077,826
Change	$7,620,765	$13,771,926	$10,872,637
Percent Change	2.3	19.6	12.3

[1] Dollar amounts are in nominal dollars.

Source: Wyoming State Board of Equalization 2014.

In Converse County, local entities with taxing authorities levied total taxes of $83.9 million in 2014, an increase of nearly 20 percent (approximately $13.8 million) from 2013, primarily in response to a sharp increase in valuation. Total property taxes levied by taxing authorities in Natrona County also saw double-digit year-over-year increases, rising 12.3 percent ($10.9 million), with total property tax receipts exceeding $99.0 million. Total taxes levied by taxing entities in Campbell County increased by $7.6 million, or 2.3 percent.

Typically, there is a direct correlation between changes in local assessed valuation and local property tax receipts as increases in assessed valuation result in increases in property taxes levied. This correlation holds unless statutory limitations restrict the responsiveness of local revenues, local officials act to use discretionary authority to change local tax rates, voters approve changes in tax rates or local facilities and services that result in changes in taxes, or long-term debt and the corresponding debt service is retired.

Sales, Use, and Lodging Taxes

Sales and use tax receipts are another vital revenue source for local governments in Wyoming. These taxes revenues are derived from taxes on capital equipment, motor vehicles, and materials and supplies purchased by oil and gas firms as well as on the retail purchases of motor vehicles, consumer goods, meals, and other taxable items by employees supported directly and indirectly by such development. The volume of sales and use taxes collected serve as a useful barometer of local economic activity over time, with changes in the industrial mix of collections providing important insights into the performance of specific industries. Although sales taxes tend to be associated with retail trades and food services, such taxes are levied by establishments in all industries, and the use taxes associated with out-of-state purchases of capital equipment, materials, and supplies can comprise substantial shares of the overall receipts. The state collects these taxes and disburses the local share back to the appropriate entities.

Counties may impose up to a 2.0 percent general-purpose local tax and up to a 2.0 percent specific-purpose tax for capital improvements. General-purpose taxes typically flow to the local general fund; whereas, receipts from the specific-purpose option typically are enacted for a specific duration or defined level of generated revenue that is earmarked for specific programs or projects. Converse and Campbell counties also were levying 1.0 percent specific-purpose option taxes. Approved for up to 10 years, the voter-approved tax measure contained sunsetting provisions of those levies that automatically eliminated the special purpose tax after the maximum authorized revenue had been collected (**Table 3.11-*33***).

Table 3.11-33 **Sales, Use, and Lodging Tax Rates: 2014**

County	State Sales and Use Tax Rate (percent)	Local General Purpose Option (percent)	Local Specific Purpose Option[1] (percent)	Lodging Tax (percent)	Total Tax Rate General / Lodging (percent)
Converse	4	1	1	3	6 / 8
Natrona	4	1	--	3	5 / 8
Campbell	4	1	1	2	6 / 8

[1] These levies have since lapsed because the maximum authorized revenue had been collected.

Source: Wyoming Department of Revenue 2014b.

The distribution of local sales and use tax revenues within counties is based on the portion of the total county population in each city and town. The county government retains the revenue share for the population in the unincorporated areas. The current distributions for each of the three counties in the study area are shown in Table 3.11-34.

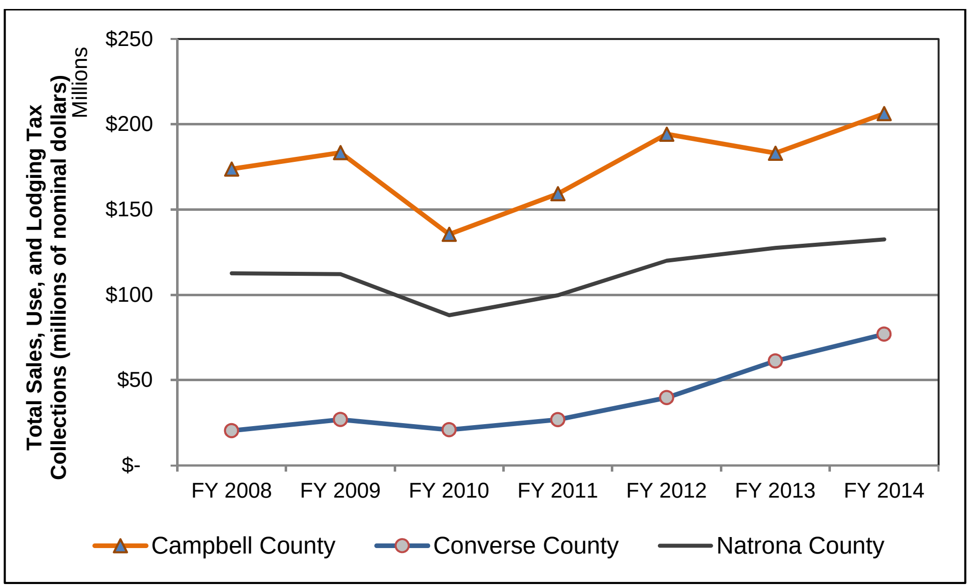
Counties also have the option to levy a lodging tax of up to 4.0 percent on lodging stays of less than 30 days. Tracking receipts over time can be useful in identifying and monitoring local tourism activity. Increases in receipts over time also may reflect expansion of a local lodging base and increasing rates due to high demand, both of which occur in Converse County in response to the upswing in oil and gas development activity. Proceeds from the lodging tax are to be used for tourism promotion and economic development.

Table 3.11-34 Local Distribution of Sales and Use Taxes

Converse County		***Natrona County***		***Campbell County***	
Entity	***Share of County Total (percent)***	***Entity***	***Share of County Total (percent)***	***Entity***	***Share of County Total (percent)***
County	***33.9***	***County***	***15.0***	***County***	***31.4***
Douglas	***44.3***	***Casper***	***73.2***	***Gillette***	***64.7***
Glenrock	***18.6***	***Edgerton***	***0.3***	***Wright***	***3.9***
Lost Springs	***0.0***	***Evansville***	***3.5***		
Rolling Hills	***3.2***	***Mills***	***4.6***		
		Midwest	***0.5***		
		Bar Nunn	***2.9***		

Source: Wyoming Department of Revenue 2016.

Sales, use, and lodging tax receipts vary dramatically between the three counties in magnitude, composition, and recent trends. Patterns in the overall receipts by county from 2008 to 2014 are shown in **Figure 3.11-*25***. Total annual sales and use tax collections in Converse County mirror the pattern described for assessed valuation, more than tripling over the 6-year period and almost doubling in the from 2013 to $69.6 million in 2014. Increases in sales tax collections account for the vast majority of growth; however, use tax receipts associated with out-of-state capital purchase of equipment such as drilling pipe or pipe for oil and gas transmission lines also increased, climbing by $5.0 million between 2012 and 2013.



Source: EAD 2014c, 2013.

Figure 3.11-25 **Annual Sales, Use, and Lodging Tax Receipts in Analysis Area: Fiscal Years 2008–2014**

The pattern of annual sales and use tax collections in Natrona County is similar to that in Campbell County, showing year-to-year declines between 2009 and 2010, followed by increases from 2011 through 2014. Factors contributing to the increases include the general economic recovery and oil and gas development in many areas of Wyoming that was supported from Casper. However, Casper derives a large portion of its sales tax receipts on consumer purchases rather than industrial activity, so the gains in Natrona County have been more modest in scale than those in Converse and Campbell counties.

Total annual collections from Campbell County ranged from $135.5 million to more than $206.3 million between 2008 and 2014. Factors contributing to the wide range include the major capital investment associated with construction of the Dry Fork generating station, response to the recession in capital investments by the mines, and increased oil and gas activity. In general, use tax receipts have declined over time in Campbell County, while sales taxes have increased.

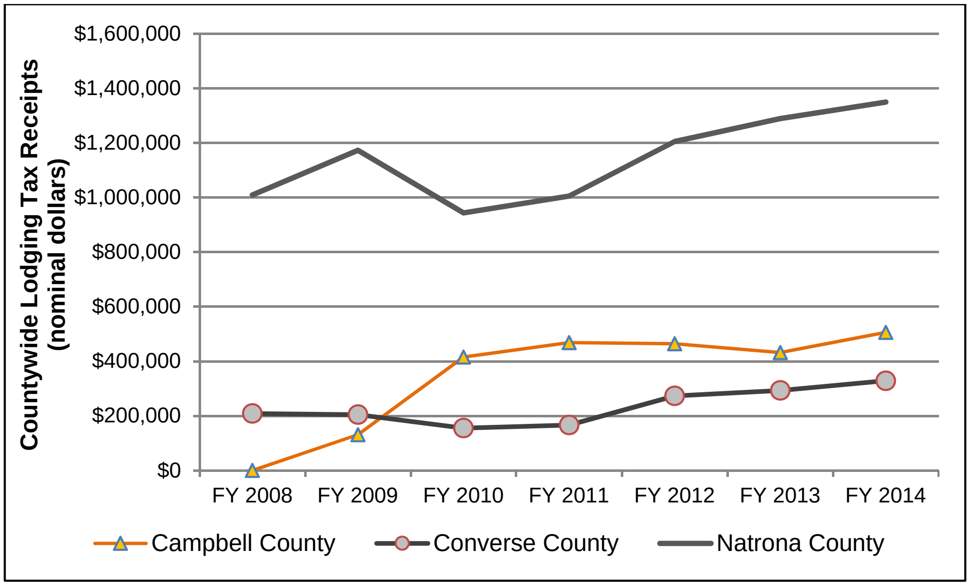
Information reported by the Wyoming Department of Revenue for fiscal years 2013 and 2014 reveal across-the-board, year-over-year increases in sales and use tax receipts for all three counties (**Table 3.11-*35***). The increases varied from nearly 26 percent in Converse County to 4 percent in Natrona County. The fiscal year 2014 receipts of $76,977,509 in Converse County and $132,511,671 in Natrona County both represent all-time highs.

All three counties levy a lodging tax. This lodging tax is at a 2 percent rate in Campbell County and 3 percent in Converse and Natrona counties. Among the three counties, Natrona has the largest base of hotel and motel rooms (**Table 3.11-*25***), including a number of recent additions. Serving the energy, traveler, and special events and conference markets has helped the local hospitality industry to maintain relatively high occupancy rates. As a result, annual lodging tax receipts in Natrona County exceeded $1.2 million for the 3 consecutive years from 2012 through 2014 (**Table 3.11-*35*** and **Figure 3.11-*26***).

Table 3.11-35 **Sales, Use, and Lodging Tax Receipts in Analysis Area: 2013–2014**

Location / Tax	FY 2013	FY 2014	Percent Change
Converse County			
Sales and Use	$61,237,365	$76,977,509	25.7
Lodging	293,143	328,774	12.2
County Total	**$61,530,508**	**$77,306,283**	**25.6**
Natrona County			
Sales and Use	$127,485,311	$132,511,671	3.9
Lodging	1,288,626	1,349,272	4.7
County Total	**$128,773,937**	**$133,860,943**	**4.0**
Campbell County			
Sales and Use	$183,089,241	$206,280,095	12.7
Lodging	431,762	505,759	17.1
County Total	**$183,521,003**	**$206,785,854**	**12.7**

Source: EAD 2014c.



Source: EAD 2014c.

Figure 3.11-26 **Lodging Tax Receipts in the Analysis Area: Fiscal Years 2008–2014**

Converse County realized lower lodging tax receipts than either Natrona or Campbell counties, with receipts in fiscal year 2014 totaling 24 percent of those collected in Natrona County. Although Converse County collected fewer lodging tax receipts, its local hospitality industry has benefitted in recent years from strong local demand associated with pipeline construction, oil and gas development, and new commercial and industrial construction in the county. These and other factors have contributed to higher occupancy rates and higher nightly rates. Annual receipts topped $300,000 for the first time in fiscal year 2014 and likely will increase following the completion of a new hotel that was under construction during the summer of 2014.

Lodging tax receipts in Campbell County generally have been between one-third and one-half the receipts in Natrona County. In part the differences reflect the lower tax rate. Another contributing factor is that RV parks provide more temporary lodging capacity in Campbell County than do hotel rooms. Recreational vehicle pads generate lower nightly fees and may have more stays of longer than 30 days, which are tax exempt. Extended motel stays by energy development workers also may be exempt from lodging taxes, although the extent to which this is the case is unknown.

The state sales and use tax of 4.0 percent is collected based on the point of sale. ***Sixty-nine*** percent of the remaining sales and use tax revenue is transferred to the state's general fund*.* ***After the withholding of 1 percent of the total to cover administration and processing expenses, 69 percent of the remaining sales and have*** the remain***ing*** 30***.68*** percent of the statewide total receipts is distributed to local governments. The amounts returned to individual counties and incorporated municipalities are determined using a multi-tiered formula that allocates a fixed amount to each county; a portion based on each county's share of the statewide population and the remainder based on the percentage shares of net statewide sales and use taxes attributable to vendors in that jurisdiction.

The latter factor can have dramatic effects on a county's allocations of the state's 4.0 percent sales taxes. A county that experiences relatively stronger growth in taxable sales relative to the remainder of the state will realize an increased allocation of the shared revenues*. *This pattern

was evident in the analysis area in recent years. As shown in Table 3.11-36, Converse County's allocation of the state shared sales tax revenues rose from 6.8 percent for fiscal year 2013 to 8.4 percent in 2015. Following the slowdown in drilling in the analysis area, the County's share dropped to 4.5 percent of the total. Campbell County's allocations experienced a similar pattern, while Natrona County's share declined steadily.

Table 3.11-36 Local Distributions of Statewide 4 percent Sales Tax, Fiscal Years 2013 to 2016

Entity	***FY2013***		***FY2014***		***FY 2015***		***FY2016***	
	Amount	***% of State***	***Amount***	***% of State***	***Amount***	***% of State***	***Amount***	***% of State***
Total Distribution to Local Governments	***$191,156,004***	***100***	***$204,153,079***	***100***	***$217,579,607***	***100***	***$171,709,688***	***100***
Converse	***$12,938,589***	***6.8***	***$14,302,182***	***7.0***	***$18,204,552***	***8.4***	***$ 7,724,628***	***4.5***
Campbell	***$36,298,830***	***19.0***	***$39,338,743***	***19.3***	***$42,807,223***	***19.7***	***$ 29,227,833***	***17.0***
Natrona	***$27,648,394***	***14.5***	***$28,448,631***	***13.9***	***$29,230,159***	***13.4***	***$ 22,059,474***	***12.8***

Source: Wyoming Department of Revenue 2018. Annual Sales and Use Tax Reports for Fiscal Years 2013 to 2016.

Table 3.11-*37* details the sales and use tax collections and distributions in the analysis area for 2013. Sales and use taxes derived from economic activity in the three counties totaled $375.7 million, of which $190.4 million was retained by the state and $185.3 million was disbursed to local governments. The three counties received a combined total of $72.7 million, led by Campbell County at $52.5 million. As a group, the municipalities in the three counties received $112.6 million, with Gillette and Casper each receiving in excess of $40 million. Douglas received $11.9 million.

Table 3.11-37 **Distribution of Sales and Use Taxes in Analysis Area: 2013**

County	**Annual Sales and Use Tax Receipts**			**Distribution of Local Share**		
	Total	**State Retained**	**Disbursed to Local Government**	**County**	**Primary Community**	**Other Communities**
Campbell	$184,316,370	$85,576,567	$98,739,803	$52,537,323	$43,510,538 Gillette	$2,691,942
Converse	$ 61,796,820	$33,323,953	$28,472,867	$10,829,501	$11,899,058 Douglas	$5,744,308
Natrona	$129,604,285	$71,542,744	$58,061,541	$9,327,381	$41,958,796 Casper	$6,775,364

Source: Wyoming Department of Revenue 2013.

<u>Wyoming State Severance Taxes</u>

Wyoming levies a state severance tax on oil, natural gas, coal, and many other minerals produced in the state. ***The current severance tax rates, levied on the value of production, are 6.0 percent on oil and gas and 7.0 percent on surface coal. Tax rates on other mineral commodities range from 2.0 percent to 4.0 percent.*** Severance taxes are quite sensitive to changes in production as well as prices such that substantial year-to-year changes occur. For example, total severance taxes of $1.15 billion were estimated on all mineral production in 2009. The following year, the corresponding total was $770 million; a decline of $385 million or 33 percent (**Table 3.11-*38***). In 2014, the estimated severance taxes levied totaled $888.6 million (Wyoming Department of Revenue 2014b). The largest single share of the total was taxes levied on natural gas: $305.4 million or 34 percent. Severance taxes on oil followed closely at $291.7 million.

Table 3.11-38 **Annual Severance Tax Receipts on Statewide Mineral Production: 2009–2014**

Year	Source of *Statewide* Annual Severance Tax Receipts (nominal dollars)				Total Statewide Severance Tax Receipts (nominal dollars)
	Coal	Natural Gas	Oil	All Other	
2009	259,741,502	720,207,059	130,633,403	44,234,842	1,154,816,800
2010	264,979,575	351,663,078	108,349,929	44,815,013	769,807,595
2011	281,395,969	456,086,175	148,501,982	59,313,989	945,298,115
2012	294,739,166	431,323,040	204,323,040	52,795,460	983,180,706
2013	283,848,546	268,239,476	253,799,879	27,163,686	833,051,587
2014	264,689,326	305,418,653	291,701,423	26,813,350	888,622,752

Source: Wyoming Department of Revenue 2008-2014.

Local counties and communities wherein the production occurs do not benefit directly from severance taxes levied on that production. Rather, the revenues accrue to the state, which are then allocated according to a multi-tiered statutory formula (see Appendix C, Section 7.2 for additional information regarding severance tax distribution). The consists of revenues equal to the proceeds from a 2.5 percent tax levy into the Permanent Wyoming Mineral Trust Fund (PWMTF), with the remainder deposited in the Severance Tax Distribution Account. The formula allocates an amount equal to the proceeds of a 1-cent statewide gas tax for use in the environmental remediation of leaking underground storage tanks. The remainder, subject to a total annual cap of $155 million, are disbursed among 7 funds as follows: the general fund (62.3 percent), water development accounts (14.6 percent), local governments (13.1 percent), highway and state aid to county road funds (7.23 percent), and capital construction (2.8 percent). Any balance remaining in the Severance Tax Distribution Account after the above distributions have been made is distributed one-third to the state's general fund and two-thirds to the budget reserve account.

Distributions to individual cities and towns are based on a community's share of the statewide population living in cities and towns. Distributions to counties are based on a combination of population and the inverse of the county's share of statewide assessed valuation. The severance tax revenue distributions to the counties, cities and towns in the Analysis Area in Fiscal Year 2014-2015 totaled more than $5.19 million; nearly $1.32 million to the three counties and $3.88 to the cities and towns (see Table 3.11-39 below). Those totals represented 22 percent and 27 percent of the respective statewide severance tax distributions to counties and cities and towns.

Table 3.11-39 Severance Tax Distributions to Local Governments in the Study Area, Fiscal Year 2014 - 2015

Counties	***Severance Taxes Distribution***
Campbell County	***$445,153.92***
Converse County	***$139,438.16***
Natrona County	***$733,385.14***
Three County Total	***$1,317,977.22***
Cities and Towns	***Severance Taxes Distribution***
Campbell County	
Gillette	***$1,101,728.66***
Wright	***$66,932.06***
Converse County	
Douglas	***$226,164.86***
Glenrock	***$94,856.06***
Lost Springs	***$148.12***
Rolling Hills	***$16,182.84***
Natrona County	
Bar Nunn	***$82,536.96***
Casper	***$2,064,140.42***
Evansville	***$98,107.46***
Mills	***$127,259.64***
Cities and Towns Total	***$3,878,075.08***

Source: Wyoming State Treasurer 2015

In years the $155 million cap is met, a total of approximately $14.3 million is distributed to cities and towns and $6.0 million is distributed to the counties. The annual cap on such disbursements has been met each year since 2010. As a consequence, year-to-year changes in the amounts distributed to individual units of local government do not vary dramatically.

Federal Mineral Royalties

Federal mineral royalties are assessed on coal, natural gas, oil, and other minerals produced on federal leases. Producers pay a 12.5 percent royalty to the federal treasury on the value of all oil, natural gas, and surface coal production on federal leases. Forty-nine percent of federal mineral royalty receipts (one-half of the total net of a 2 percent processing and administrative fee) are disbursed to the state in which the production occurred. The size of the resource base, the rate of mineral production in the Powder River Basin, and the predominance of federal ownership combine to make federal mineral royalties an important revenue source. Across Wyoming, approximately 90 percent of all coal production and large shares of the natural gas and oil are from federal minerals (ONRR 2014; WDWS 2014).

Federal mineral royalty receipts on coal (in nominal dollars) have grown sharply as production in Wyoming, and from the Powder River Basin in particular, has increased. Royalty receipts on coal produced in Wyoming first topped $100 million in 1989 and $200 million in 1999. Total federal mineral royalties from coal in 2003 were $298.6 million, increasing to over $635.7 million in 2012

(**Table 3.11-*40***), before falling to $560.8 million in 2013 as production declined. Aggregated federal mineral royalties on coal over the past 5 years totaled slightly over $3 billion.

Table 3.11-40 **Federal Mineral Royalties and Related Revenues and Disbursements to the State of Wyoming: 2009–2013**

	Mineral Revenues (nominal dollars)					
Source	**2009**	**2010**	**2011**	**2012**	**2013**	**5-Year Total**
Coal	$591,544,868	$603,288,725	$627,212,526	$635,735,109	$560,790,404	$3,018,571,632
Natural gas	$566,454,275	$832,384,441	$754,302,856	$418,689,748	$548,325,839	$3,120,157,159
Oil	$179,140,031	$259,855,491	$312,990,789	$407,695,329	$335,409,964	$1,495,091,603
Other minerals	$15,517,891	$15,435,768	$20,218,474	$43,456,350	$46,809,306	$ 141,437,790
Bonus bids and other sources	$423,330,069	$172,922,087	$303,640,646	$424,433,716	$507,548,254	$1,831,874,773
Total Mineral Revenues	**$1,775,987,134**	**$1,883,886,513**	**$2,018,365,291**	**$1,930,010,252**	**$1,998,883,767**	**$9,607,132,957**
Disbursements to Wyoming	**$957,232,075**	**$886,871,352**	**$971,498,012**	**$995,169,510**	**$932,475,424**	**$4,743,246,373**

Source: ONRR 2014.

Since 2005, federal mineral royalties also have been generated on coalbed natural gas production. When combined with federal mineral royalties from conventional gas and natural gas liquids, those revenues topped $832 million in 2010, but declined sharply as the price of gas fell dramatically in 2011/2012. Total federal mineral royalties on gas over the past 5 years were $3.12 billion, surpassing the total from coal by approximately $100 million.

Federal mineral royalties on oil produced from federal leases have climbed sharply in recent years; although, the total federal mineral royalties of $1.5 billion from oil over the past 5 years equaled only approximately half of that from coal. Total federal mineral royalties on all other minerals over the past 5 years were less than 5.0 percent of the revenues generated from either coal or natural gas.

Additional federal mineral revenues are generated by mineral lease rents and bonus bids paid on new parcels leased during BLM's quarterly lease sale in Wyoming. The annual amounts of such revenues fluctuate in response to the number, size (quantity of resources), and quality of resources offered. These other sources generated more than $1.8 billion in Wyoming over the past 5 years.

From 2009 to 2013, aggregate federal mineral royalties and other revenues in Wyoming averaged $1.92 billion per year and totaled $9.6 billion. After a 2.0 percent deduction for administration and processing, half of the remainder was disbursed to Wyoming. For this 5-year period, those disbursements totaled $4.74 billion.

Like severance tax receipts, distributions of the state's share of federal mineral royalty receipts follow a legislatively established, two-tier formula ***(see Appendix C Section 7.1.1 for additional detail regarding the distribution of the State's share of Federal Mineral Royalties)***. The first tier covers total annual receipts up to $200 million and the second applies to receipts over $200 million per year. Under the ***first*** tier allocation, a 1.0 percent administration fee is transferred to the general fund. The remaining funds are allocated to the Wyoming School Foundation Program (44.8 percent), the highway and county road funds (30.4 percent), the University of Wyoming (6.75 percent), capital and school construction accounts (6.45 percent)***, and cities and towns (9.375 percent)*****.**

Federal mineral royalty funds distributed to cities and towns are statutorily limited to use for planning, construction or maintenance of public facilities or providing public services. A city or town may expend these revenues or pledge future revenues for payment of revenue bonds issued to provide public facilities. The statutory limitations may limit the application of these for some high priority general administrative functions during periods of high growth, although is it likely that funding for the maintenance of public facilities and provision of public services alsi would be high during such periods.

In years that the $200 million cap is met, a total of approximately $18.6 million is distributed to cities and towns. The distributions of Federal Mineral Royalties to the cities and towns in the Study Area in Fiscal Year 2014-2015 totaled more than $4.57 million (see Table 3.11-41 below). That total represented approximately 25 percent of the statewide total of $18,6 million in distributions to cities and towns). Counties do not receive distributions from the State's share of Federal Mineral Royalties.

Table 3.11-41 Distributions of Federal Mineral Royalties to Local Governments in the Study Area, Fiscal Year 2014 - 2015

Cities and Towns	***Federal Mineral Royalty Distribution***
Campbell County	
Gillette	***$1,553,582.25***
Wright	***$107,354.33***
Converse County	
Douglas	***$323,310.11***
Glenrock	***$143,556.93***
Lost Springs	***$12,200.62***
Rolling Hills	***$36,930.00***
Natrona County	
Bar Nunn	***$97,199.21***
Casper	***$2,045,791.23***
Evansville	***$113,014.08***
Mills	***$138,985.64***
	$4,571,924.40

Source: Wyoming State Treasurer 2015

The distribution of Federal Mineral Royalties in effect at the time of the Draft EIS was changed by the 2016 Session of the Wyoming State Legislature, redirecting some funds to the general fund to help address declining state revenues. The overall 9.375 percent allocation to cities and town remained unchanged, however, the subsequent allocations of those funds to individual cities and towns was changes such that now, each city and town shall receive:

- ***$12,000 if the population is 325 persons or less, or $15,000 if the population is more than 325 persons; plus***
- ***An amount based on the proportion that the population of each city or town bears to the total population of all cities and towns in the county, with the allocation to be distributed in each county based on the proportion of the average daily membership, as defined in***

W.S. 21-13-101, of all school districts in each county to the total statewide average daily membership (W.S. 9-4-601).

Allocations of the tier-two funds (i.e., annual receipts in excess of $200 million) are distributed to the state budget reserve account (66.67 percent) and the Wyoming School Foundation Program (33.33 percent).

Payments in Lieu of Taxes

Congress authorized PILT to local governments that have certain federal lands within their boundaries (31 USC 6901-6907–1976). These payments supplement other federal land receipt-sharing payments that the government may receive to help offset the costs of providing public services such as law enforcement, fire protection, and road construction/maintenance affected by the presence and use of those federal lands.

PILTs are authorized to local governments (generally counties) based on the acres of entitlement lands within their boundaries. Such entitlement lands consist of lands in the National Forest and National Park systems, some lands involved in Bureau of Reclamation projects, National Wildlife Refuges, and lands administered by the BLM. The entitlement acreage is updated annually to reflect additions or disposal of federal lands. The amount of PILT disbursed to each eligible county is based on a formula factoring in the number of entitlement acres, a per-acre payment rate, deductions for certain other federal land payments, and a ceiling or cap on payments based on the population of the area.

A total of 2,254,004 acres of entitlement land are located in the three-county analysis area (**Table 3.11-*42***). Of that total, approximately 81 percent is public land managed by the BLM, 18 percent is land within the National Forests/National Grasslands, and the remainder is other eligible federal lands. Among the three counties, Natrona County has the largest base of PILT entitlement acres with 1.448 million. The annual PILTs for the three counties in Fiscal Year 2014 ranged from $631,029 in Converse to $3.47 million in Natrona County.

Table 3.11-42 **Entitlement Acreage and Federal Payments in Lieu of Taxes: Fiscal Year 2014**

County	Entitlement Acres				PILT Payment
	BLM	USFS	Other	Total	
Converse	145,464	257,456	1,061	403,981	$631,029
Natrona	1,448,346	5,533	30,105	1,483,984	$3,474,159
Campbell	227,687	138,352	0	366,039	$638,158
Three-county Combined	1,821,497	401,341	31,166	2,254,004	$4,743,346

Source: ONRR 2014.

Unlike federal mineral royalties, the amount of PILT is not a function of land use activity or mineral production that might occur on the land. Consequently, oil and gas development on federal land does not directly affect a county's eligibility for PILT, although land exchanges or substantial development-related impacts affecting local population levels could indirectly affect PILT payments.

3.11.10.2 Local Government Fiscal Overview

The three county governments and their municipalities shoulder the primary responsibilities for providing general administrative, judicial, law enforcement, and other essential public services to residents and businesses within their respective jurisdictions. Energy resource development generates revenues for these local governments, but also creates demands on facilities and services. Previous sections of this baseline described current conditions for public education and key facilities and services in the region.

The region's history with energy and mineral resource development provides local governments with substantial capability to address issues associated with oil and gas development. That capability is accompanied by a fiscal foundation supported by the existing energy infrastructure and ongoing development. **Tables 3.11-*43*** and **3.11-*44*** provide selected fiscal indicators for the three counties and their respective county seats. All of the jurisdictions are fiscally sound, have reserves meeting or exceeding the required minimums, and have no outstanding long-term general obligation debt.

Table 3.11-43 **Fiscal Summary for Campbell, Converse, and Natrona Counties: 2013**

Parameter	Campbell County	Converse County	Natrona County
Total Assessed Valuation	$5,559,437,548	$1,003,112,636	$1,255,227,453
Property Tax Mill Levies			
General Purpose	11.051	12.00	12.00
Bonds and Interest	0.00	0.00	0.00
Current General Fund Budget			
Revenues	$119,850,609	$21,467,817	$40,929,122
Expenditures	$111,953,206	$14,243,012	$43,458,757
Ending Fund Balances[1]	$82,562,051	$20,675,735	*not reported*

[1] Fund balances are for the general fund and represent net balances accumulated over time. Fund balances include reserves and may include funds being set aside for capital projects.

Source: Campbell County 2014f; Converse County 2014a,b; Natrona County 2014b.

Table 3.11-44 **Fiscal Summary for the Cities of Gillette, Douglas, and Casper: 2013**

Parameter	City of Gillette	City of Douglas	City of Casper
Total Assessed Valuation	$214,341,272	$46,434,684	$463,379,072
Property Tax Mill Levies			
General Purpose	8.00	8.00	8.00
Bonds and interest	0.00	0.00	0.00
Current General Fund Budget			
Revenues	$56,452,926	$8,754,268	$48,158,252
Expenditures	$53,610,786	$6,695,288	$39,061,857
Ending Fund Balances[1]	$41,324,469	*not reported*	$54,629,541
City Staff (full time equivalent)	303.25	*not reported*	645

[1] Fund balances are for the general fund and represent net balances accumulated over time. Fund balances include reserves and may include funds being set aside for capital projects.

Source: City of Casper 2014; City of Douglas 2014c; City of Gillette 2014c.

3.11.11 Social Conditions and Trends

This section focuses on social conditions and trends associated with recent and ongoing oil and gas development in the analysis area. Information for this section was obtained from BLM documents;

interviews with local officials, service administrators and residents; and from newspaper articles, editorials, interest group websites, and other publications.

Section 3.81 of the BLM Casper RMP identifies some of the interests on BLM lands in the Casper Resource Area and states that "… resource development and resource protection are (both) community values within the planning area" (BLM 2007b). Chapter 1 of the TBNG LRMP states that… "National forests and national grasslands have a role in sustaining or diversifying area economies and providing amenity values" (USFS 2002). Chapter 3 of the LRMP identifies various major public user/interest groups of USFS lands.

Although 6 percent of the CCPA surface area is administered by the BLM, and four percent by the USFS, over 83 percent of the surface is privately owned. As demonstrated by public comments received during the scoping process, there are a variety of public parties with interests in the CCPA. These generally include oil and gas interests, local businesses, local landowners that lease minerals or receive surface use payments from oil and gas operators, economic development organizations, ranchers, rural residential landowners, recreational users of public lands, environmental interest groups, and those interested in maintaining the existing character of communities and landscapes. It is important to note that an individual may hold values for more than one of these interests. For example, some ranchers also may be a recreational user of public lands, and some members of economic development organizations may have interests in maintaining the existing character of communities and landscapes. It also is the case that an individual may have a range of attitudes toward oil and gas development, supporting such development on public lands and in rural areas, but opposing development in proximity to communities and rural residential areas. This section identifies some of the trade-offs that have emerged with recent oil and gas development in and near the CCPA.

Converse, Natrona, and Campbell counties and the communities within the analysis area have had long histories of energy development prior to the current oil and gas expansion. Each county has experienced periods of economic expansion and decline tied to energy development, but the diversity of natural resources and the underlying agriculture and tourism/outdoor recreation and traveler economies have helped avoid the more drastic "busts" that have occurred in other energy communities in the western U.S.

Converse County has experienced coal mine and power plant construction as well as oil and gas booms. More recently, construction of wind energy projects, natural gas pipelines, and uranium mining has resulted in periodic economic and employment surges in the county. Growth in Natrona County has been related to oil and gas development and to the role of Casper as a regional oil and gas, construction, commercial, professional services, and health care center. Campbell County has experienced periods of economic and population growth and decline related to coal mining and electric power generating plant construction and operations, as well as oil and gas development.

Local governments and residents of all three counties are familiar with the economic and fiscal effects that accompany surges in energy and natural resource development. They are equally familiar with the challenges such surges and subsequent declines can pose for local governments, school districts, businesses, housing markets, and the quality of life for their residents.

During the expansion phases of energy and natural resource development projects, economic and fiscal expansions often are accompanied by work force and housing competition, increased demand for community infrastructure and services, increased traffic, and the presence of large numbers of temporary workers in communities. These effects can alter the community setting and pose challenges for local governments, school districts, and some residents of affected communities. Expansion phases are typically accompanied by substantial tax revenues, which have, in turn, been used by local governments and school districts to improve facilities and expand service systems. Although municipalities that provide public services and infrastructure to energy-related populations receive a portion of production related tax revenues, local governments often have difficulty funding infrastructure and service expansions in a timely fashion because local distributions of these funds are small and tend to lag a year or more behind when community services begin being strained by the added demand associated with the influx of energy development workers (AECOM 2012b).

Given the familiarity with energy industries and the fact that the employment of many residents is supported directly or indirectly by energy development, many residents accept and support energy development in the analysis area. In a survey conducted for the Douglas Master Plan, nearly 60 percent of respondents identified energy development (oil, gas, and coal) as their top economic development priority (City of Douglas 2014b). In a survey of residents conducted in conjunction with the Campbell County 2013 Comprehensive Plan, 81.5 percent of respondents agreed with the goal to promote mineral development and energy production (Campbell County 2013).

While the general attitude toward energy development within the analysis area is supportive and accepting, there also has been conflict associated with adjacent land use, health, traffic, and split estate issues. The potential for conflict arises when residences, farms, ranches, and public recreation areas are within or adjacent to energy development areas and along primary access routes. Conflict also can occur where ancillary facilities such as natural gas processing plants, pipeline terminals, and rail transfer stations are located or planned. These issues have involved concerns, about noise, traffic, lighting, air quality, water quantity and quality, health and safety, changes in the setting and character of areas adjacent to development, and effects on property values, agricultural, and recreational uses.

While the majority of the CCPA is rural and sparsely populated, there are some communities inside the CCPA (i.e., Rolling Hills and Bill) as well as adjacent to the CCPA (i.e., Douglas and Glenrock are adjacent to the southern boundary, and Lost Springs is located along an access route just outside of the boundary). The CCPA also includes rural residential areas around Douglas, where oil and gas development has increased in recent years.

As noted in Section 3.11.3, approximately 84 percent of the federal mineral estate in the CCPA is located beneath privately owned surface estate, resulting in a large area of split estate, wherein the surface and mineral estate have different owners. Consequently, there is relatively high potential for conflicts between mineral developers and the owners of surface rights adjacent to oil and gas development, particularly in parts of the county where there is a higher concentration of rural residential and smaller agricultural properties. The potential for conflict within the CCPA is heightened by the fact that Converse County does not have a zoning ordinance. As a result, industrial land uses can and do occur in relatively close proximity to residential land uses, subject to state regulations.

In November 2014, 32 rigs were drilling in the three county region; 18 of those in Converse County (Baker Hughes 2014). The Casper area also was experiencing an upsurge in economic activity related to its role as a regional oil and gas service center. Consequently, communities in the analysis area are experiencing both positive and adverse socioeconomic effects of the current oil and gas boom.

As might be expected, these challenges include work force and housing shortages (Blanchard 2014; Blanton 2014; Chaffin 2014; Espeland 2014; Hughes 2014; McCreight 2014). The 2014 labor market was tight, and most oil and gas service firms and industrial and commercial construction companies were relying heavily on nonlocal workers. As discussed in Section 3.11.7, temporary housing is in short supply, particularly in Converse County. The lodging industry was beginning to respond to the demand; new hotels were being constructed in Douglas and Casper and several were under consideration for Gillette and Wright (Chaffin 2014; Collins 2014; McCreight 2014; Surface 2014). However, addressing the housing issues was challenging because real estate developers and lenders have previous experience with energy boom-bust cycles, and developers experienced difficulty hiring and retaining contractors and qualified construction laborers to construct new lodging establishments and conventional housing for the rental and owner-occupied markets. Construction costs also were rising due to demand for equipment, concrete, and other materials and supplies. The competition for qualified labor, combined with the effects of the high wages paid by the oil and gas industry and high cost and limited availability of housing also resulted in hiring and recruiting difficulties for local governments and businesses (Blanton 2014; Collins 2014; Espeland 2014; Maidl 2014; Sonenson 2014).

Although essential utility systems (water, wastewater, and solid waste disposal) had adequate capacity to accommodate growth through 2014, rapid increases in demand for public services such as law enforcement and road maintenance strained local government capacities, particularly in Converse County. For example, the Converse County Sheriff's Office increased the number of deputies by 45 percent, from 11 to 16, in response to an 80 percent increase in calls for service between 2009 and 2013. The number of criminal cases also rose approximately 20 percent per year (Becker 2014; Douglas Budget 2014b). The Douglas Police Department increased its staffing by three officers (City of Douglas 2014a), and Memorial Hospital of Converse County increased the number of staff physicians and opened its urgent care facility on Saturdays (Dugger 2014).

A number of land use conflicts and health, safety, and traffic concerns accompanied the recent round of oil and gas development in Converse County. A truck-to-rail oil transfer facility, a gas processing plant, and oil and gas pipelines and other ancillary facilities were developed outside the CCPA in areas that previously were rural and residential. The siting and operation of these industrial facilities raised concern regarding traffic and air quality in Douglas. Traffic, flaring of natural gas, the potential for accidents, and adverse effects on the value of adjacent and nearby properties have caused concerns for some residents of rural residential and agricultural areas experiencing oil and gas development.

Larger landowners in Converse County have benefitted from past experience in dealing with energy companies during previous rounds of coal, oil and gas, uranium, and more recent wind energy development. That experience served as an impetus for the formation of the Converse County Land Owners Association, which serves as a resource for landowners who are negotiating with energy companies for surface use and damage agreements. For some large landowners, payments associated with surface use and damage agreements provide an additional source of income, which has been helpful in light of economic hardships associated with the recent drought. Some large landowners have negotiated surface agreements that include such conditions as speed limits on private roads, dust control, limitations on times of use, and fines for livestock and wildlife mortality (Huntington 2014; Schroeder 2014).

Many smaller landowners and rural homeowners whose land and homes are adjacent to areas of development or along county roads providing access to development receive little or no direct benefits from oil and gas development. The traffic, noise, lighting effects, concern for health and safety, and change in character of the rural setting are seen as adverse effects on their lifestyle, quality of life and property values. These concerns were heightened for landowners by a 2012 well blowout, an increase in drilling and industrial development in the rural residential area north and east of Douglas (including that along Antelope Road/Wyoming 52) increases in the volume of heavy truck traffic and accidents on county roads, recent oil and gas leasing near the Town of Rolling Hills, and development of ancillary facilities south of Douglas.

These concerns resulted in oil and gas impact forums and citizen, landowner, and non-governmental organization requests for action on the part of the Wyoming legislature and the WOGCC (Powder River Basin Resource Council et al. 2013), including consideration by the WOGCC of new rules for setbacks between wells and homes, schools, and other residential buildings; flaring; and bonding for development on split estate lands (WOGCC 2014a). In response, the Wyoming legislature passed a measure to increase the bonds paid by oil companies on split estates, and the WOGCC initiated a rule-making process to increase the required setback distance for drilling rigs from occupied structures from a distance of 350 feet to 500 feet. This process also requires notification of landowners within 1,000 feet of a lease before drilling is to begin.

Heritage resources include cultural and archeological resources and historic trails (BLM 2007b). Cultural resources within and near the CCPA help support the tourism and recreation economy in Converse County and surrounding areas, and also are important as an amenity for many residents and nonresidents. During the scoping process for this analysis, there was a concern that damage to heritage resources, including historic and cultural landscapes (e.g., wide open spaces), could adversely affect the tourism and recreation economy and reduce the quality of life for residents. See Section 3.2, Cultural Resources, Historical Trails, and Native American Concerns, for more detail regarding these concerns.

3.11.12 Non-market Values

People derive a variety of values from public and private lands in Central Wyoming. These values include those associated with commercial and non-commercial uses of these lands (e.g., grazing, mineral and energy resource production, guided hunting and fishing, and unguided recreational opportunities) as well as the personal benefits derived from the physical appearance and ecological processes and functions of the landscape. These two types of values are known as market and non-market values.

Market values supported by BLM-administered surface lands and federal mineral estates are relatively easy to understand and assess. Commodities produced through the use of BLM-administered lands (e.g., oil and gas, hard rock minerals, mineral materials, livestock, and timber) are bought and sold through market transactions using prices that reflect their value. Other uses of BLM-administered lands (e.g., outdoor recreation) may not require users to pay a fee but also are attributed with stimulating economic activity through visitors' purchases of gas, food, lodging, rental equipment, and local guides. These land use activities often are economic drivers for rural economies that surround federal public lands and contribute to the economic well-being of local residents.

In addition to market values, people derive a variety of values from environmental goods and services that are not reflected in traditional market transactions. Non-market values of open space and well-managed natural resources include a broad range of human benefits resulting from healthy ecosystem conditions and functions. Natural landscapes within the CCPA provide clean air and water and help sustain regional biodiversity, decomposition of wastes, soil and vegetation generation and renewal, pollination of crops and natural vegetation, groundwater recharge, seed dispersal, greenhouse gas mitigation, and aesthetically pleasing landscapes that serve as habitat for wildlife and important game species. Although people do not explicitly pay to enjoy these natural amenities, they are widely recognized to derive "use" and "non-use" benefits that contribute to personal health and well-being and are an important part of the unique sense of place and quality-of-life enjoyed by rural residents from these ecosystem services.

Other examples of non-market values include non-monetary benefits from wildlife viewing, fishing, or hunting for recreation.

Visiting OHV users, fishermen, and hunters spend money on motels and restaurants, but for the most part recreation on BLM- and USFS-managed lands comes free or at a nominal charge. Therefore, much of the value that humans might place on maintaining lands for conservation and recreation have no monetary value in the market economy. The BLM and USFS are increasingly asked to consider these values, in effect, to replace that zero value with a more useful number for planning and analysis purposes.

Non-market values derived from natural and cultural resources administered by the BLM include both use and non-use values. Use values refer to the benefits an individual derives from direct and indirect interactions with the environment, such as outdoor recreation, watershed services, and soil stabilization and erosion control. In contrast, non-use values, also referred to as "passive use" values, are not associated with individual consumptive or non-consumptive uses of the environment. Instead, these values stem from a desire to preserve or improve a resource (e.g., natural landscape, restored ecosystem, endangered species) as a social or public good (existence value), for future use (option value), or for enjoyment by future generations (bequest value) (Brown et al. 2007; Sanders et al. 1990).

Economists have developed a variety of non-market valuation techniques to estimate the monetary value people associate with public lands and the benefits they provide. In the absence of traditional prices, economists measure these non-market values by estimating the consumer surplus, or personal benefits, individuals derive beyond any monetary costs they incurred to derive them. These net benefits reflect the personal satisfaction or utility derived from the natural environment that an individual would have been willing to pay for but does not have to pay for in order to receive personal satisfaction. Around the country, on-site use values have been calculated for public goods like recreation and water quality. Passive use values have been calculated for rare species and environments such as wilderness. Valuation studies of recreation use are common nationally and many studies of this type are available for the intermountain area (Rosenberger and Loomis 2001). **Table 3.11-*45*** provides an example of such estimates, displaying the average on-site use values for selected recreation activities that resemble public use near the CCPA. These values represent the economic value received by users over and above what they received for their direct expenditures.

Table 3.11-45 **Non-market Use Value of Recreation on Public Lands in the Intermountain Area**

Recreational Activity	Value per Person per Activity Day (2006 dollars)[1]
Biking	69
Camping	28
General Recreation[2]	16
Hiking	35
Picnicking	28
Sightseeing	14
Wildlife Viewing	38

[1] Original data in 1996 dollars was adjusted to 2006 dollars using the gross domestic product inflation index.

[2] General recreation is a composite of recreation opportunities at a site with a measure for the site, not a specific activity.

NOTE: The Intermountain Area is USDA Forest Service Regions 1 through 4.

Source: Rosenberger and Loomis 2001.

Individuals, groups, and society also may value lands and landscapes for their non-use, or “passive,” attributes and characteristics that do not involve active on-site use. Examples of passive, or non-use, values include the pleasure associated with viewing a scenic open vista or a ranching landscape with cattle grazing in an irrigated pasture; individual actions to support establishment of wilderness and the opportunities for solitude thereby provided, whether one ever intends to recreate in a wilderness or not; or, satisfaction from the knowledge that efforts are being taken to protect critical habitat for an endangered species. While passive use values can be more difficult to quantify than use values, their existence can be observed in people’s willingness to give up time, money, and energy to preserve natural resources that they never use in any tangible way. Examples of this willingness to preserve in the absence of direct use can be observed through local, state, and national taxpayer funded programs that support a large variety of conservation and protection programs (e.g., national parks, state parks, local parks and parkways, open space initiatives) as well as non-profit organizations devoted a wide variety of conservation and wildlife-related causes. Many if not most of the supporters of these programs and organizations derive no direct benefit from their contributions.

Use values and passive or non-use values associated with public lands are very much a matter of individual preference, lifestyle, and social and economic circumstances. Non-market values can vary over time or in response to changing levels of availability, jeopardy, or scarcity of a resource or condition. Thus, while individuals may not assign much value to protecting common habitat or insect species that are considered pests, they would assign higher values to efforts to protect and restore an endangered species. On the other hand, where one group of individuals might view improved access onto public lands as a benefit by supporting motorized recreation and easier access to fishing, others would view it negatively because it may increase pressures on wildlife.

To date there has been relatively limited research in terms of the potential effects of oil and gas development located on wide-open prairie and grassland landscapes, characterized as lightly populated, mostly privately held surface lands used for ranching and farming. Concerns regarding potential adverse effects of oil and gas development, and specifically hydraulic fracturing, have risen over time as horizontal drilling has become a widespread practice, and the public at large has gained awareness regarding the mechanics, water use, and other aspects of the practice. Included among the concerns are the following:

- The effects on visual quality, particularly when industrial development is located within the foreground setting of a larger vista;
- Adverse effects on wildlife species, including breeding and migration, and adverse effects on habitat fragmentation;
- Potential or perceived effects on human health and quality of life due to traffic, noise, air quality effects, and hydraulic fracturing;
- Potential conflicts with established traditional uses, including agriculture, hunting, grazing, and other outdoor recreation on public lands, or diminishment of the level of enjoyment/pleasure gained from such use; and
- Potential or perceived adverse effects on property values, particularly to nearby/adjacent property where the surface owners realized no direct benefit from development or in proximity to industrial facilities and rail lines used to transport products.

Public awareness of the potential linkages between oil and gas development and public goods has become part of the community dialogue in Wyoming. Although the foundation of non-market values is rooted in economic terms, the local dialogue regarding impacts, compatibility with other uses, and other effects is subjective and qualitative in nature, often using personal perspectives and frames of reference and terms that are more social in character than they are economic. The fact that the dialogue is occurring is an indication of a shift in public attitudes toward oil and gas development among some members of the public.

Another aspect of the local dialogue regarding oil and gas development relates to the concept of externalities. Externalities refers to the effects of resource use decisions by one party on others who did not have a choice in the decision and whose interests were not taken into account in the decision. An example of a negative externality would be noise from a highway, drilling rigs, compressor stations, or airports that diminishes the quality of life of residents living nearby and may detract from property values. Externalities also can be positive or beneficial.

While there are difficulties associated with measurement of non-market values, it is well-accepted that the natural and cultural resources of an area and the open space the area may provide can have monetary values ascribed to them. For example, it is common for real estate investors to pay more for view lots or property adjacent to open space, and for people to donate to help protect endangered species or other sensitive resources.

Although the generalized evidence of nonuse values is clear, estimating nonuse values for specific resources is difficult and often controversial. BLM guidance recommends that use values be emphasized rather than nonuse values (BLM 2010b).

3.11.13 Environmental Justice

Environmental Justice is defined by the USEPA as “The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means that no group of people including racial, ethnic, or socioeconomic groups should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of federal, state, local, and tribal programs and policies” (USEPA 1998).

EO 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, states “each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations…”

EO 12898 also applies to federally recognized Indian tribes; therefore, it is important to determine whether any Indian tribes are present in the area, have treaty or reserved rights for lands and resources in the analysis area, or have traditional cultural and historical use tied to lands and resources in the analysis area. This requires federal agencies to determine what, if any, interests federally recognized Tribes may have in a given analysis area.

The purpose of EO 12898 is to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects on low-income populations, minority populations, or Indian tribes that may experience common conditions of environmental exposure or effects associated with a project. It is important to note that minority populations, low-income populations, or tribes may experience common effects from a project even if they do not reside in the immediate analysis area. EO 12898 requires federal agencies to ensure opportunities for effective public participation by potentially affected low-income populations, minority populations, or Indian tribes. These populations are potential environmental justice populations of concern that should be addressed throughout the NEPA process.

The assessment of potential environmental justice impacts is guided by the CEQ Environmental Justice Guidance under the NEPA (CEQ 1998). Determination of environmental justice impacts for minority and low income populations requires three steps: 1) determining the presence and geographic distribution of low-income, minority, and tribal populations in the affected area; 2) assessing whether the action under consideration would produce impacts that are high and adverse; and 3) determining whether high and adverse effects would disproportionately affect minority and low income populations. Determination of potential impacts on Native American lands and resources (e.g., treaty-protected resources, cultural resources and/or sacred sites) requires identification of current and historical use of the area by Native Americans, identification of resources of Native American concern within the area, and determination of the impacts of the actions under consideration on those resources.

The BLM and USFS work in cooperation with American Indian tribes to coordinate and consult before making decisions or approving actions that could result in changes in land use, physical changes to lands or resources, changes in access, or alienation of lands. Federal programs are required to be carried out in a manner sensitive to American Indian concerns and tribal government planning and resource management programs. Details regarding public involvement and tribal consultation to date are provided in Sections 1.6 and 7.2, respectively.

The remainder of this section identifies the presence and geographic distribution of minority and low income populations in areas potentially affected by the Project to determine whether sufficient numbers and relative concentrations of either category exist to warrant detailed consideration of disproportionate affects from an environmental justice perspective. This section also describes interests of federally recognized Indian tribes in areas potentially affected by the Project as a basis for determining environmental justice effects of the action alternatives on those interests. See Section 1.6 for a description of the scoping process and other opportunities for minority, low income, and Native American participation in the EIS process. See Section 7.2.1 for a description of the government-to-government consultation process conducted to date by the BLM with affected federally recognized Indian Tribes.

The CCPA primarily encompasses the central and northern portions of Converse County, including the communities of Rolling Hills and Bill, and the southern portions are near Douglas, Glenrock, and Lost Springs. **Table 3.11-*46*** provides the 2010 U.S. Census information on the presence of racial and ethnic minority residents in the U.S., the State of Wyoming, and Converse, Campbell, and Natrona counties. For purposes of this assessment minority is defined as individuals who self-identified themselves as other than White Alone by race and of non-Hispanic ethnicity, including American Indians (U.S. Census Bureau 2011b).

There are no recognized American Indian Reservations in or near the CCPA.

Table 3.11-46 **Racial and Ethnic Minority Populations in the Analysis Area: 2010**

Geographic Area	Total Population	White Alone and not Hispanic or Latino (percent)	Total Racial and Ethnic Minority[1] (percent)	American Indian or Alaskan Native[2] (percent)
U.S.	308,745,538	63.7	36.3	1.7
Wyoming	563,626	85.9	14.1	3.3
Converse County	13,833	91.3	8.7	1.6
Census Tract 9566, Block Group 12	1,451	95.7	4.3	1.7
Campbell County	46,133	88.9	11.1	2.1
Census Tract 1, Block Group 23	2,359	95.0	5.0	2.0
Natrona County	75,450	89.1	3.2	1.9

[1] This category includes all people who self-identified as something other than non-Hispanic and White Alone. American Indians alone or in combination with one or more other races are included in this category.

[2] American Indian or Alaskan Native alone or in combination with one or more other races. This category is included in the total racial and ethnic minority category.

[3] Census Tract 9566, Block Group 1 includes the rural portion of Converse County north of the North Platte River including the communities of Rolling Hills and Bill.

[4] Census Tract 1, Block Group 2 includes the southwestern portion of Campbell County including the Town of Wright.

Source: U.S. Census Bureau 2011b, 2011a.

At the time of the 2010 Census, all three counties in the socioeconomics and environmental justice analysis area, the Converse County block group that encompasses most of the CCPA, and the block group in southwestern Campbell County that includes Wright and the surrounding rural areas had relatively smaller racial and ethnic minority populations, expressed as a percentage of the total population, than did either the nation or the state as a whole. Residents identifying themselves as American Indians, either alone or in combination with one or more other races, accounted for lower shares of the local populations in the analysis area than across the state and was comparable to or slightly higher than the national average.

Converse County Census Tract 9566, Block Group1 from the 2010 Census covers more than 2,000 square miles and most closely corresponds to the portion of the CCPA in central and northern Converse County. The 2010 Census reported an estimated population of 1,451 residents in the area, which is equivalent to an average population density below 1.0 person per square mile. Of those, 62 (approximately 24 percent) were not white and not Hispanic, 24 of whom were American Indian. The majority of racial and ethnic minority residents living elsewhere in Converse County, including 86 percent of the 106 American Indian residents in the county, lived in or near Douglas and Glenrock. Review of the 3,481 census tracts in Converse County revealed that there are no large concentrations of racial minorities, including American Indians, in any census tract. No concentrations of racial minorities, including American Indians, were identified in any community or rural area during the EIS scoping process or in interviews with local government officials and staff.

Based on county-level estimates prepared by the U.S. Census Bureau, **Table 3.11-*47*** provides a summary of the incidence of poverty for 2012 in the CCPA.

Table 3.11-47 **Estimated Poverty Rates in the Analysis Area: 2012**

Geographic Areas	2012 Population	Persons in Poverty	Percent of Population Below Poverty Level
U.S.	306,086,063	48,760,123	15.9
Wyoming	561,478	66,879	11.9
Converse County	13,862	1,316	9.5
Census Tract 9566, Block Group 1[1]	1,468	28	1.9
Campbell County	47,118	3,292	7.0
Census Tract 1, Block Group 2[2]	2,512	210	8.4
Natrona County	76,633	9,595	12.5

[1] Census Tract 9566, Block Group 1 includes the rural portion of Converse County north of the North Platte River including the communities of Rolling Hills and Bill.

[2] Census Tract 1, Block Group 2 includes the southwestern portion of Campbell County including the Town of Wright.

Source: U.S. Census Bureau 2013.

As noted in Section 3.11.5.5, the 2012 per capita personal income in Converse, Natrona, and Campbell counties was higher than the national average, and in Converse and Natrona counties it was higher than the statewide average. Per capita income in Campbell County was 3 percent below the statewide average in 2012. Across Converse and Campbell counties, the estimated incidence of poverty in 2012 was lower than the national and state averages. The incidence of poverty in Converse County, Census Tract 9566, Block Group 1 was 1.9 percent, which was considerably lower than the county and statewide averages. An estimated 8.4 percent of the 2012 population of Campbell County, Census Tract 1, Block Group 2, which lies north of the CCPA and includes the Town of Wright, had income below the poverty level.

The incidence of poverty in Natrona County was lower than the national average but 0.6 percent higher than the statewide average. The Natrona County poverty level was not meaningfully higher than the statewide average, and given that the CCPA is at some distance from Natrona County, adverse health or safety effects would not be anticipated.

No concentrations of low-income residents were identified in any community or rural area during the EIS scoping process or in interviews with local government officials and staff.

As noted in Section 3.2.3.1, the analysis area for effects on land and resources of Native American concern is the CCPA plus their viewsheds. Based on historical research and on tribal consultation conducted by the BLM, Native American groups known to have used the CCPA protohistorically and historically include the Crow, Eastern Shoshone, Northern Arapaho, Northern Cheyenne, and Sioux tribes. The 1868 Treaty of Fort Laramie established the Great Sioux Reservation, encompassing all of present day western South Dakota and acknowledging a large portion of eastern Wyoming and northern Nebraska as “unceded” territory (Section 3.2.3.1).

WYCRO file searches conducted as part of the cultural assessment for the EIS identified two known TCPs within the CCPA (Section 3.2.3.5). Tribal consultation was previously conducted for the two ***cultural resources, which is what established that both are TCPs***. Previous inventories identified additional site types that potentially also could be TCPs or other resources of Native American concern.

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3.12 Soils

A variety of data sources were used to identify the baseline soil characteristics in the CCPA. Information on Major Land Resource Areas (MLRAs) and soil types was obtained from NRCS literature or databases, including the Land Resource Regions and MLRAs of the United States, the Caribbean, and the Pacific Basin U.S. Department of Agriculture Handbook 296 (USDA-NRCS 2006) and the Soil Survey Geographic Database (SSURGO). Soil baseline characterization for the CCPA was based on SSURGO database review and analyses. SSURGO is the most detailed level of soil mapping done by the NRCS (2014).

3.12.1 Laws, Ordinances, and Regulations

Soil resources are managed through a broad set of regulations, guidelines, and formal planning processes. These controls and directions are administered through federal, state, or local units of government. At the federal level, primary land management agencies include the BLM and USFS. Through state and local agency offices, the NRCS administers soil conservation programs on private lands. In addition, the NRCS inventories Prime and Unique Farmlands, as identified in 7 CFR 657. These farmlands are of statewide or local importance to crop production. The Farmland Protection Policy Act states that federal programs that contribute to the unnecessary and irreversible conversion of farmland to non-agricultural uses will be minimized and shall be administered in a manner that, as practicable, is compatible with state and local government and private programs and policies to protect farmland.

On lands administered by the BLM, soil resources primarily are addressed through BLM Handbook H-4810-1, Rangeland Health Standards, which are based on 43 CFR 4180.1, Fundamentals of Rangeland Health. This regulation directs the BLM to ensure that “watersheds are in, or are making significant progress toward, properly functioning physical condition, including their upland, riparian-wetland, and aquatic components; soil and plant conditions support infiltration, soil moisture storage, and the release of water that are in balance with climate and landform and maintain or improve water quality, water quantity, and timing and duration of flow.” The BLM CFO administers these regulations and guidelines, including soil conservation considerations, through the Casper RMP and ROD (BLM 2007b) and project-level assessments. Additionally, the Surface Operating Standards for Oil and Gas Exploration and Development (Gold Book) provides guidance and standards to help oil and gas operators obtain permit approval for development on federal surface or mineral estate (USDOI-USDA 2007). The Gold Book guidance includes avoidance of sensitive soils, topsoil segregation and storage, use of drainage structure, and erosion control. The Gold Book applies to lands managed by both the BLM and the USFS, including those within the TBNG. The BLM Wyoming Reclamation Policy (IM WY-2012-032) identifies reclamation requirements, including measures for topsoil and subsoil salvage that must be addressed when developing reclamation proposals for any surface-disturbing activity on BLM-administered lands. Other guidance that can be used to determine soil health includes Soil Inventory, Monitoring, and Management Handbook H-7100-1 and EO 11514, Protection and Enhancement of Environmental Quality.

The USFS addresses soil resource management by implementing policy set forth in the TBNG LRMP through management, protection and use goals and guidelines in accordance with the National Forest Management Act. The Forest Service Manual, Soil Management (Chapter 2550) and the Forest Service Handbook, Watershed Conservation Practices Handbook (Chapter 2509.25) specific to each region also provide policy and guidance on managing soil resources.

The WDEQ administers the Wyoming Pollutant Discharge Elimination System Large Construction General Permit, which requires the implementation of a Storm Water Pollution Prevention Plan to minimize exposed soil during construction, disturbance of steep slopes, soil compaction, and other factors that contribute to soil erosion during construction on all lands regardless of ownership.

Local soil conservation districts report to state administrative agencies, typically conservation commissions associated with state departments such as the Wyoming Department of Agriculture. The soil conservation districts are responsible for local planning, program development, and reporting in order to administer soil and water conservation programs. They interact with their respective state-level departments as well as the NRCS.

3.12.2 Major Land Resource Areas

The majority of the CCPA is located within two MLRAs (USDA-NRCS 2006):

- Southern Portion of the Northern Rolling High Plains
- Mixed Sandy and Silty Tableland and Badland

The Southern Portion of the Northern Rolling High Plains MLRA is in the Missouri Plateau, unglaciated section of the Great Plains Province of the Interior Plains and makes up the largest proportion of the analysis area. This MLRA is an area of old plateaus and terraces that have been deeply eroded. Slopes are generally gently rolling to steep, and wide belts of steeply sloping badlands border a few of the larger river valleys. Terraces are common along most of the major river systems in the area. In places, flat-topped, steep-sided buttes rise sharply above the plains. The dominant soil orders in this MLRA are aridisols and entisols. Aridisols form in an arid or semi-arid climate. They are well developed soils that have a very low concentration of organic matter. In contrast, entisols are considered recent soils that lack soil development because erosion or deposition rates occur faster than the rate of soil development. Soils have developed in alluvium and residuum derived mainly from the Wasatch Formation. Lithology consists of light to dark yellow and tan siltstone and sandstones with minor coal seams.

The south eastern portion of the CCPA is in the Mixed Sandy and Silty Tableland and Badland Missouri Plateau MLRA. This MLRA is located in the unglaciated section of the Great Plains Province of the Interior Plains. This portion of the MLRA is an area of old plateaus and terraces that have been deeply eroded. Badlands consist of eroded walls and escarpments, small grass-covered tablelands and mesas, and basins in which there are scattered eroded buttes. Slopes range from nearly level to very steep. Many streams and gullies cut the Badlands. Tertiary continental sediments consisting of sandstone, siltstone, and claystone underlie most of this area. The Badlands consist of stream-laid layers of silt, clay, and sand mixed with layers of volcanic ash. The dominant soil orders in this MLRA are entisols, inceptisols, and mollisols. Entisols are described above. Inceptisols are soils that exhibit minimal horizon development, but exhibit more soil development that entisols. They are often shallow to bedrock or on steeply sloping lands. Mollisols are fertile soils with high organic matter and a nutrient-enriched, thick dark surface.

3.12.3 Existing Conditions

Soil characteristics such as susceptibility to erosion and the potential for revegetation are important to consider when planning for construction activities and stabilization of disturbed areas. These hazards or limitations for use are a function of many physical and chemical characteristics of each soil, in combination with the climate and vegetation. **Table 3.12-1** provides a summary of limiting soil characteristics in the CCPA including prime farmland, hydric, highly erodible, limited revegetation potential, droughty soils by land ownership. The descriptions of each soil characteristics are described in further detail below.

Table 3.12-1 Acreage of Limiting Soil Characteristics

Limiting Soil Characteristic	Acres in CCPA					Percent[1] of CCPA
	BLM	USFS	State	Private	Total	
Water Erodible	23,506	4,985	13,410	166,852	208,753	14
Wind Erodible	24,092	4,202	19,801	234,679	282,773	19
Droughty Soils	37,240	23,031	44,321	555,757	660,349	44
Hydric Soils[2]	1,545	1,124	4,315	49,644	56,874	4
Shallow Depth to Bedrock	0	0	119	262	381	<1
Prime Farmland	0	0	127	604	731	<1
Compaction Prone	26,525	38,428	29,254	352,652	446,859	30
Limited Reclamation Potential	14	0	76	4,106	4,196	<1

[1] ***Percentage reflects several soils with multiple limiting characteristics.***

[2] The acreage of hydric soils likely is overestimated because it is based on the acreage of entire map unit, which may be only partially hydric.

Source: NRCS 2014.

Water erosion is the detachment and movement of soil by water. Natural erosion rates depend on inherent soil properties, slope, soil cover, and climate. Water erosion hazard is determined by several factors including organic matter content, K factor (the higher the number the higher the hazard), permeability class, and slope. Soils on steep slopes are highly prone to water erosion. Water erosion prone soils were determined to have a K factor greater than 0.32 and a slope greater than 20 percent. Additionally, all soils on slopes over 30 percent were determined to be water erosion prone (**Figure 3.12-1**). Areas susceptible to water erosion potential are present throughout most of the CCPA, with the exception of the northeast portion and a corridor on either side of State Highway 59. Water erodible soils within the CCPA are often found along drainages. Approximately 14 percent of the soils within the CCPA are highly water erodible.

Wind erosion is the physical wearing of the earth's surface by wind that removes and redistributes soil. Small blowout areas may be associated with adjacent areas of deposition at the base of plants or behind obstacles, such as rocks, shrubs, fence rows, and roadbanks. Severe wind erosion hazards were identified by using the soil wind erodibility group rating, which is a numerical value indicating the susceptibility of soil 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, frozen soil layers, surface fragments (rock, duff, litter) slope and other factors also may influence erosion. There are nine wind erodibility groupings: 1, 2, 3, 4, 4L, 5, 6, 7, and 8. The lower the number, the greater the risk of wind erosion. Wind erodible soils were characterized as having a wind erodibility group value of 1 or 2. The greatest concentration of soils with high wind erosion potential is associated with eolian sand dunes in the southwestern portion of the analysis area (**Figure 3.12-2**). Approximately 19 percent of the soils within the CCPA are wind erodible.

Droughty soils have physical characteristics that may limit plant growth due to low water holding capacity. Droughty soils in the CCPA were determined by identifying soils with a surface texture of sandy loam or coarser and a drainage class of moderately well to excessively drained. In addition, the success of stabilization and restoration efforts in these areas may be limited unless additional treatments and practices are employed to offset the adverse physical characteristics of the soils. The majority of the soils in the CCPA are droughty. Approximately 44 percent of the soils within the CCPA are droughty (**Figure 3.12-3**).

Hydric soils are soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper portion. These soils are commonly associated with floodplains, lake plains, basin plains, riparian areas, wetlands, springs, and seeps. Due to the scale of mapping, small areas of hydric soils may not be captured by this dataset. Approximately 4 percent of the soils within the CCPA are hydric.

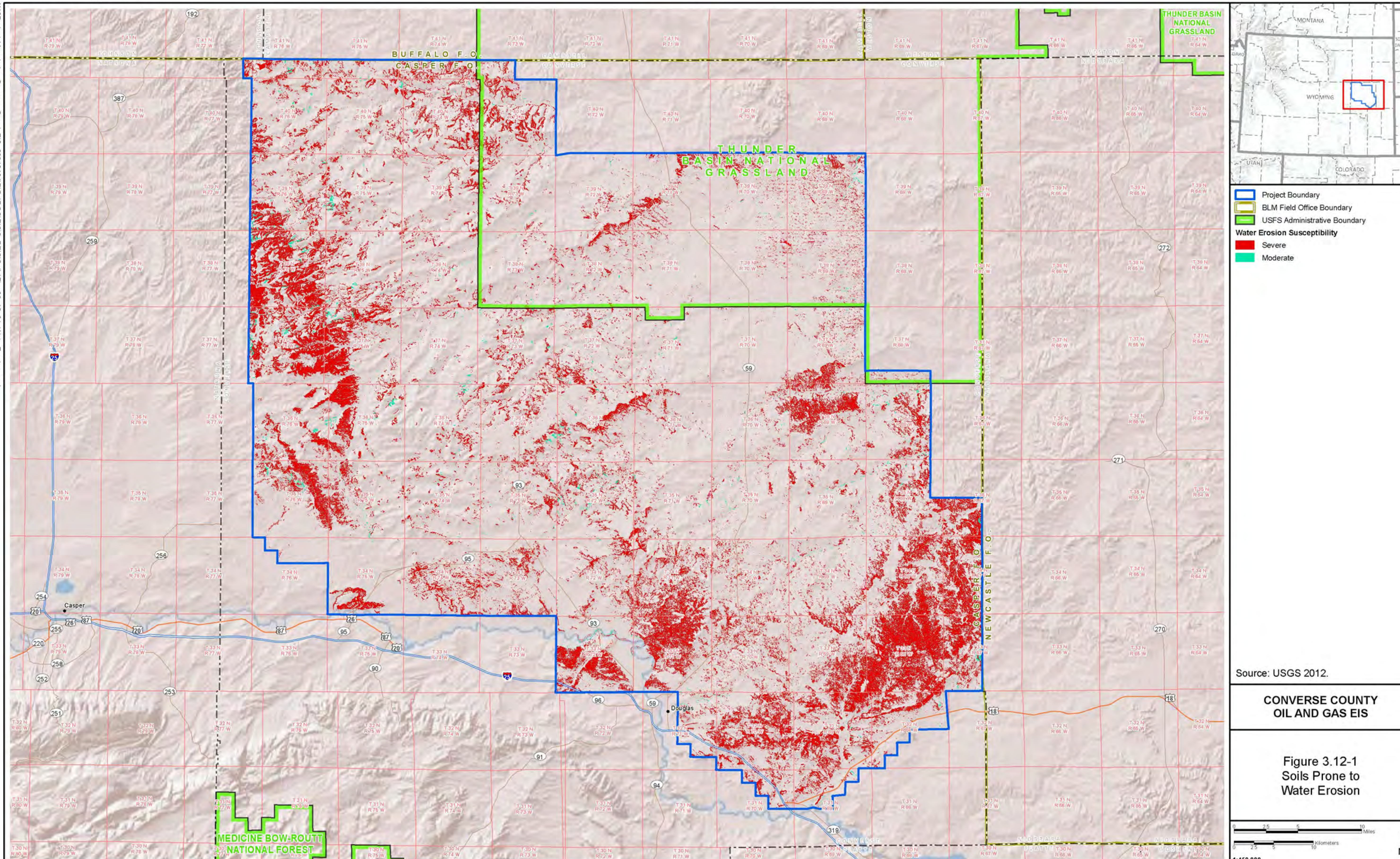
In areas with a shallow depth to lithic bedrock (relative to the well pad excavation depth or a pipeline), excavation may result in rock fragments remaining on the surface at levels that would limit the success of restoration efforts. Shallow depth to bedrock is of low concern in the CCPA.

Prime farmland is land that has the best combination of physical and chemical characteristics for producing crops and that is available for these uses. Prime farmland soils have the combination of soil properties, growing season, and moisture supply needed to produce sustained high yields of crops in an economic manner if they are treated and managed according to acceptable farming methods. These soils have the capability to be prime farmland, but may not have yet been developed for irrigated agriculture uses. The Farmland Protection Policy Act states that federal programs that contribute to the unnecessary and irreversible conversion of farmland to non-agricultural uses will be minimized and shall be administered in a manner that, as practicable, are compatible with state and local government as well as private programs and policies to protect farmland. Soils within the analysis area are only characterized as prime farmland if they are irrigated. No prime farmlands occur on federal lands within in the CCPA.

Soil compaction occurs when soil particles are pressed together, which reduces the pore spaces between them and increases the bulk density. This results in a decrease in infiltration and an increase in runoff and erosion. Moist, fine textured (i.e., clayey) soils are most susceptible to compaction. Soils with greater than 28 percent clay were interpreted as compaction prone. Approximately 30 percent of the soils in the CCPA are compaction prone (**Figure 3.12-4**).

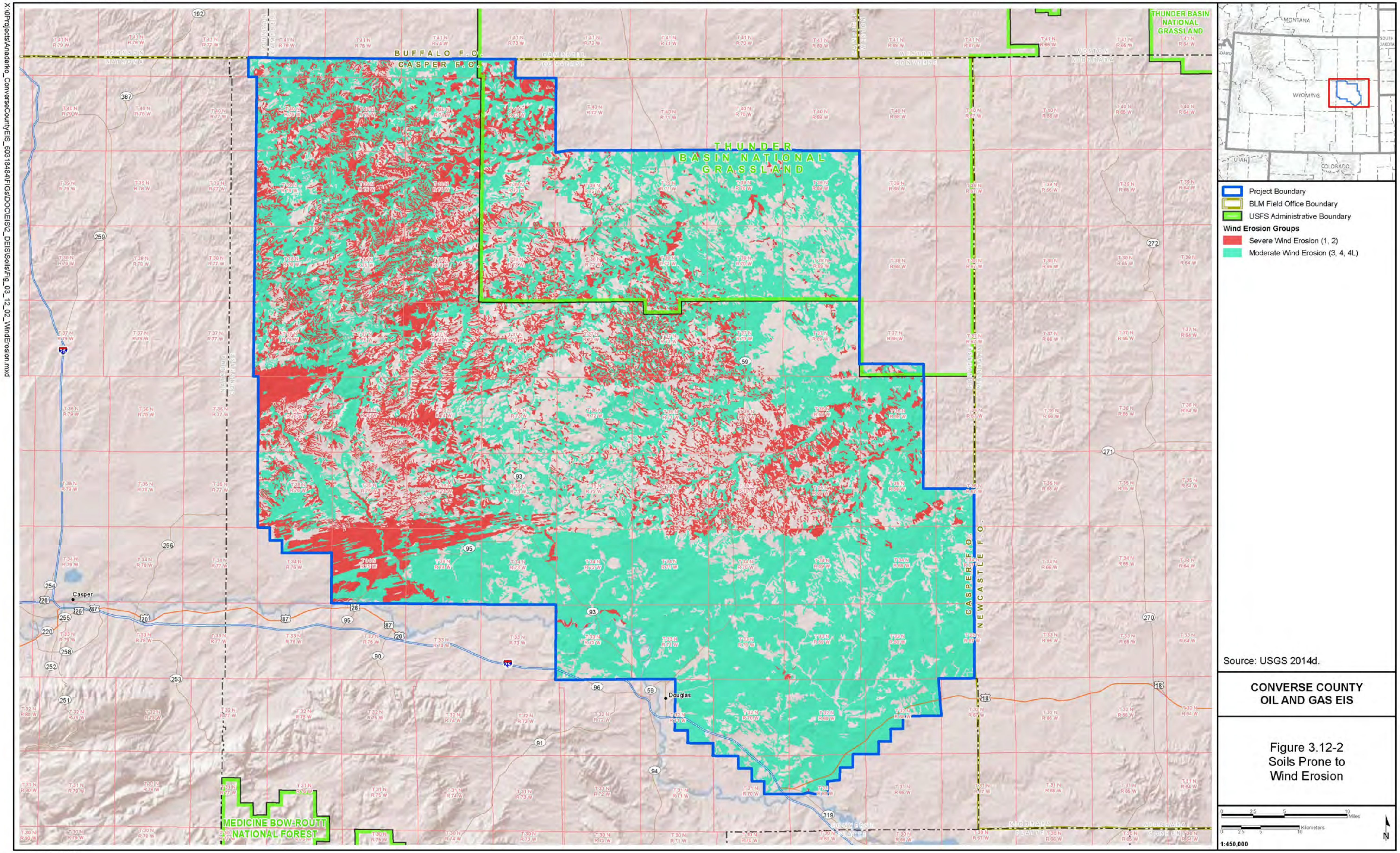
The BLM Wyoming statewide reclamation policy definition of areas with limited reclamation potential includes those characterized by highly sensitive and/or erosive soils, highly sensitive vegetation types, soils with severe physical or chemical limitations, extremely steep slopes, etc. These limited reclamation potential areas may require site-specific reclamation measures not specifically addressed in the Wyoming Reclamation Policy. Some areas with limited reclamation potential are identified as miscellaneous areas including, but not limited to, badlands, rock outcrop, and gullied lands in the SSURGO soils data. Other potential areas with limited reclamation potential may include areas susceptible to mass movement, very shallow soils, blown-out areas, areas with chemical properties rated unsuitable in WDEQ topsoil and overburden criteria, or other areas identified through on-site investigation as having properties that make meeting all of the reclamation requirements unrealistic or impossible.

Soils with limited reclamation potential have chemical characteristics such as high salts, sodium, or pH that may limit plant growth. Salinity impacts a plant's ability to take in water, whereas sodicity slows the movement of water through the soil. In addition, the success of stabilization and restoration efforts in these areas may be limited unless additional treatments and practices are employed to offset the adverse physical and chemical characteristics of the soils. Soils with limited reclamation potential are not prevalent in the CCPA (**Figure 3.12-5**).



CONVERSE COUNTY
OIL AND GAS EIS

Figure 3.12-1
Soils Prone to
Water Erosion



CONVERSE COUNTY
OIL AND GAS EIS

Figure 3.12-2
Soils Prone to
Wind Erosion

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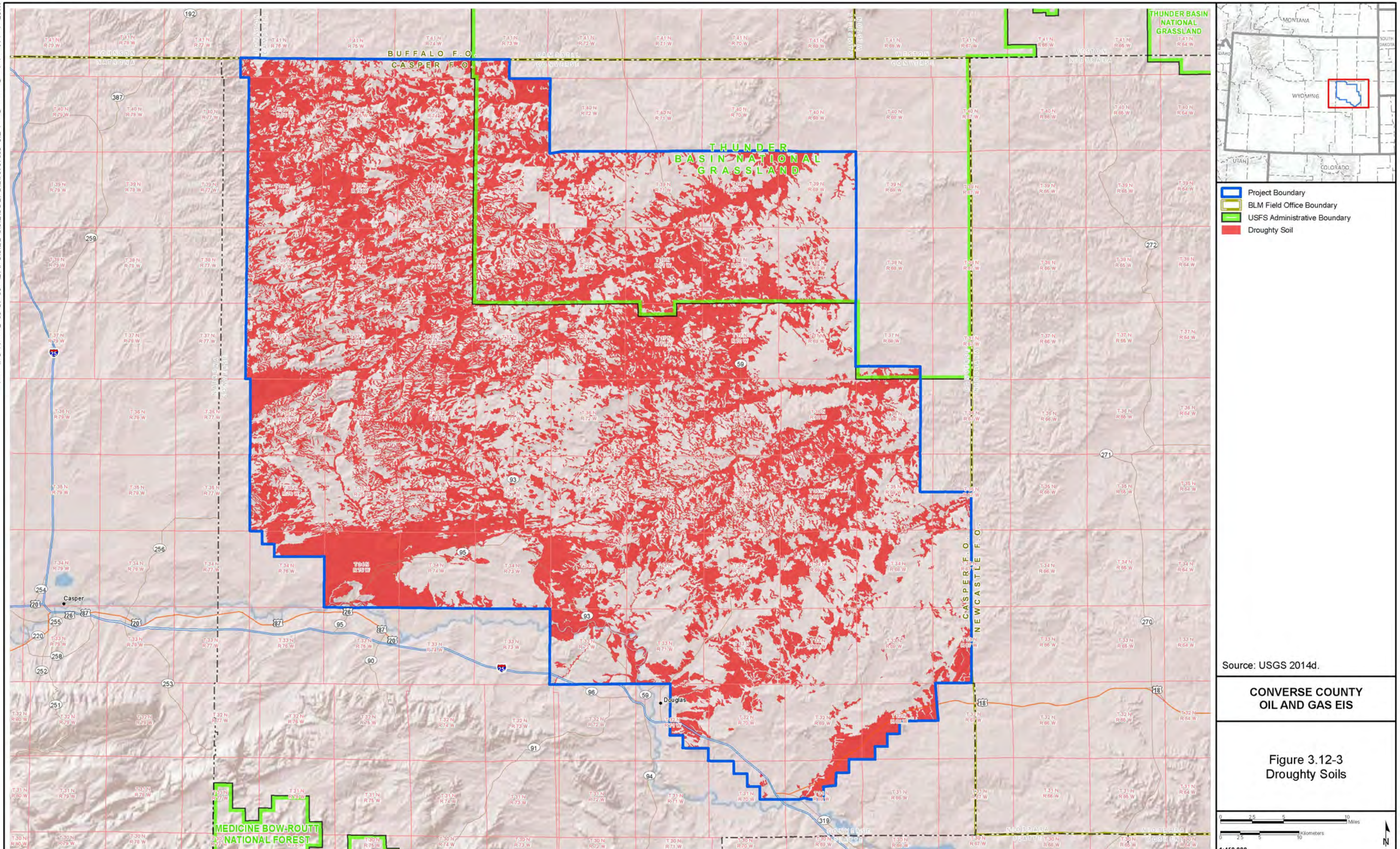

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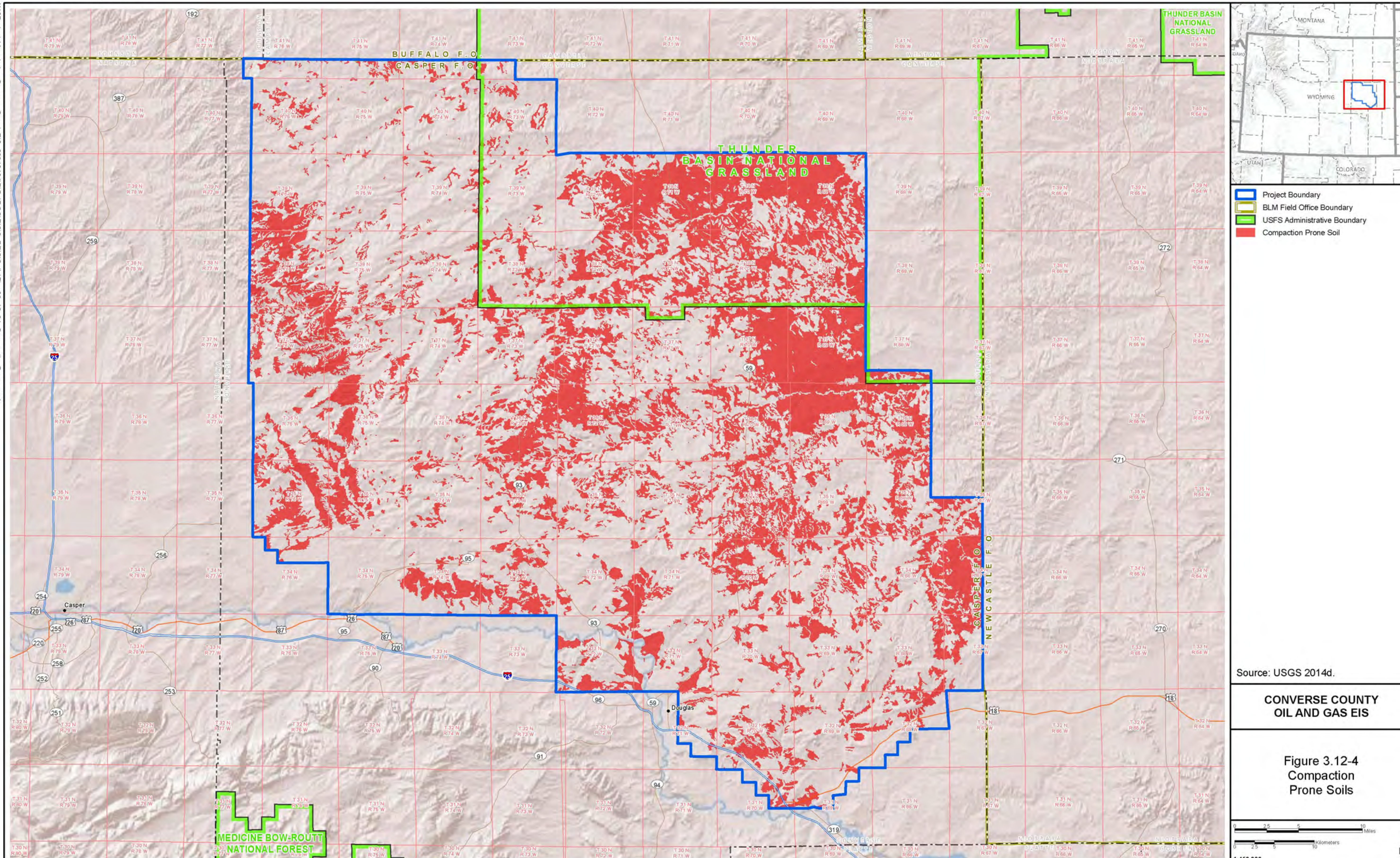

Source: USGS 2014d.

CONVERSE COUNTY OIL AND GAS EIS

Figure 3.12-4 Compaction Prone Soils

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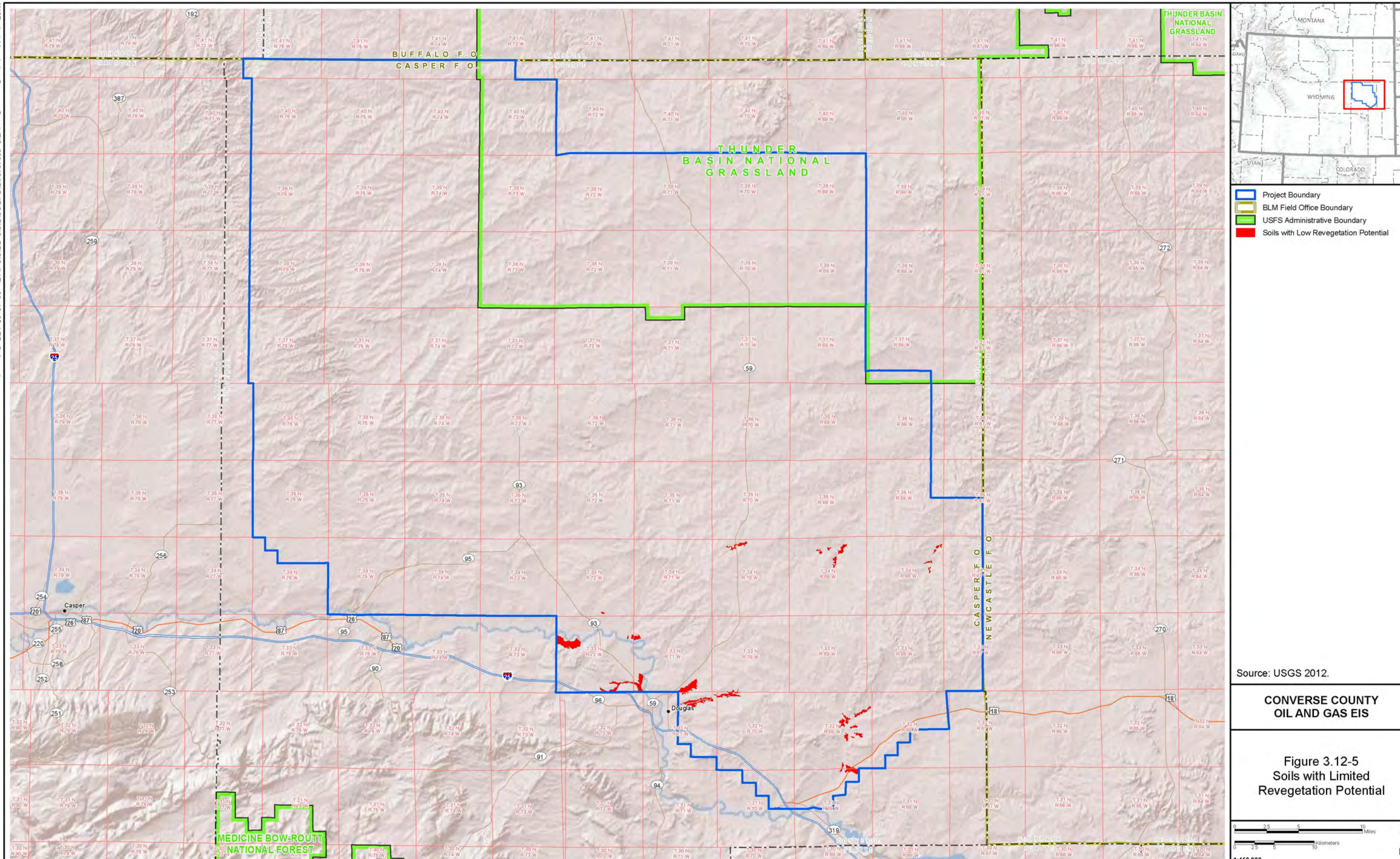

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3.12.4 Ecological Sites

Ecological site descriptions provide soil and vegetation information needed for resource identification, management, and reclamation recommendations. A summary of the ecological sites within the CCPA and their corresponding MLRA, approximate acreage, and percentage of the total area identified within the CCPA boundary are listed in **Table 3.12-2**.

Table 3.12-2 Ecological Site within CCPA

MLRA / Ecological Site Name	Acres	Percent of CCPA
Southern Portion of Northern Rolling High Plains		
Clayey (10- to 14-inch Northern Plains Precipitation Zone)	131,455	8.7
Clayey Overflow (10- to 14-inch Northern Plains Precipitation Zone)	2,672	0.2
Gravelly Loamy (12- to 17-inch Precipitation Zone)	218	<0.1
Loamy (High Plains Southeast)	2,047	0.1
Loamy (10- to 14-inch Northern Plains Precipitation Zone)	536,492	35.7
Loamy (12- to 17-inch Precipitation Zone)	67	<0.0
Lowland (10- to 14-inch Northern Plains Precipitation Zone)	51,989	3.5
Overflow (10- to 14-inch Northern Plains Precipitation Zone)	612	<0.1
Ponderosa Pine and Little Bluestem	22,080	1.5
Saline Upland (10- to 14-inch Northern Plains Precipitation Zone)	30,542	2.0
Sands (10- to 14-inch Northern Plains Precipitation Zone)	52,206	3.5
Sandy (10- to 14-inch Northern Plains Precipitation Zone)	183,985	12.2
Sandy (14- to 17-inch Precipitation Zone)	210	<0.1
Shallow Clayey (10- to 14-inch Northern Plains Precipitation Zone)	2,524	0.2
Shallow Loamy (10- to 14-inch Northern Plains Precipitation Zone)	363,831	24.2
Shallow Sandy (10- to 14-inch Northern Plains Precipitation Zone)	23,132	1.5
Shallow Sandy (15- to 17-inch Northern Plains Precipitation Zone)	134	<0.1
Very Shallow (10- to 14-inch Northern Plains Precipitation Zone)	133	<0.1
Wet Land	2	<0.1
Wetland (10- to 14-inch Northern Plains Precipitation Zone)	23	<0.1
Non-site	679	<0.1
Undefined	55,354	3.7
Total Southern Portion of Northern Rolling High Plains	*1,460,387*	*97.2*
Mixed Sandy and Silty Tableland and Badlands		
Clayey (10- to 14-inch Northern Plains Precipitation Zone)	158	<0.1
Loamy (High Plains Southeast)	901	0.1
Loamy (10- to 14-inch Northern Plains Precipitation Zone)	14,986	1.0
Loamy (12- to 17-inch Precipitation Zone)	102	<0.1
Loamy (14- to 17-inches Precipitation Zone)	49	<0.1
Lowland (10- to 14-inch Northern Plains Precipitation Zone)	862	0.1
Overflow (10- to 14-inch Northern Plains Precipitation Zone)	592	<0.1
Ponderosa Pine and Little Bluestem	763	<0.1

Table 3.12-2 Ecological Site within CCPA

MLRA / Ecological Site Name	Acres	Percent of CCPA
Sandy (10- to 14-inch Northern Plains Precipitation Zone)	10,454	0.7
Sandy (14- to 17-inch Precipitation Zone)	2,206	0.2
Shallow Loamy (10- to 14-inch Northern Plains Precipitation Zone)	4,135	0.3
Shallow Sandy (10- to 14-inch Northern Plains Precipitation Zone)	2,833	0.2
Non-site	1,672	0.1
Undefined	2,168	0.1
Total Mixed Sandy and Silty Tableland and Badlands	*41,881*	*2.8*
Grand Total	**1,502,268**	**100.0**

Source: NRCS 2014.

Dominant ecological sites and plant communities identified in the CCPA include loamy, sandy, shallow loamy, and clayey sites all within the 10- to 14-inch Northern Plains Precipitation Zone MLRA. These four ecological site types are all rangeland site types. Minor ecological sites and plant communities identified as areas that are difficult to reclaim include sands and sandy sites. Additionally, small inclusion areas of shallow parent material (10 feet or less deep) exist within the CCPA. See Section 3.14, Vegetation for a more detailed description of vegetation types in the CCPA.

The loamy ecological site covers approximately 36 percent of the CCPA. Composed of gently undulating rolling lands, this ecological site receives approximately 10 to 14 inches of annual precipitation and consists of well-drained, moderately permeable, and deep to moderately deep soils. The dominant species found within this ecological site include western wheatgrass (*Pascopyrum smithii*), needle-and-thread (*Hesperostipa comate*), green needlegrass (*Nassella viridula*), Cusick's bluegrass (*Poa cusickii*), Sandberg bluegrass (*Poa secunda*), bluebunch wheatgrass (*Pseudoroegneria spicata* spp. *spicata*), and blue grama (*Bouteloua gracilis*). Wyoming big sagebrush (*Artemisia tridentate*) typically comprises 15 percent of the vegetation community. Disturbances such as overgrazing and changes in the fire regime lead to changes in the vegetation community. Overgrazing would increase the Wyoming big sagebrush and blue grama but decrease cool season grasses. The absence of fire could increase the cover and percentage of Wyoming big sagebrush on the site until it becomes the dominant species. Disturbances also can lead to an increase in cheatgrass, western wheatgrass, and plains pricklypear (*Opuntia polyacantha*) (USDA-NRCS 2015).

The shallow loamy ecological site covers approximately 24 percent of the CCPA. Found on hills, ridges, and escarpments ranging from nearly level to 60 percent slopes, these ecological sites receive approximately 10 to 14 inches of annual precipitation and consist of shallow, well-drained soils. The dominant species found within this ecological site include western wheatgrass, bluebunch wheatgrass, needle-and-thread, little bluestem (*Schizachyrium scoparium*), Cusick's and Sandberg bluegrass, blue grama, and prairie junegrass (*Koeleria macrantha*). Wyoming big sagebrush typically comprises 5 to 10 percent of the vegetation community. As with the loamy ecological site in this same precipitation zone, disturbances such as overgrazing and changes in the fire regime lead to changes in the vegetation community (USDA-NRCS 2015).

The sandy ecological site covers approximately 12 percent of the CCPA. Found on alluvial fans, plateaus, and ridges ranging from nearly level to 30 percent slopes, these ecological sites receive approximately 10 to 14 inches of annual precipitation and consist of moderately deep to very deep, well-drained soils. Soils are moderately to very deep, well-drained, and have moderate to rapid permeability. These ecological site types are dominated by warm and cool season midgrasses. Typical species include needle-and-thread, prairie sandreed (*Calamovilfa longifolia*), little bluestem, Sandberg bluegrass, and Indian ricegrass (*Achnatherum hymenoides*). Dominant forb species include silver sagebrush (*Artemisia cana*) and green rabbitbrush (*Chrysothamnus viscidiflorous*). Disturbances such as overgrazing can lead to the conversion of sandy and loamy sites to a blowout community dominated by yucca (*Yucca glauca*), plains pricklypear, fringed sagewort (*Artemisia frigida*), sandbur (*Cenchrus* spp.) and western ragweed (*Ambrosia psilostachya*) (USDA-NRCS 2015).

The clayey ecological site covers approximately 9 percent of the CCPA. Found on hill sides, alluvial fans, and stream terraces on nearly level to slopes of 30 percent, this ecological site receives approximately 10 to 14 inches of annual precipitation and consists of well-drained, slightly permeable, and moderately to deep soils formed in alluvium or alluvium over residuum. The dominant species found within this ecological site include western wheatgrass, green needlegrass, Cusick's bluegrass, Sandberg bluegrass, needleleaf sedge (*Carex duriuscula*), blue grama, and plains reedgrass. Big sagebrush is a conspicuous element of this community (5 to 10 percent), occurring in a mosaic pattern; however, big sagebrush may become a dominant species with the absence of fire. As a result of frequent and severe grazing, species such as blue grama, plains pricklypear, cheatgrass, and big sagebrush may increase in dominance (USDA-NRCS 2015).

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3.13 Transportation and Access

The analysis area for transportation and access is the CCPA plus the regional highway network. The CCPA is located north of I-25 and is transected north-south by Wyoming SH 59 (**Figure 3.13-1**). Access to the CCPA typically is by Wyoming SH 59, Wyoming SHs 95 and 93, and U.S. Highway 18/20, all initiating from I-25 near the southern portion of the CCPA. Wyoming SH 59 heads north from I-25 near the City of Douglas. Wyoming SHs 95 and 93 also head in northerly directions from I-25 and U.S. Highway 18 heads east from I-25, and U.S. Highway 20 combines with I-25 and heads west. Several county roads branch off from these highways, and there are numerous existing rural roads and 4 wheel drive trails throughout the CCPA.

3.13.1 Regulatory Guidance

Transportation resources on BLM-managed land are subject to the stipulations and recommendations detailed in the BLM Handbook H-8342 and Manuals 9113 and 1626. BLM Handbook H-8342 provides specific guidance for preparing, amending, revising, maintaining, implementing, monitoring, and evaluating BLM land use and travel management plans. BLM Manual 9113 provides for the inventory, functional classification, sufficiency analyses, and establishment of maintenance levels on BLM roads, as well as BLM road standards, and guidelines for road project planning, design, construction and maintenance. Lastly, BLM Manual 1626 provides detailed policy, direction, and guidance to establish a comprehensive program for travel and transportation planning. The BLM categorizes roads as collector roads, local roads, and resource roads as follows:

- Collector Roads: These roads normally provide primary access to large blocks of land and connect with or are extensions of the public road system. Collector roads generally receive the highest volume of traffic on all roads in the BLM system. User cost, safety, comfort, and travel time are primary road management considerations.
- Local Roads: These roads typically serve a smaller area than collector roads and connect to collector roads or public road systems. Local roads receive lower volumes, carry fewer traffic types, and generally serve fewer users. User cost, comfort, and travel time are secondary to construction and maintenance cost considerations.
- Resource Roads: These roads generally are spur roads that provide point access and connect to local or collector roads. Resource roads carry very low volume and accommodate only one or two types of use. Use restrictions are applied to prevent conflicts between users needing the road and users attracted to the road.

Portions of the CCPA also are under USFS jurisdiction. The Travel Management Rule Action Plan, applicable to USFS-managed land, was revised in 2007 and is designed to serve as a tool for implementation of the 2005 Travel Management rule. This rule requires each USFS district to designate the roads, trails, and areas that are open to motor vehicle use. Classification of USFS roads falls into maintenance levels 1 through 5. Approximately 200 miles of roads transect USFS-managed lands. Of these 200 miles of roads, 84 miles are classified as level 1 maintenance roads, which are closed to motor vehicle use. These roads provide for long-term management access, but they are not to be used for general motor vehicle use. The remainder of the roads are classified as level 2 maintenance roads, which are for administrative and public use and are maintained for pickup trucks and other higher clearance vehicles, although passenger cars are not prohibited from using these roads.

Figure 3.13-1 depicts the road network in and around the CCPA. The CCPA is transected by or is adjacent to two federal highways, three state highways, and numerous county roads. I-25 skirts the southern portion of the CCPA and is a four-lane federal highway that is maintained by the Federal Highway Administration and the WYDOT. U.S. Highway 18/20 transects the southeastern portion of the CCPA and is accessed via I-25 at the Town of Orin. U.S. Highway 18/20 also is a two-lane federal highway maintained by the Federal Highway Administration and WYDOT. ***U.S. Highway 20/26/87 skirts***

east-west along the southwest edge of the CCPA, initiating in Casper and terminating at I-25 southeast of Glenrock. Wyoming SHs 59 and 93 both originate in Douglas and track north and northwest, respectively, into the CCPA. They are two lane roads maintained by WYDOT. Wyoming SH 95 also is a two lane state highway. It originates in Glenrock and tracks northeast into the CCPA. Numerous county roads also transect the CCPA. These roads include but are not limited to county roads 31 (Ross Road), 32 (Highland Loop Road), 34 (Jenne Trail Road), 38 (Dull Center Road), 43 (Walker Creek Road), 48 (Flat Top Road), 55 (Ranch Road), and 63 (Bill Hall Road). There are approximately 305 miles of county roads within the CCPA. These roads are depicted in **Figure 3.13-1**.

There are approximately 2,978 miles of roads within the CCPA, the majority of which are rural in nature or are associated with oil and gas development. Of the 2,978 miles of roads within the CCPA, 169 miles transect BLM-managed lands, the majority of which roads are classified as local roads.

Traffic counts for roads in the vicinity of the CCPA are provided in **Table 3.13-1**. Traffic on I-25 near the CCPA decreased from 2003 to2016. With the exception of truck traffic on a portion of U.S. Highway 18/20, I-25 is the only major roadway near the CCPA to witness an overall decline in all vehicle traffic; however, I-25 also experienced the largest increase in truck traffic. Of the major roadways within the CCPA, Wyoming SH 95 experienced the most dramatic increase in traffic during the 2003 to 2016 timeframe, with all vehicle traffic rising by over 900 percent. The majority of traffic along these roads consists of oil and gas maintenance workers as well local traffic associated with ranching activities. A portion of traffic traveling Wyoming SH 59 consists of vehicles that support coal mining within and adjacent to the Converse County border with Campbell County.

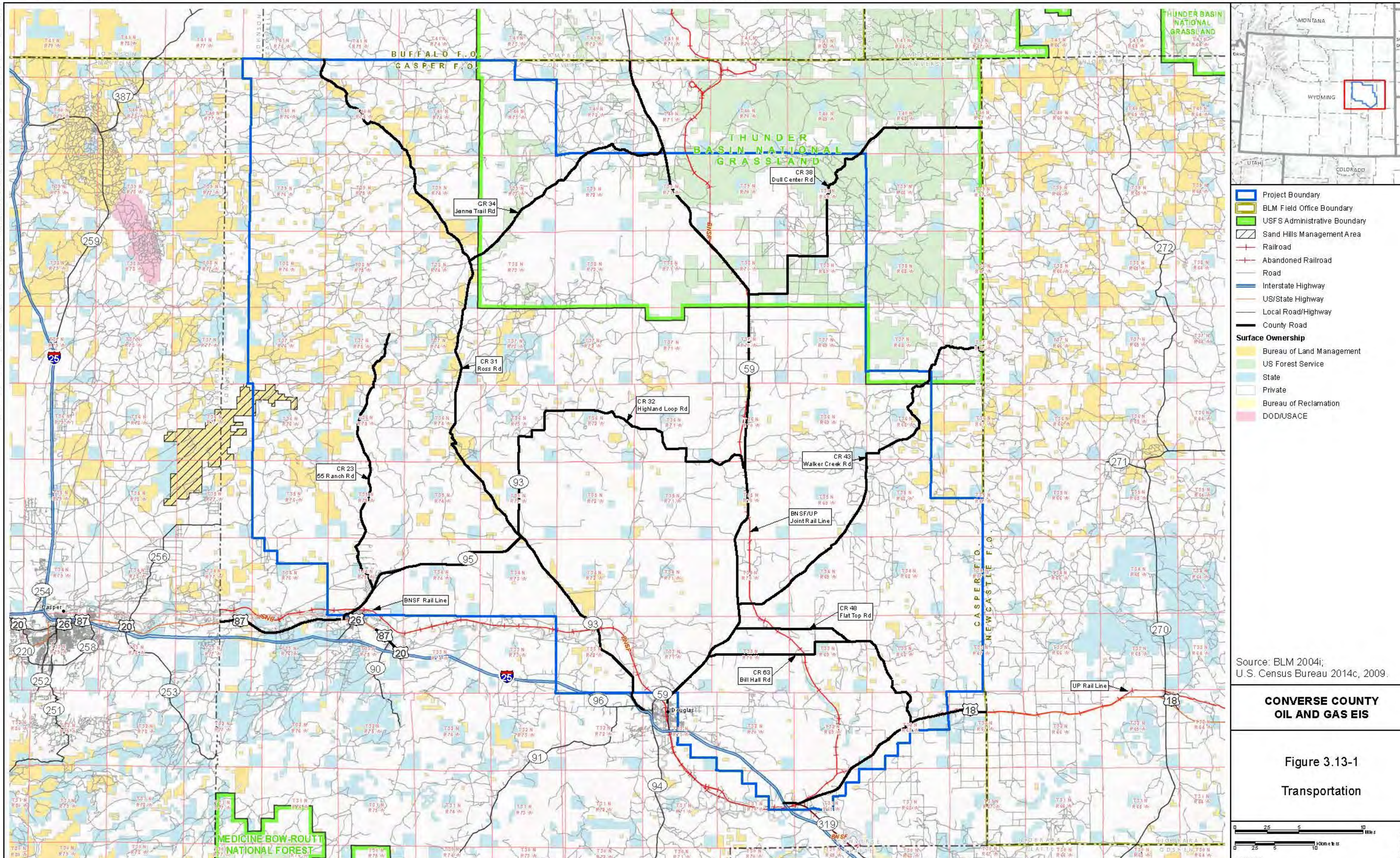
Table 3.13-1 Interstate Traffic Volume Near the CCPA: 2003 to 2016

Route	2003		2016		Percent Change 2003 to 2016	
	All Vehicles	Trucks	All Vehicles	Trucks	All Vehicles	Trucks
I-25 (Junction WY 59)	6,560	220	5,436	672	-17	205
I-25 (East Douglas Corporation Limit)	5,300	280	3,994	750	-25	168
WY 59 (County Road 43)	1,700	200	2,072	464	22	132
WY 59 (Converse/Campbell County)	1,200	200	2,403	319	100	60
US 18/20 (Junction WY 319)	1,830	420	2,059	322	13	-23
US 20/26/87 (Junction WY 95)	***3,830***	***130***	***3,800***	***349***	***-0.8***	***168***
WY 93 (Junction WY 95)	80	10	102	24	28	140
WY 95 (Junction County Road 26)	220	50	2,411	69	996	38

Note: Traffic counts presented in Average Daily Traffic Volume.
Source: WYDOT 2017, 2014.

Three rail lines transect the CCPA: the BNSF, the Union Pacific (UP), and the BNSF/UP Joint rail lines. The BNSF rail line roughly parallels I-25 along the southern portion of the CCPA traveling west at the town of Orin. A UP line roughly parallels U.S. Highway 18/20 transecting the southeast portion of the CCPA in an easterly direction from Orin. The BNSF/UP Joint rail line primarily transports coal from the Powder River Basin and transects the CCPA in a north-south direction, roughly paralleling Wyoming SH 59. Approximately 75 miles of railway transect the CCPA.

On BLM-managed lands, there are areas where OHV travel is allowed, areas where OHV use is limited to designated or existing roads and trails, and areas that are closed to OHV use. The majority of public lands in the CCPA are designated as OHV use limited to existing roads and trails. Additionally, on USFS-managed lands, OHV use is limited to designated roads and trails (USFS 2002). As noted in **Figure 3.13-1**, there is a small portion of the CCPA associated with the Sand Hills Management Area where OHV use is limited to existing roads and trails.



CONVERSE COUNTY OIL AND GAS EIS

Figure 3.13-1

Transportation

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3.14 Vegetation

Vegetation resources presented in this section include general vegetation communities, noxious weeds and invasive plant species, and special status plant species.

3.14.1 General Vegetation

The CCPA is located within two MLRAs identified by NRCS (2006) as:

- Northern Rolling High Plains, Southern Part
- Mixed Sandy and Silty Tableland and Badland

This area typically experiences a dry climate with approximately 12 to 14 inches average annual precipitation according to five nearby National Oceanographic and Atmospheric Administration (NOAA) weather stations (WRCC 2014b). Sagebrush shrubland and grassland are the dominant vegetation communities within the CCPA (BLM 2007b). Common plants found within these communities include Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*), silver sagebrush (*Artemisia cana*), winterfat (*Krascheninnikovia lanata*), rubber rabbitbrush (*Chrysothamnus nauseosus*), green needlegrass (*Nassella viridula*), needle-and-thread grass (*Hesperostipa comata*), bluebunch wheatgrass (*Pseudoroegneria spicata*), prairie junegrass (*Koeleria macrantha*), Sandberg bluegrass (*Poa secunda*), blue grama (*Bouteloua gracilis*), little bluestem (*Schizachyrium scoparium*), asters (*Aster* spp.), paintbrushes (*Castilleja* spp.), biscuitroot (*Lomatium* spp.), western yarrow (*Achillea millefolium*), fringed sagewort (*Artemisia frigida*), Hood's phlox (*Phlox hoodii*), buckwheat (*Eriogonum* spp.), and numerous other grasses and forbs (BLM 2012a).

3.14.1.1 Vegetation Community Types

Vegetation cover types and community characterizations in the CCPA were based on the Landscape Fire and Resource Management Planning Tools Project (LANDFIRE) database (LANDFIRE 2014). Due to the extensive characterization of the LANDFIRE dataset, the vegetation community types were grouped into nine general vegetation community types: grassland, sagebrush shrubland, barren/sparsely vegetated, conifer, agriculture, developed, wetland/riparian, mixed shrubland, and open water. Distribution of vegetation types in these areas is strongly influenced by variations in landscape position, soil type, moisture, elevation, and aspect. **Table 3.14-1** summarizes the acreage of each vegetation type within the CCPA. The distribution of these vegetation types throughout the CCPA is displayed on **Figure 3.14-1**.

Table 3.14-1 Vegetation Community Types within the CCPA

Vegetation Community Type	Surface Ownership (acres)				Total	
	BLM	USFS	State	Private	Acres	Percent of CCPA
Grassland	53,648	40,775	66,827	834,456	995,706	66.3
Sagebrush shrubland	23,280	13,407	23,437	270,339	330,463	22.0
Barren/sparsely vegetated	8,951	9,102	8,375	99,588	126,016	8.4
Conifer	1,220	5.0	540	9,475	11,240	0.7
Agriculture	14	21	316	9,922	10,273	0.7
Developed	154	104	222	9,840	10,320	0.7
Wetland/riparian	132	443	857	7,676	9,108	0.6
Mixed shrubland	1,064	50	425	5,878	7,417	0.5
Open water[1]	2.0	5.4	13	304	1,838	0.1
Total	**88,465**	**63,912**	**101,012**	**1,247,478**	**1,502,381**	**100**

[1] Open water also includes 1,514 acres of the North Platte River that does not fall under any of the listed land owners.

Descriptions of the nine general vegetation community types are provided in the following subsections. Species nomenclature is consistent with the NRCS Plants Database (NRCS 2011).

Grassland

The grassland vegetation community type is comprised of mixed and short-grass prairie, desert and montane grassland, and meadow communities (LANDFIRE 2014). Grasslands occupy approximately 66.3 percent of the CCPA (995,706 acres) and are dispersed fairly evenly across the area, interspersed with shrubland communities. Common native graminoid species may include Indian ricegrass (*Achnatherum hymenoides*), basin wildrye (*Leymus cinereus*), thickspike wheatgrass (*Elymus lanceolatus* ssp. *lanceolatus*), prairie junegrass (*Koeleria macrantha*), western wheatgrass (*Pascopyrum smithii*), needle-and-thread grass (*Hesperostipa comata*), little bluestem (*Schizachyrium scoparium*), green needlegrass (*Nassella viridula*), blue grama (*Bouteloua gracilis*), and bluebunch wheatgrass (*Pseudoroegneria spicata*) (LANDFIRE 2014; USFS 2014c). There are areas of introduced upland plants concentrated in the northeastern portion of the CCPA as well as along several intermittent streams found in the northern portion of the CCPA. The LANDFIRE (2014) database does not provide species specific occurrence information.

Sagebrush Shrubland

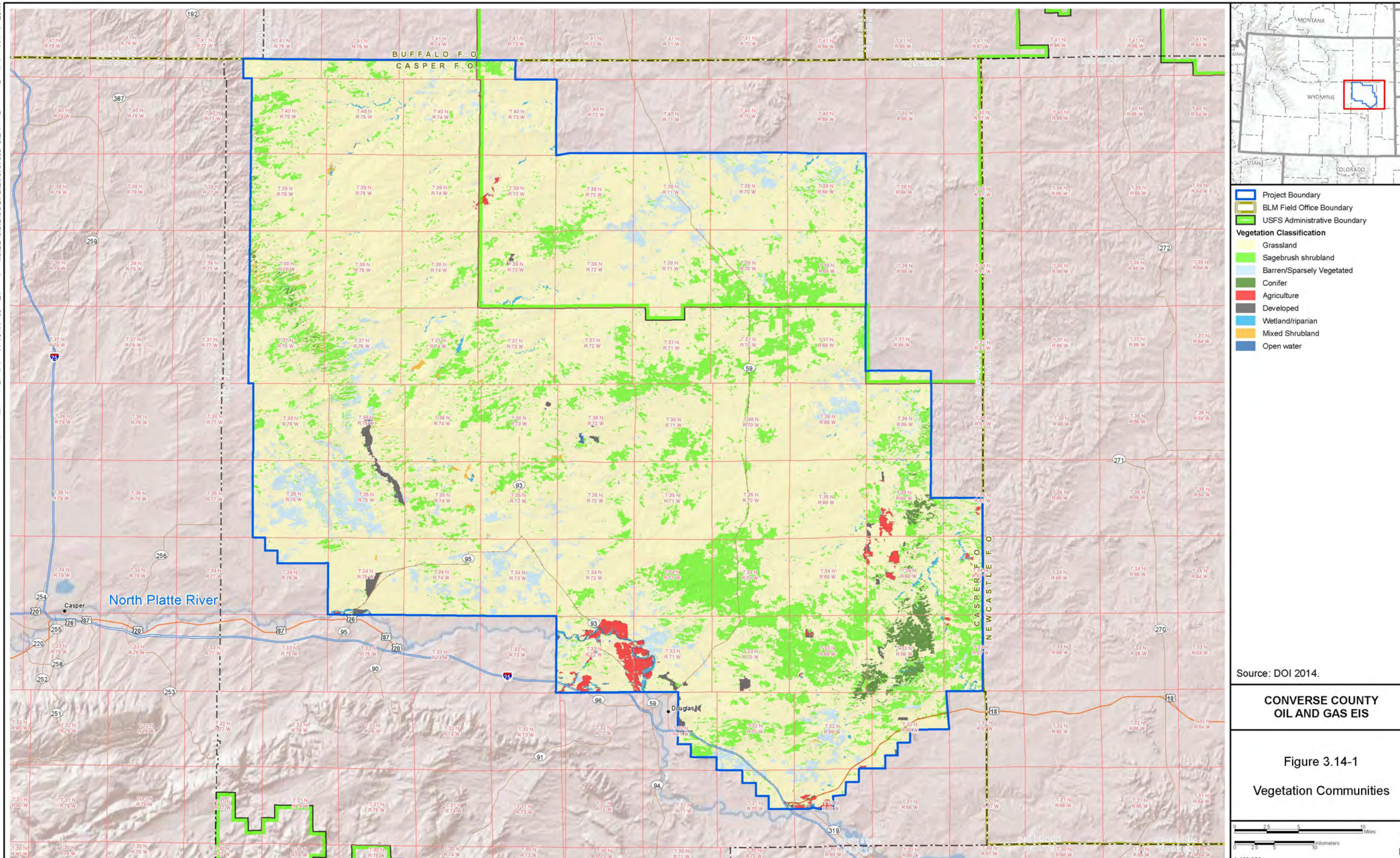
The sagebrush shrubland vegetation community type is comprised of intermountain sagebrush steppe and basin communities (LANDFIRE 2014). Sagebrush shrublands occupy approximately 22.0 percent of the CCPA (330,463 acres) and are dispersed fairly evenly across the area among mixed shrublands and grasslands. In addition to big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*), common sagebrush shrubland species may include shadscale saltbush (*Atriplex confertifolia*), silver sagebrush (*Artemisia cana*), and mountain big sagebrush (*Artemisia tridentata* var. *vaseyana*) (LANDFIRE 2014; USFS 2014c).

Barren/Sparsely Vegetated

The barren/sparsely vegetated community type is comprised of barren, cliff, scree, rock, alpine-montane, and Great Plains sparsely vegetated systems (LANDFIRE 2014). Barren/sparsely vegetated areas occupy approximately 8.4 percent of the CCPA (126,016 acres) and are concentrated in the southwestern portion of the CCPA in sand dunes.

Conifer

The conifer vegetation community type is comprised of pine-juniper woodland, montane mixed conifer forest, and ponderosa pine (*Pinus ponderosa*) woodland and savanna communities (LANDFIRE 2014). Mixed shrublands occupy approximately 0.7 percent of the CCPA (11,240 acres). Conifer vegetation is largely concentrated in two higher elevation areas of the CCPA; one in the southeast and one in the west in an area referred to as Pine Ridge. The conifer vegetation community type is comprised of evergreen (conifer), open, closed, and sparse canopy communities. Woodlands within the CCPA typically occupy warm, dry sites on mountain slopes and ridges on substrates. Common overstory species may include limber pine (*Pinus flexilis*), ponderosa pine, juniper (*Juniperus* spp.), douglas fir (*Pseudotsuga menziesii*), quaking aspen (*Populus tremuloides*), and lodgepole pine (*Pinus contorta*) (LANDFIRE 2014). Shrub and herbaceous layers generally are sparse but may include curl-leaf mountain mahogany (*Cercocarpus ledifolius*), alderleaf mountain mahogany (*Cercocarpus montanus*), shrubby cinquefoil (*Dasiphora fruticosa* ssp. *floribunda*), skunkbush sumac (*Rhus trilobata*), Woods' rose (*Rosa woodsii*), chokecherry (*Prunus virginiana*), sagebrush, blue grama, needle-and-thread grass, rough fescue (*Festuca campestris*), spike fescue (*Leucopoa kingii*), prairie junegrass (*Koeleria macrantha*), littleseed ricegrass (*Piptatherum micranthum*), Sandberg bluegrass, and bluebunch wheatgrass (*Pseudoroegneria spicata*) (CNHP 2005; LANDFIRE 2014).



CONVERSE COUNTY OIL AND GAS EIS

Figure 3.14-1

Vegetation Communities

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<u>Agricultural</u>

The agricultural vegetation community type is comprised of active row crops, fallow/idle cropland, pasture, hayland, and wheat fields (LANDFIRE 2014). Agriculture occupies approximately 0.7 percent of the CCPA (10,273 acres) and is concentrated in the south and southeast.

<u>Developed</u>

The developed category is comprised of quarries, strip mines, gravel pits, roads, and towns. This category also includes urban forest, shrubland, and herbaceous areas (LANDFIRE 2014). Developed areas occupy approximately 0.7 percent of the CCPA (10,320 acres). These areas are concentrated in the southern portion of the CCPA and include subdivisions, abandoned pivots, homesteads, and a reclaimed mine area that has been converted to a wind farm.

<u>Wetland/Riparian</u>

The wetland/riparian vegetation cover type is comprised of floodplain, riparian, and herbaceous wetland communities (LANDFIRE 2014). Wetland/riparian occupy approximately 0.6 percent of the CCPA (9,108 acres) and are located primarily along the North Platte River as well as Antelope, Bear, La Prele, Sand, and Stinking Water creeks. The wetland/riparian areas are fairly dispersed across the CCPA among the grassland and shrubland communities. See Section 3.17, Wetlands and Riparian Areas, for further information regarding these community types.

<u>Mixed Shrubland</u>

The mixed shrubland vegetation community type is comprised of curl-leaf mountain mahogany shrubland, greasewood flat, and montane foothill deciduous shrubland communities (LANDFIRE 2014). Mixed shrublands occupy approximately 0.5 percent of the CCPA (7,417 acres) and are dispersed fairly evenly across the area among grassland communities. The mixed shrubland vegetation community type is comprised of shrublands not dominated by sagebrush species. These may include but are not limited to winterfat, paintbrushes, rubber rabbitbrush, curl-leaf mountain mahogany, saltbush, chokecherry, serviceberry (*Amelanchier arborea*), rose (*Rosa* spp.), and sagebrush. Graminoid species typically are found within this community type, such as *Poa* spp., western wheatgrass, and alkali sacaton (*Sporobolus airoides*).

<u>Open Water</u>

The open water cover type is comprised only of open water (LANDFIRE 2014). Open water occupies approximately 0.1 percent of the CCPA (1,838 acres). Approximately 1,514 acres of this is the North Platte River. The rest is distributed within the CCPA and is concentrated mostly at Rice Reservoir and Morton Reservoir in the middle to northwest portion of the CCPA.

3.14.2 Noxious Weeds and Invasive Plant Species

3.14.2.1 Laws, Ordinances, Regulations, and Standards

Under the Federal Plant Protection Act of 2000 (formerly the Noxious Weed Act of 1974 [7 USC SS 2801–2814]), a noxious weed is defined as "any plant or plant product that can directly or indirectly injure or cause damage to crops, livestock, poultry, or other interests of agriculture, irrigation, navigation, the natural resources of the U.S., the public health, or the environment." Each state is federally mandated to uphold the rules and regulations set forth by this act and manage their lands accordingly.

The Plant Protection Act (7 USC 7701 et seq.) prohibits the import, introduction, export, or movement in interstate commerce of any noxious weed "unless the importation, entry, exportation, or movement is authorized under general or specific permit and is in accordance with such regulations as the Secretary [of Agriculture] may issue to prevent the introduction of plant pests into the U.S. or the dissemination of plant pests within the United States."

The Wyoming Department of Agriculture manages and coordinates weed and pest activities for the State of Wyoming among the Wyoming Weed and Pest Control Districts; Wyoming Weed and Pest Council; federal, state, and local agencies; as well as the private sector. Per Wyoming Statutes, a declared weed is defined as "any plant which the board and the Wyoming Weed and Pest Council have found, either by virtue of its direct effect, or as a carrier of disease or parasites, to be detrimental to the general welfare of persons residing within a district."

The Federal Plant Protection Act also requires cooperation with state, local, and other federal agencies in the application and enforcement of all laws and regulations relating to the management and control of noxious weeds. Recognizing these regulations, the BLM requires that NEPA documents consider and analyze the potential for the spread of noxious weed species and provide preventative rehabilitation measures for each management action involving surface disturbance. The BLM considers plants invasive if they have been introduced into an environment where they did not evolve. As a result, they usually have no natural enemies to limit their reproduction and spread.

The BLM CFO and the Converse County Weed and Pest District have a Memorandum of Understanding that provides authorization to manage invasive plants throughout Converse County using an integrated pest management approach. The BLM conducts cheatgrass treatments according to the Decision Record for Cheatgrass Treatments for Natrona and Converse Counties (BLM 2011a).

3.14.2.2 Resource Overview and Existing Condition

Many invasive, non-native plant species, including noxious weeds, occur or have the potential to occur within the CCPA. Introduction and establishment of invasive plant species are more likely to occur in surface-disturbed areas. Known vectors for introduction can include wind, vehicles, machinery, livestock, wildlife species, and humans. Cheatgrass is very difficult to control, and invasion remains pervasive across the CCPA; in some cases cheatgrass is the dominant herbaceous species (BLM 2011b).

The analysis area for invasive plant species includes the CCPA, where Project-related activities may contribute to the spread of invasive plant species. Species addressed in this section include:

- State of Wyoming Designated Noxious Weeds
- Converse County Declared Weeds: a species that the "Wyoming Board of Agriculture and the Wyoming Weed and Pest Council have found, either by virtue of its direct effect or as a carrier of disease or parasites, to be detrimental to the general welfare of persons residing within a district" (Wyoming Legislative Service Office 1973).
- Invasive species: a species "non-native to the ecosystem under consideration and whose introduction causes or is likely to cause economic or environmental harm or harm to human health" (EO 13112). The National List of Invasive Weed Species of Concern (BLM 2008c) is included in this definition.

The description of existing conditions for invasive plant species in the CCPA is based on the Converse County list of declared weeds (Wyoming Weed and Pest Control 2017a); Wyoming Noxious Weed List (Wyoming Weed and Pest Control 2017b); BLM National List of Invasive Weed Species of Concern (BLM 2008c); and EAs recently conducted in the CCPA (BLM 2012a,b,c, 2011b).

Noxious weeds have invasive habits and/or the potential to become monocultures that damage native ecosystems and wildlife habitat as well as degrade land value. Invasive non-native plant species can cause economic impacts due to loss of forage productivity for livestock and increased control costs. Some noxious weeds and invasive plant species such as halogeton (*Halogeton glomeratus*) and black henbane (*Hyoscyamus niger*), can be poisonous to livestock when ingested. Invasive plant species also can increase soil erosion and risk of wild fire. They generally result in increased competition with native plants for habitat, sunlight, nutrients, and water. Most noxious weeds are early successional species that prosper following surface disturbance after activities such as wildfires, human developments, and surface erosion.

Invasive plant species such as cheatgrass, musk thistle (*Carduus nutans*), Canada thistle (*Cirsium arvense*), field bindweed (*Convolvulus arvensis*), Russian knapweed (*Acroptilon repens*), spotted knapweed (*Centaurea maculosa*), diffuse knapweed (*Centaurea diffusa*), leafy spurge (*Euphorbia esula*), hoary cress (*Cardaria draba*), halogeton, perennial pepperweed (*Lepidium latifolium*), and dalmatian toadflax (*Linaria genistifolia* spp. *dalmatica*) may all occur within the CCPA (BLM 2012a). **Table 3.14-2** identifies the invasive plant species and declared weeds present or with the potential to occur in the CCPA. The BLM processes several pesticide use proposals each year within the CCPA where treatment on BLM lands would occur. Species treated include Canada thistle, musk thistle, Scotch thistle (*Onopordum acanthium*), and Russian knapweed, as well as other noxious weeds (BLM 2014a, 2013c). **Figure 3.14-2** shows documented heavily infested locations of noxious weeds and invasive plants within the CCPA.

3.14.3 Special Status Plant Species

This section identifies special status plant species documented and those with the potential to occur in the CCPA. Special status plant species include those listed as threatened, endangered, or proposed for listing under the ESA as well as plant species classified as sensitive by the BLM CFO and USFS Region 2.

3.14.3.1 Resource Overview

The analysis area for special status plant species is the CCPA plus a one mile buffer to account for any indirect effects. The analysis area also includes riparian habitats of the North Platte River downstream of the CCPA with potential to be affected by water depletions from Project-related activities.

Existing data to describe the potential for the CCPA to support special status plant species was used for analysis. Special status plants include the following:

- Species listed as threatened, endangered, or proposed for listing under the ESA (50 CFR 17.11).
- BLM sensitive species requiring special management consideration to promote their conservation and reduce the likelihood and need for future listing under the ESA. The species are designated as sensitive by the BLM Wyoming State Director and are listed within each BLM Field Office (BLM 2008b).
- USFS Region 2 (Rocky Mountain) sensitive species, designated by the Regional Forester for which the USFS develops and implements conservation strategies in coordination with other USFS units, managing agencies, and landowners.

Special status species were considered as having potential to occur within the analysis area if occurrence has been documented for the species, the species geographic range currently exists within the analysis area, and/or suitable habitat is present. Those species ***listed as having*** the potential to occur in the analysis area were either analyzed through existing Wyoming Natural Diversity Database (WYNDD) predictive distribution models or were analyzed through desktop GIS to identify suitable habitat. Parameters such as vegetation cover, soils, and elevation were developed based on the following sources:

- USFWS species accounts;
- USFS Region 2 sensitive species conservation assessments;

- WGFD Wyoming Interagency Spatial Database and Online Management (WISDOM) database; and
- WYNDD species records, species accounts, and habitat descriptions.

3.14.3.2 Laws, Orders, Regulations and Standards

The USFWS has jurisdiction over species listed as threatened or endangered under Section 7 of the Federal ESA (16 USC 1536 et seq.). Under Section 7***(a)(2)*** of the ESA of 1973, as amended, ***federal*** agencies in ***consultation*** with the USFWS, must ensure that any action they authorize, fund, or carry out ***is not likely to jeopardize the continued existence of any listed species or result in the destruction of*** designated critical habitat. The ESA and 50 CFR 402 contain the implementation regulations for Section 7(a)(2) of the Act where in federal action agencies are required, with the assistance of the USFWS, to ensure that any action authorized, funded, or carried out is not likely to jeopardize the continued existence of the species or result in the destruction or adverse modification of designated critical habitat for threatened and endangered species.

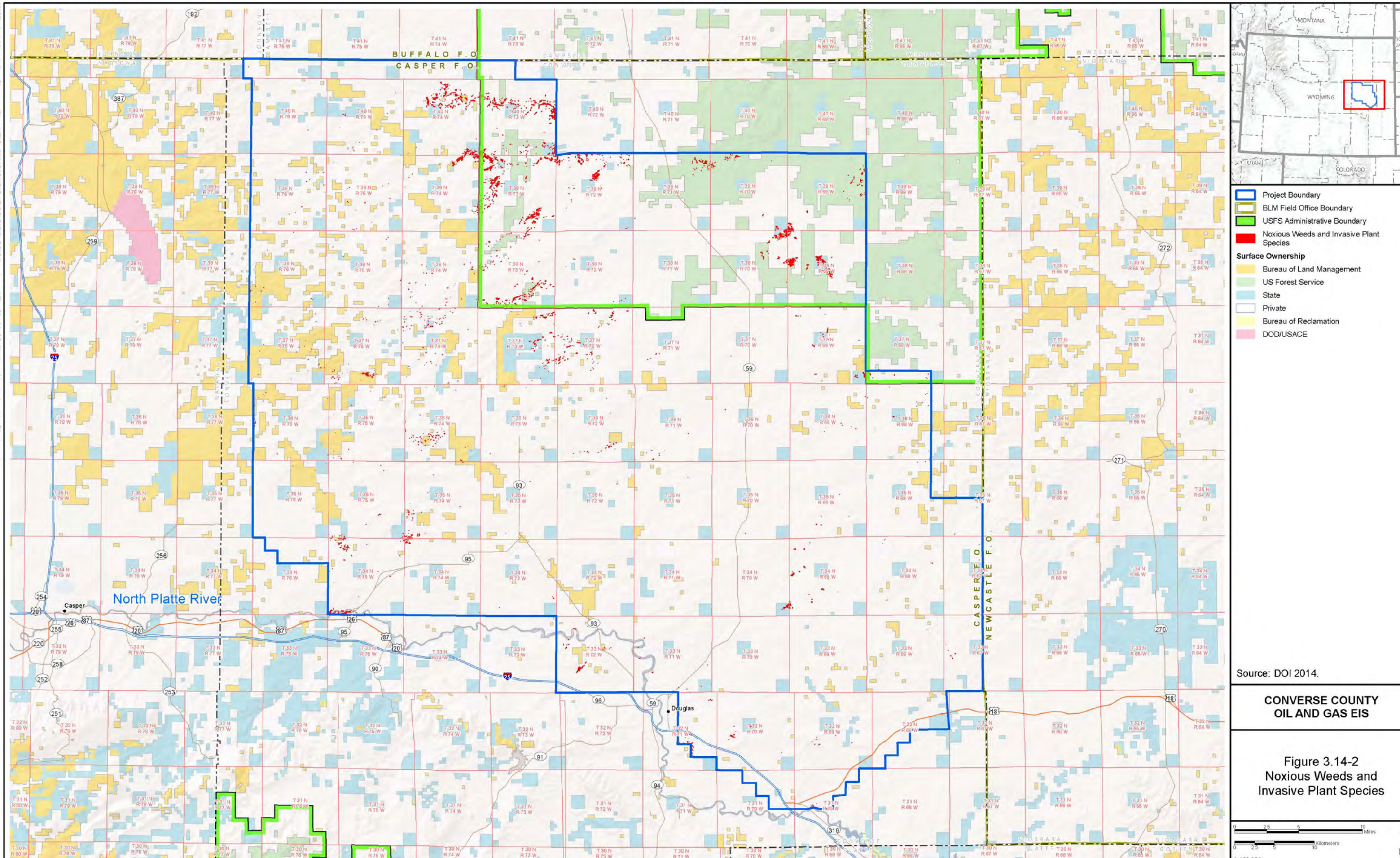
The Wyoming BLM State Director's Sensitive Species List is maintained by the Wyoming State Office. The field offices coordinate with the State Office in maintaining the list and occurrence of these species within their District and field offices.

The FSM 2600 (USFS 2005) provides policies pertaining to the management of sensitive plants on USFS-administered land. This manual stipulates that the USFS provide special management importance for sensitive species to ensure their sustainability and preclude trends toward federal listing. USFS Region 2 accomplishes this by maintaining a list of sensitive plant species specific to the region. Section 2672.2 of the manual states that the USFS should manage habitat at levels that aid in the recovery of federally listed species, as documented in USDA recovery plans (USFS 2005).

The BLM 6840 Manual is the principal policy instrument for BLM management of special status species. Special status species include those species listed or proposed for listing under the ESA together with species designated internally as BLM sensitive. The manual identifies how field offices are to meet their responsibilities under the ESA and its implementing regulations, as well as how to designate and ensure the conservation of BLM sensitive species on public lands.

3.14.3.3 Endangered, Threatened, Proposed, and Candidate Species

The Ute ladies'-tresses orchid (*Spiranthes diluvialis*) is the only federally listed plant species with the potential to occur within the CCPA. One federally endangered species, the Western prairie fringed orchid (*Platanthera praeclara*), does not occur within the CCPA (**Table 3.14-3**) but does have known occurrances downstream of the CCPA; therefore, it was included in the analysis due to the potential to be impacted by activity upstream. Documented occurrences, habitat, and known threats to these species are described below.



CONVERSE COUNTY OIL AND GAS EIS

Figure 3.14-2
Noxious Weeds and Invasive Plant Species

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Table 3.14-2 Invasive Plant Species and Declared Noxious Weeds Present or with Potential to Occur in the CCPA

Common Name	Scientific Name	BLM National List[1]	Wyoming Noxious Weed List[2]	Converse County Declared List[3]
Absinth wormwood	*Artemisia absinthium*	X		X
Baby's breath	*Gypsophila paniculata*	X		X
Black henbane	*Hyoscyamus niger*	X	X	
Buffalobur	*Solanum rostratum*	X		X
Bull thistle	*Cirsium vulgare*	X		X
Bur buttercup	*Ceratocephala testiculata*	X		X
Canada thistle	*Cirsium arvense*	X	X	
Cheatgrass	*Bromus tectorum*	X		X
Chicory	*Cichorium intybus*	X		X
Common burdock	*Arctium minus*	X	X	
Common cocklebur	*Xanthium strumarium*	X		X
Common crupina	*Crupina vulgaris*	X		X
Common mullein	*Verbascum Thapsus*	X		X
Common St. Johnswort	*Hypericum perforatum*		X	
Common sunflower	*Helianthus annuus*	X		X
Common tansy	*Tanacetum vulgare*		X	
Curly dock	*Rumex crispus*	X		X
Curlycup gumweed	*Grindelia squarrosa*	X		X
Dalmation toadflax	*Linaria genistifolia* spp. *dalmatica*	X	X	
Dames rocket	*Hesperis matronalis*	X		X
Diffuse knapweed	*Centaurea diffusa*	X	X	
Dyers woad	*Isatis tinctoria*		X	
Field bindweed	*Convolvulus arvensis*	X	X	
Goatsrue	*Galega officinalis*	X		X
Gorse	*Ulex europaeus*	X		X
Halogeton	*Halogeton glomeratus*	X		X
Hoary cress	*Cardaria draba*	X	X	
Houndstongue	*Cynoglossum officinale*	X	X	
Iberian starthistle	*Centaurea iberica*	X		X
Italian thistle	*Carduus pycnocephalus*	X		X
Jointed goatgrass	*Aegilops cylindrical*	X		X
Leafy spurge	*Euphorbia esula*	X	X	
Meadow knapweed	*Centaurea pratensis*	X		X
Medusahead	*Taeniatherum caputmedusae*	X		X
Musk mustard	*Chorispora tenella*	X		X
Musk thistle	*Carduus nutans*	X	X	

Table 3.14-2 Invasive Plant Species and Declared Noxious Weeds Present or with Potential to Occur in the CCPA

Common Name	Scientific Name	BLM National List[1]	Wyoming Noxious Weed List[2]	Converse County Declared List[3]
Orange hawkweed	*Hieracium aurantiacum*	X		X
Ox-eye daisy	*Chrysanthemum leucanthemum*		X	
Perennial pepperweed	*Lepidium latifolium*	X	X	
Perennial sowthistle	*Sonchus arvensis*		X	
Plains larkspur/Geyer larkspur	*Delphinium geyeri*	X		X
Plumeless thistle	*Carduss acanthoides*		X	
Poison hemlock	*Conium maculatum*	X		X
Puncturevine	*Tribulus terrestris*	X		X
Purple loosestrife	*Lythrum salicaria*		X	
Purple starthistle	*Centaurea calcitrapa*	X		X
Quackgrass	*Agropyron repens*		X	
Redstem filaree	*Erodium cicutarium*	X		X
Rush skeletonweed	*Chondrilla juncea*	X		X
Russian knapweed	*Centaurea repens*	X		
Russian olive	*Elaeagnus angustifolia*	X	X	
Saltcedar	*Tamarix* spp.	X	X	
Sandbur	*Cenchrus incertus*	X		X
Scentless chamomile	*Matricaria perforate*	X		X
Scotch broom	*Cytisus scoparius*	X		X
Scotch thistle	*Onopordum acanthium*	X	X	
Showy milkweed	*Asclepias speciosa*	X		
Skeletonleaf bursage	*Franseria dicolor Nutt.*		X	
Spotted knapweed	*Centaurea maculosa*	X	X	
Squarrose knapweed	*Centaurea virgata Lam.* ssp. *Squarrosa*	X		X
Sulfur cinquefoil	*Potentilla recta*	X		X
Syrian beancaper	*Zygophyllum fabago*	X		X
Tansy ragwort	*Senecio jacobaea*	X		X
Teasel	*Dipsacus fullonum*	X		X
Wavyleaf thistle	*Cirsium undulatum*	X		X
Western sticktight	*Lappula occidentalis*	X		X
Whitetop	*Cardaria draba* and *Cardaria pubescens*	X	X	

Table 3.14-2 Invasive Plant Species and Declared Noxious Weeds Present or with Potential to Occur in the CCPA

Common Name	Scientific Name	BLM National List[1]	Wyoming Noxious Weed List[2]	Converse County Declared List[3]
Wild licorice	*Glycyrrhiza lepidota*	X		X
Yellow hawkweed	*Hieracium fendleri*	X		X
Yellow toadflax	*Linaria vulgaris*		X	

[1] BLM 2008a.

[2] Wyoming Weed and Pest Control 2017a.

[3] Wyoming Weed and Pest Control 2017b.

Table 3.14-3 Federally Threatened and Endangered Plant Species Suitable Habitat within the CCPA

Species (*Scientific Name*)	Status	Habitat Description	Suitable Habitat by Ownership (acres)			
			BLM	USFS	State	Private
Ute ladies'-tresses orchid (*Spiranthes diluvialis*)	Threatened	Low, flat floodplain terraces or abandoned oxbows below 7,000 feet. Sites are subirrigated, often seasonally flooded, and remain moist into the summer. Soils are sandy loams, sands, and silt loams derived from Quaternary alluvial deposits.	166[1]	12[1]	772[1]	5,724[1]
Western prairie-fringed orchid (*Platanthera praeclara*)	Endangered	Unplowed, calcareous prairies and sedge meadows.	None[2]	None[2]	None[2]	None[2]

[1] Based on existing WYNDD data.

[2] Has not been documented within the CCPA but may occur in the downstream riparian habitats of the North Platte River in Nebraska and could be adversely affected by water depletions in the North Platte River system resulting from Project-related activities.

Source: BLM 2007b.

Ute Ladies'-Tresses Orchid

Ute ladies'-tresses orchid (*Spiranthes diluvialis*) is listed as federally threatened (USFWS 2015). A petition to delist this species and initiate a 5-year review was issued by the USFWS in 2004 (69 FR 60605-60607), and a rangewide status review was completed in 2005 (Fertig et al. 2005). The final ruling is pending. This species currently is known from western Nebraska, southeastern Wyoming, north-central Colorado, northeastern and southern Utah, east-central Idaho, southwestern Montana, and central Washington. In Wyoming, the Ute ladies'-tresses orchid is known from the western Great Plains in Converse, Goshen, Laramie, and Niobrara counties. Rangewide, the Ute ladies'-tresses orchid occurs primarily on moist, sub-irrigated or seasonally flooded soils in valley bottoms, gravel bars, old oxbows, or floodplains bordering springs, lakes, rivers, or perennial streams at elevations between 1,780 and 6,800 feet (Fertig 2000). Suitable soils vary from sandy or coarse, cobbley alluvium to calcareous, histic, or fine-textured clays and loams. Populations have been documented from alkaline sedge meadows, riverine floodplains, flooded alkaline meadows adjacent to ponderosa pine, Douglas fir woodlands, sagebrush steppe, and streamside floodplains. Some occurrences also are found on agricultural lands managed for winter or early season grazing or hay production. Known sites often have low vegetative cover and may be subjected to periodic disturbances such as flooding or grazing. Populations are often dynamic and “move” within a watershed as disturbances create new habitat or succession eliminates old habitat (Fertig 2000). Threats to the species include habitat loss and modification through urbanization, competition from invasive species, herbicide drift (i.e., from management of noxious weeds), overcollection, recreation, grazing, and hydrology changes (e.g., modification of wetlands, flood control, and de-watering) (USFWS 2015).

Based on a predictive distribution model developed by WYNDD, approximately 6,675 acres of suitable habitat exist for Ute ladies’-tresses orchid within the CCPA (**Figure 3.14-3**). There are three populations known to occur within the CCPA located along Antelope, Wind, and North Stinking Water creeks (BLM 2017c). The BLM Casper Field Office administers the land at these locations. Based on Fertig et al. (2005), the number of individual plants observed at the Antelope Creek population between 1994 and 2004 varied from 0 to 35. Current threats to this population include competition from non-native plants and vegetation succession. There also are three populations found outside the CCPA in Goshen, Niobrara, and Laramie counties on lands owned by the State of Wyoming and private parties. As reported by Fertig et al. (2005), populations overall are more stable, especially if subterranean seedling and dormant individuals are counted, and more tolerant of human-induced disturbances than originally suspected.

Western Prairie Fringed Orchid

The Western prairie-fringed orchid was listed as threatened under the ESA in September of 1989. The USFWS published 5-year summary and evaluation in February of 2009. While a large number of the orchid’s populations were protected from habitat destruction, the evaluation determined that protection under the ESA was still warranted, and the status for the western prairie fringed orchid remained the same (71 FR 16176). Threats to the species include conversion of habitat to cropland, overgrazing, competition from invasive species, herbicide drift, and off-site water drainage that would lower water levels downstream.

The western prairie fringed orchid may occur in downstream riparian habitats of the North Platte River in Nebraska. Soil moisture is a critical determinant of the growth, flowering, and distribution of this species (USFWS 2009). Water depletions upstream could cause a reduction of soil moisture, which could adversely affect the western prairie fringed orchid. As discussed in Section 3.16.1, hydrologically connected sub-basins of the North Platte River watershed exist within the CCPA (**Figure 3.16-3**).

3.14.3.4 BLM and USFS Sensitive Species

The BLM has identified five sensitive plant species that may occur within the CCPA and has undertaken specific management efforts toward maintaining satisfactory habitats for these species (BLM 2010a). The USFS Region 2 has identified 90 sensitive plant species that may have the potential to occur with the CCPA; **Appendix F** provides an assessment of these BLM and USFS sensitive plant species. **Table 3.14-4** lists only those species documented to occur or determined to have the potential to occur in the CCPA.

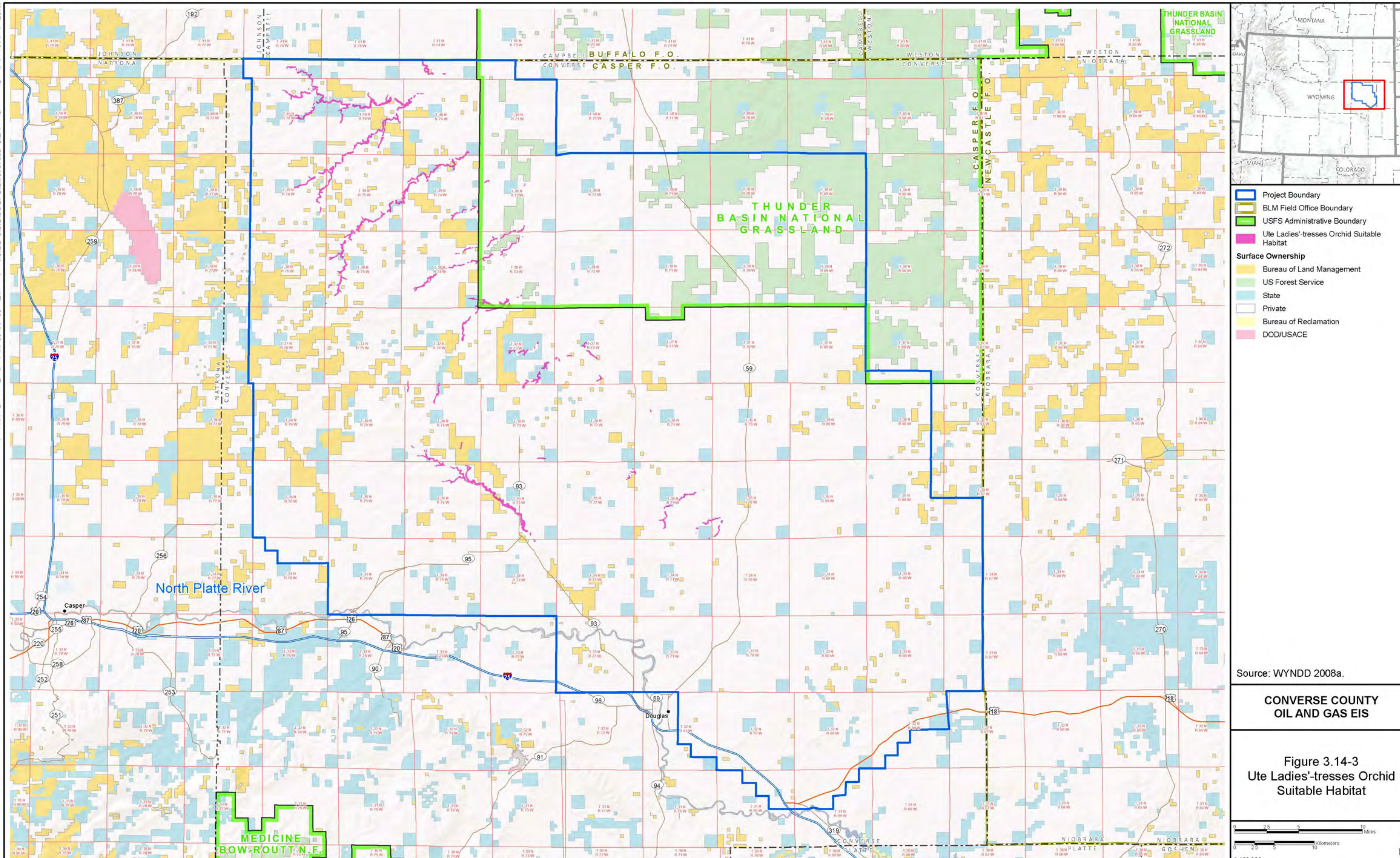

Figure 3.14-3
Ute Ladies'-tresses Orchid Suitable Habitat

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Table 3.14-4 BLM and USFS Sensitive Plant Species Potential and Documented Occurrence in the CCPA

Species (*Scientific Name*)	Habitat Description	Suitable habitat in CCPA			
		BLM Land	USFS Land	State	Private
BLM Sensitive Species					
Porter's sagebrush (*Artemisia porter)*	Sparsely vegetated badlands of ashy or tufaceous mudstone and clays slopes 5,300 to 6,500 feet in elevation.	Suitable habitat present	Suitable habitat present	Suitable habitat present	Suitable habitat present
USFS Sensitive Species					
Barr's milkvetch *(Astragalus barrii)*	Dry badlands and semi-barren slopes with low vegetation cover.	Not Documented	Documented	Unlikely to occur	Unlikely to occur
Prairie dodder *(Cuscuta plattensis)*	Sand prairie hill habitat.	Unlikely to occur	Suitable habitat present	Suitable habitat present	Suitable habitat present
Visher's buckwheat *(Eriogonum visheri)*	Gentle, rolling plains and hillocks of barren or semi-barren sandy clay, or clay soils derived from shale in dry steppe communities.	Unlikely to occur	Suitable habitat present	Suitable habitat present	Suitable habitat present
Common twinpod (*Physaria didymocarpa)*	Sagebrush steppe and foothills/intermontane prairie.	Suitable habitat present	Suitable habitat present	Suitable habitat present	Suitable habitat present

Source: BLM 2010a, 2002a; USFS 2014a, 2013; WYNDD 2016.

Based on WYNDD (2016) data, Porter's sagebrush is the only BLM sensitive species with potential suitable habitat or documented populations in the CCPA. Four USFS sensitive species have suitable habitat or documented populations in the CCPA: Barr's milkvetch, prairie dodder, Visher's buckwheat, and common twinpod.

Porter's Sagebrush

WYNDD has recorded 209 observations of Porter's sagebrush throughout Wyoming; however, there currently are no documented occurrences of this species in the CCPA (WYNDD 2016). Based on a predictive distribution model developed by WYNDD, potential suitable habitat does exist in the western portion of the CCPA (**Figure 3.14-4**). Porter's sagebrush is endemic to the Wind River and Powder River basins in central Wyoming and occurs primarily on BLM-managed lands in the Buffalo, Casper, and Lander field office jurisdictions. This species occurs in sparsely vegetated clay flats, gullies, depressions, and badlands slopes at 5,300 to 6,500 feet amsl. Most populations are found on pale whitish or red- to green-banded silty loams derived from shales or consolidated volcanic ash of the Eocene Wagon Bed or Wind River formations (Fertig 2002). Threats to this species include oil and gas exploration and development (BLM 2007b).

Barr's Milkvetch

There are 87 documented populations of Barr's milkvetch in Wyoming, six of which have been documented in the CCPA (WYNDD 2016). Current distribution of Barr's milkvetch is limited to the northeastern corner of the CCPA, primarily on USFS-managed lands (Heidel 2003), although WYNDD data indicates suitable habitat in the extreme southeast portion of the CCPA (WYNDD 2016). This species is a regional endemic of northeastern Wyoming; however, its elevation range and habitat only exist within the TBNG. Barr's milkvetch is found primarily on dry, rocky prairie knolls, hillsides, and barren areas. In Wyoming, populations occur most frequently on sparsely vegetated badlands, often on whitish, sandy-silty (often calcareous) or sandy soils at elevations of 3,700 to 5,700 feet amsl. Reported threats to this species in Wyoming may include coal bed natural gas, oil, and gas developments (Fertig 2008).

Prairie Dodder

Suitable habitat exists for prairie dodder within the CPPA based on GIS analysis of habitat, vegetation cover, elevation, and soil (**Figure 3.14-5**); however, there are no known occurrences within the CCPA. Prairie dodder is known from one extant location and three historical reports in the vicinity of the TBNG (Handley and Fertig 2001). This species is an annual, rootless, twining, parasitic herb primarily found on sand prairie hills at elevations of 4,200 to 4,900 feet amsl. Threats to this species may include agricultural practices, especially herbicide drift (Handley and Fertig 2001).

Common Twinpod

Common twinpod is a regional endemic to the Powder River Basin. However, in Wyoming it has a low number of occurrences, low population numbers, and unknown trends, and it is not known in Converse County (Heidel and Handley 2004). It inhabits sparsely vegetated, sandy or clayey soil of eroding slopes, banks, and badlands within montane plains and valleys (Montana Natural Heritage Program 2014). It is known from 14 occurrences in the foothills of the Bighorn Range and Powder River Basin in Big Horn, Campbell, Johnson, and Sheridan counties. There also are three occurrences within the Bighorn National Forest. No occurrences are known but suitable habitat does exist within the CCPA based on GIS analysis of vegetative cover (**Figure 3.14-6**). Threats to the species appear to be livestock trampling, recreational use of habitat, and mining (Mills and Fertig 2000).

Visher's Buckwheat

Current USFS Region 2 documented occurrences of Visher's buckwheat are restricted to South Dakota and no occurrences have been documented within the CCPA. Suitable habitat does exist and it is similar to the vegetative habitat of common twinpod (**Figure 3.14-6**), but the species' habitats vary based on differing soil requirements. The species inhabits the badlands, gentle, rolling plains, and hillocks of barren or semi-barren loamy, sandy clay, or clay soils in dry steppe communities with a semiarid continental climate. Visher's buckwheat grows in the least vegetated parts of the grassland/shrubland mosaic at elevations between 1,900 and 2,700 feet amsl (Ladyman 2006). In USFS Region 2, livestock grazing, agricultural uses, invasive non-native plant species, and recreation activities appear to be the greatest threats (Ladyman 2006).

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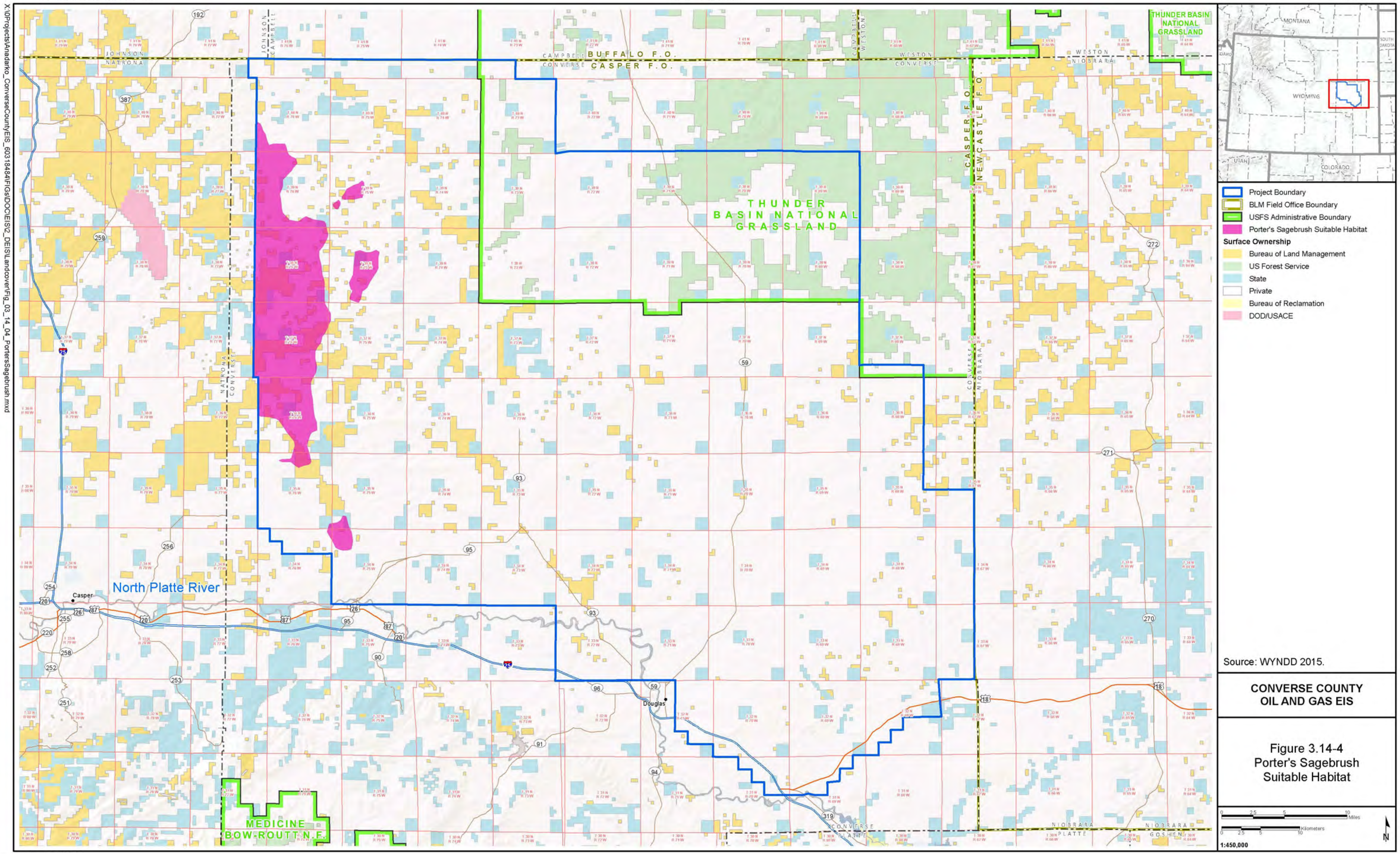
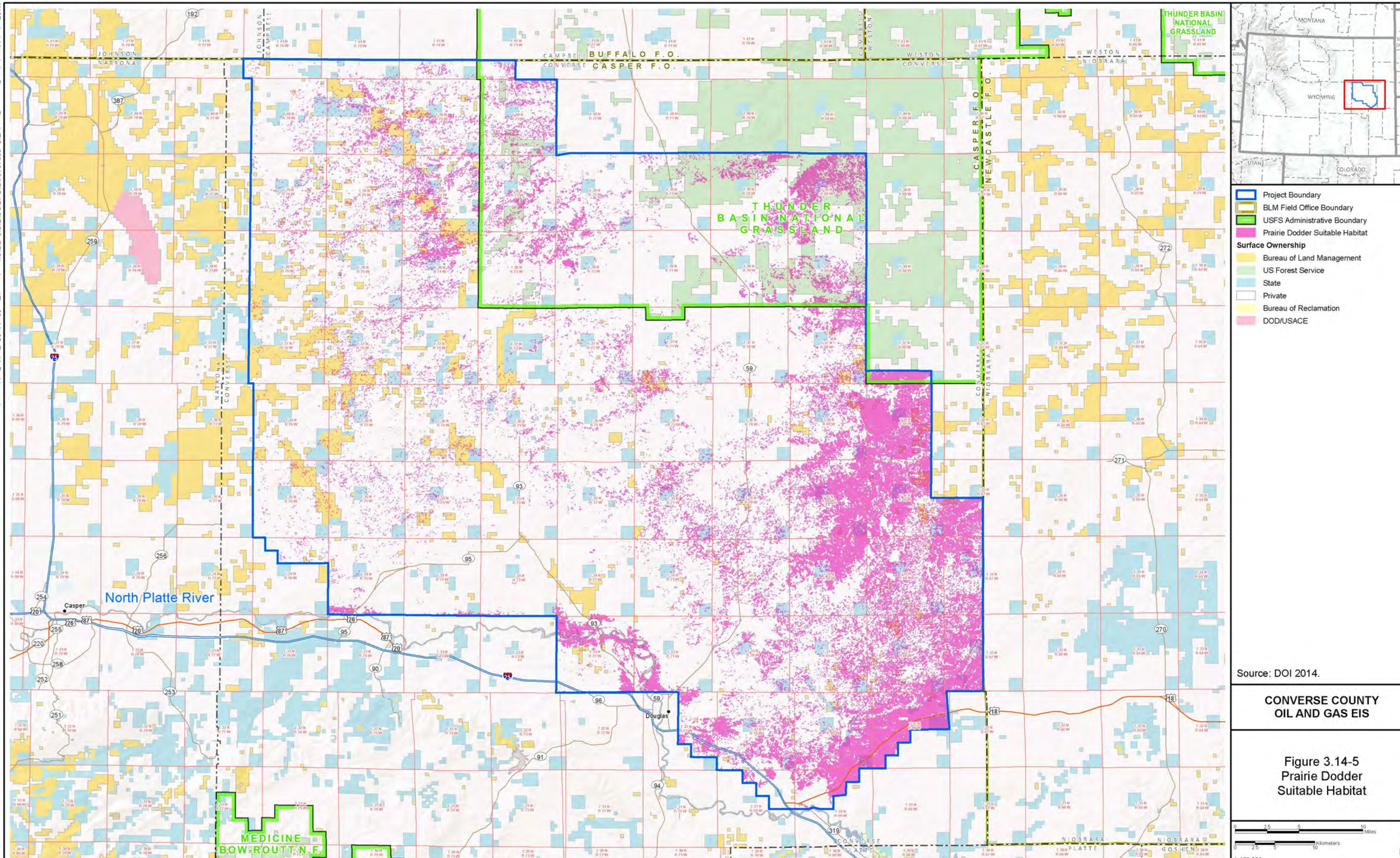


Figure 3.14-4
Porter's Sagebrush Suitable Habitat



CONVERSE COUNTY OIL AND GAS EIS

Figure 3.14-5
Prairie Dodder
Suitable Habitat

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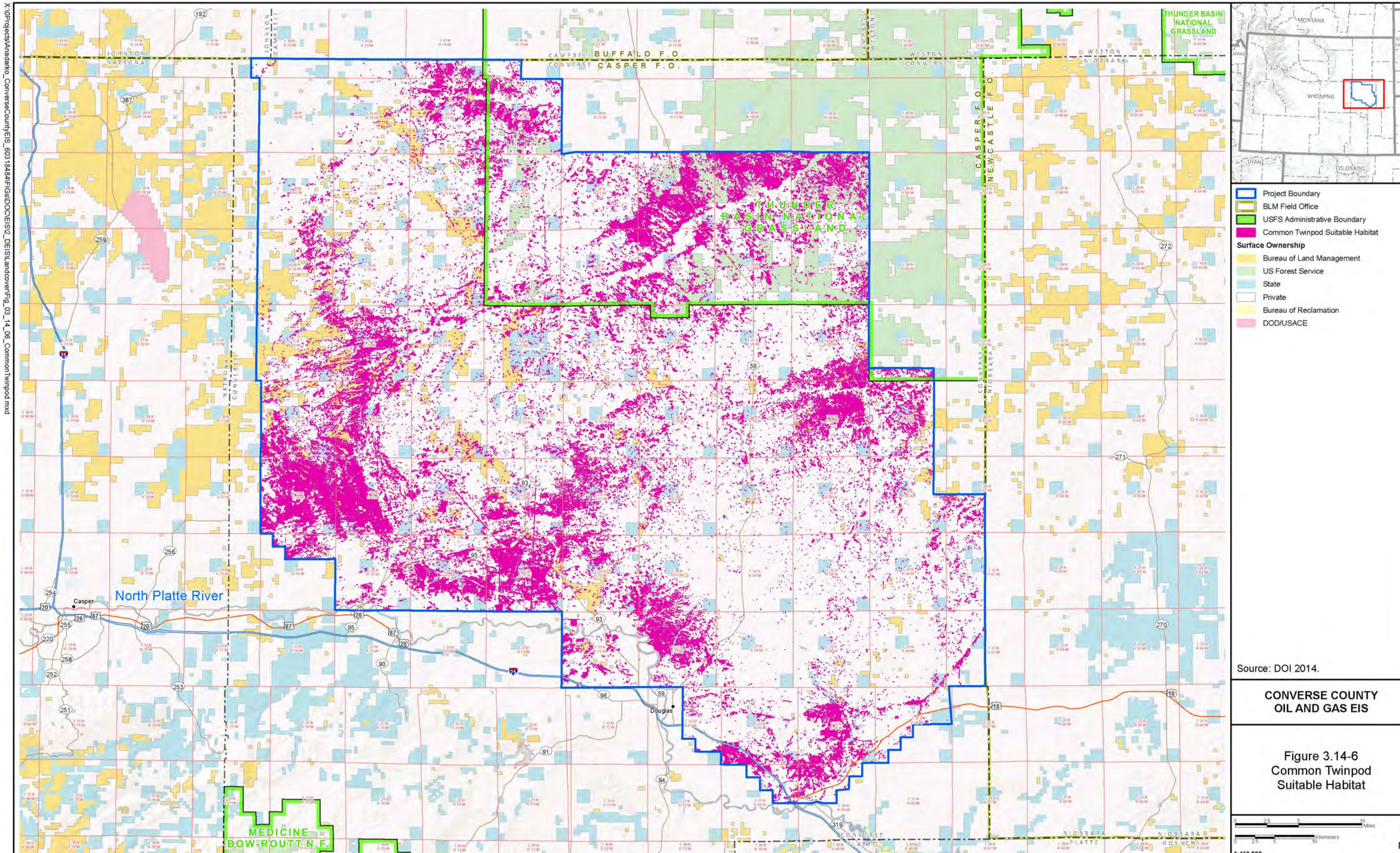

Figure 3.14-6
Common Twinpod
Suitable Habitat

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Environmental Impact Statement
for
Converse County Oil and Gas Project

Final

Volume II – Section 3.15 through Chapter 9.0

2020

BLM

Casper Field Office, Wyoming

DOI-BLM-WY-P060-2014-0135-EIS

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3.15 Visual Resources

The CCPA contains expansive views and includes jurisdictions of the BLM, USFS, and State of Wyoming as well as private lands. Affected visual resources are within the BLM Casper, Buffalo, and Newcastle field offices and the USFS TBNG. The analysis area includes the CCPA plus a 15-mile background distance zone surrounding the CCPA (**Figure 3.15-1**) Visual resources consist of the topography, soils, vegetation, bodies of water (i.e., lakes, streams, and rivers), and human-made structures that are noticeable on the landscape. These elements of the landscape can be described in terms of their form, line, color, and texture or pattern. The Project viewshed, as shown on **Figure 3.15-1**, is the area from which potential oil and gas development throughout the CCPA would be visible. Several historic trails are located inside the analysis area and Project viewshed. BLM identified three key observation points (KOPs) as the viewpoints for conducting the characteristic landscape, impacts, visual resource management (VRM) compliance, and scenic integrity objective (SIO) consistency analyses. KOP locations are as follows:

- KOP-1 is a linear KOP associated with viewers along historic trails;
- KOP-2 is a linear KOP running the length of the Highway 59; and
- KOP-3 is a linear KOP associated with viewers along the Child's Cutoff of the Oregon NHT within the southern portion of the CCPA.

3.15.1 Regulatory Framework

Scenic quality is the measure of the visual appeal of a unit of land. Section 102(a) of the FLPMA states that "...the public lands are to be managed in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archeological values" (DOI/BLM and Office of the Solicitor 2001). Section 103(c) identifies scenic values as one of the resources for which public land should be managed. Section 201(a) states that "the Secretary shall prepare and maintain on a continuing basis an inventory of all public lands and their resources and other values (including scenic values)..." Section 505(a) requires that "each ROW shall contain terms and conditions which will...minimize damage to the scenic and esthetic values..."

Section 101(b) of the NEPA requires that measures be taken to "assure for all Americans safe, healthful, productive, and aesthetically and culturally pleasing surroundings" (42 USC 4331). Under FLPMA, the BLM developed a standard visual assessment methodology, known as the VRM System, to inventory and manage scenic values on lands under its jurisdiction. Guidelines for applying the VRM system on BLM lands are described in BLM Manual 8400 et seq.

The National Forest Management Act requires the USFS to inventory and evaluate visual resources and incorporate visual quality objectives. USFS Manual 2300 (Recreation, Wilderness, and Related Resource Management), Chapter 2380 (Landscape Management) requires the inventory, evaluation, management, and, where necessary, restoration of scenery as a fully integrated part of the ecosystems of USFS-managed lands. This manual specifies a requirement to "conduct and document a scenery assessment for all activities that may affect scenic resources and that require analysis under NEPA" and "Ensure application of the principles of landscape aesthetics, scenery management, and environmental design in project-level planning." Individual forest plans identify the SIOs required for each management area. The term scenic integrity indicates the degree of intactness of the landscape character or, conversely, the degree of visible disruption of the landscape character. A landscape with very minimal visual disruption is considered to have high scenic integrity (USFS 1995). The TBNG LRMP establishes SIOs for USFS lands within the CCPA.

3.15.2 Analysis Area

The analysis area is located in a remote area that has and continues to support oil and gas development. Other development within the analysis area includes coal mines, uranium in situ recovery, and wind power facilities and related roads and railroads; developments near the towns of Douglas and Bill; and I-25 and Wyoming SH 59. The characteristic landscape of the analysis area is contained within a variety of landforms of the Interior Plains physiographic province (Fenneman 1931). Visual resources within the analysis area are influenced by topographic, vegetative, geologic, hydrologic, and land use characteristics. The topography of the area is predominantly flat or rolling with frequent dry or ephemeral drainages. Topographic features in the region include the Dry Fork of the Cheyenne River and North Platte River drainages, the Pine Ridge Area in the western portion of the analysis area, and the foothills of the Laramie Mountains to the south of the analysis area. The analysis area generally has a dry, arid climate. Vegetation across the analysis area is predominantly sagebrush and grassland, with pine forests at higher elevations in the southeastern vicinity. The forms, lines, colors, and textures are mostly consistent with the natural scenery of the landscape, but are contrasted with ranches, residences, and existing oil and gas development. Other existing activity affecting the characteristic landscape in the analysis area includes sparsely distributed range improvements and unimproved roads associated with livestock grazing and range management. See Section 3.14, Vegetation, for detailed information on vegetation types and characteristics in the CCPA

3.15.2.1 Sensitive Viewers

The main public access roads in the viewshed of the Project include I-25 and Wyoming SH 59. The North Platte River flows through southern portions of the CCPA. Beyond the North Platte River, there is little surface water in the area with exception of intermittent streams, and small reservoirs associated with grazing and with oil and gas facilities. Recreational activities such as driving, hiking, photography, and picnicking associated with historic trails depend on the settings and scenic views that VRM is required to manage.

The CCPA is within the viewshed of residences in the city of Douglas, the towns of Bill, Glenrock, Lost Springs, and Rolling Hills, and multiple ranch residences throughout the analysis area. Within the 15-mile background distance zone are the towns of Edgerton and Midwest. Immediately outside of the 15-mile background distance zone are the communities of Casper and Wright. The Pumpkin Buttes ACEC is located approximately 13 miles north of the CCPA.

BLM historic trail guidelines, based on the National Trail System Act (1968), are applied to much of the trails viewsheds west of Douglas. This region is within the viewsheds of the Oregon, California, Mormon Pioneer, ***and*** Pony Express NHTs. The Bozeman Trail crosses the western portion of the CCPA, and Child’s Cutoff of the Oregon, California, Mormon Pioneer, and Pony Express NHTs crosses the CCPA near its southern boundary.

Other linear viewpoints include I-25 and U.S. Highway 18/20 that run east to west in the southern portion of the analysis area and Wyoming SH 59 that runs north to south in the eastern half of the analysis area.

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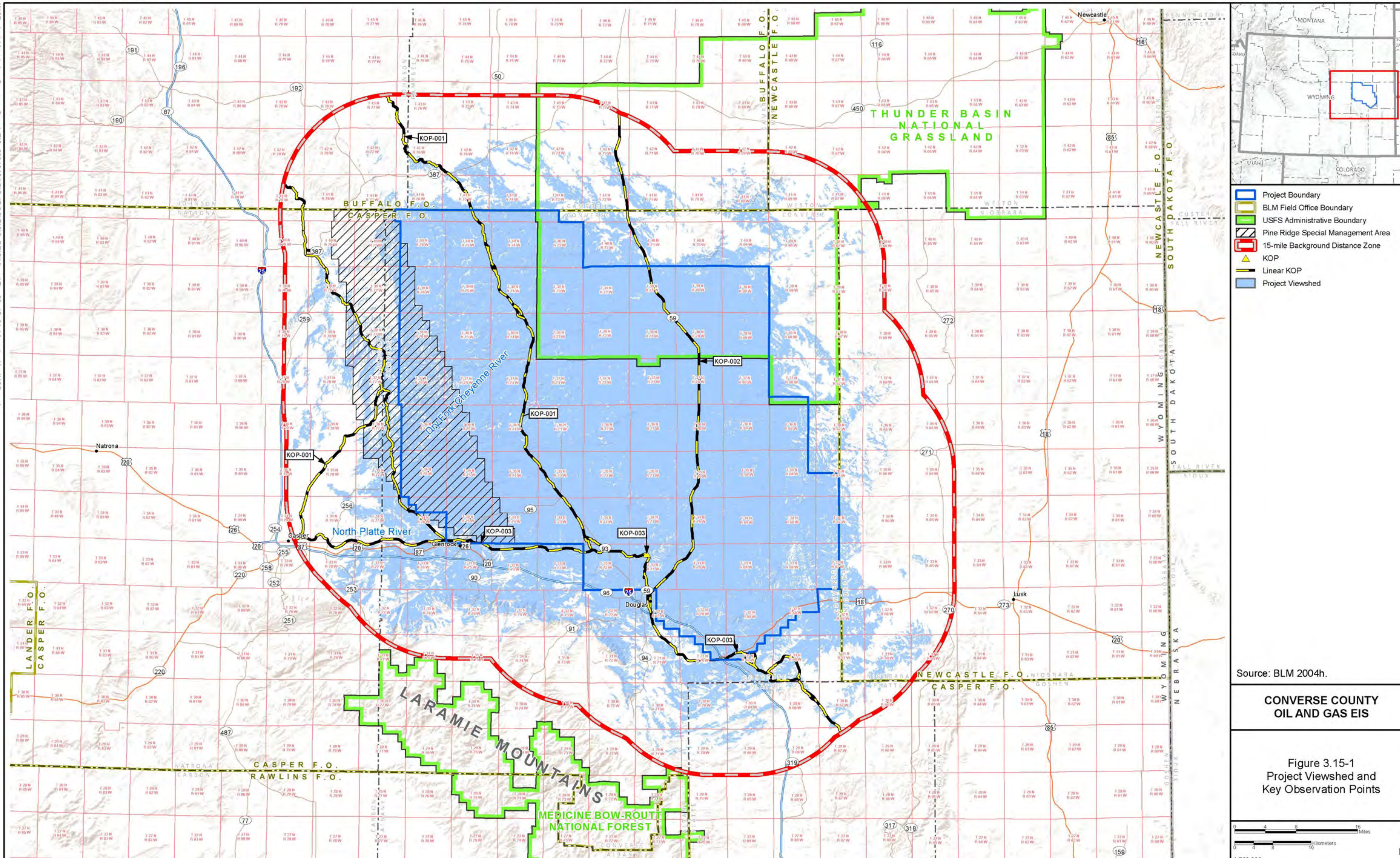

Figure 3.15-1
Project Viewshed and Key Observation Points

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3.15.3 Visual Resource Inventories

Visual Resource Inventories (VRI) were conducted by the BLM (**Table 3.15-1**) and USFS (**Table 3.15-2**) to determine the visual values of the BLM Casper and Buffalo field offices and the TBNG, respectively. The Newcastle Field Office has not conducted a VRI. The components of VRIs for the BLM and USFS include: scenic quality (BLM), scenic attractiveness (USFS), sensitivity levels (BLM), user concern (USFS), visibility, distances zones, scenic integrity (USFS), and visual resource inventory classes (BLM). **Table 3.15-1** provides a summary of the acreages and percent of the analysis area categorized by BLM VRI component the resulting VRI Classes, and the RMP VRM Classes. **Table 3.15-2** provides a summary of the acreages and percent of the analysis area categorized by USFS VRI component and the Forest Plan SIOs.

3.15.3.1 Scenic Quality and Scenic Attractiveness

For the BLM scenic quality evaluation, lands are rated as Class A (19 points or more), Class B (12 to 18 points), or Class C (11 points or less). BLM lands are rated using seven key factors: landforms, vegetation, water, color, influence of adjacent scenery, scarcity, and cultural modifications. For the USFS scenic attractiveness evaluation, lands are rated based on their visual appeal, and designated Class A-Distinctive, Class B-Typical, and Class C-Indistinctive. **Figure 3.15-2** illustrates the scenic quality and scenic attractiveness classifications in the analysis area.

3.15.3.2 Sensitivity Levels and User Concern

The BLM sensitivity level analysis and USFS user concern analysis measure public concern for visual resources. BLM lands are assigned high, medium, or low sensitivity levels based on consideration of the following factors: types of users, amount of use, public interest, adjacent land uses, special areas, and other factors. USFS lands are assigned Concern Level 1, 2, or 3 to reflect high, medium, or low level of importance. **Figure 3.15-3** illustrates the sensitivity levels and user concern levels in the analysis area.

3.15.3.3 Distance Zones

Distance zones are delineated to subdivide the landscape based on relative visibility from travel routes, use areas, or vantage points. **Figure 3.15-4** illustrates the distance zones, which include:

- BLM Foreground-Middleground Zone: This is the area that can be seen from a distance of 3 to 5 miles.
- BLM Background Zone: This is the area that can be seen from approximately 15 miles.
- BLM Seldom Seen Zone: These are areas that are not visible within the foreground-middleground and background zones and areas beyond the background zones.
- USFS Foreground Zone: This is the area that can be seen from a distance of up to 0.5 mile.
- USFS Middleground Zone: This is the area that can be seen from a distance of up to 4 miles from the Foreground Zone.
- USFS Background Zone: This is the area which can be seen from 4 miles to the horizon.

Table 3.15-1 BLM Visual Resource Inventory and Management Summary within CCPA and 15-mile Background Distance Zone

	Class A		Class B		Class C		Not Rated[1]	
	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent
Scenic Quality	28,264	1	354,181	9	2,342,841	59	1,225,153	31

	High		Medium		Low		Not Rated[1]	
	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent
Sensitivity Level	735,642	19	1,209,181	30	780,463	20	1,225,153	31

	Foreground		Foreground-Middleground		Background		Seldom Seen		Not Rated[1]	
	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent
Distance Zones	1,217,425	31	288,589	7	1,219,272	31	0	0	1,225,153	31

	VRI Class I		VRI Class II		VRI Class III		VRI Class IV		Not Rated[1]	
	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent
VRI Classes	0	0	196,240	5	573,583	15	1,955,463	49	1,225,153	31

	VRM Class I		VRM Class II		VRM Class III		VRM Class IV		Not Rated[1]	
	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent
VRM Classes	0	0	185,573	5	970,458	24	2,015,142	51	779,266	20

[1] Areas categorized as not rated are within the BLM Newcastle Field Office or USFS jurisdiction. Although not inventoried, BLM lands in the Newcastle Field Office (445,887acres within the analysis area) are managed as VRM Class III.

Table 3.15-2 USFS Scenic Inventory and Management Summary within CCPA and 15-mile Background Distance Zone

	Class A		Class B		Class C		Not Rated[1]	
	Acres	**Percent**	**Acres**	**Percent**	**Acres**	**Percent**	**Acres**	**Percent**
Scenic Attractiveness	51,165	1	116,498	3	611,603	16	3,171,173	80

	Level 1		Level 2		Level 3		Not Rated[1]	
	Acres	**Percent**	**Acres**	**Percent**	**Acres**	**Percent**	**Acres**	**Percent**
User Concern	0	0	458,261	12	321,005	8	3.117,173	80

	Foreground		Middleground		Background		Not Rated[1]	
	Acres	**Percent**	**Acres**	**Percent**	**Acres**	**Percent**	**Acres**	**Percent**
Distance Zones	130,843	3	494,756	13	153,667	4	3,171,173	80

	Very High		High		Moderate		Low		Very Low		Not Rated[1]	
	Acres	**Percent**	**Acres**	**Percent**	**Acres**	**Percent**	**Acres**	**Percent**	**Acres**	**Percent**	**Acres**	**Percent**
Existing Scenic Integrity	0	0	0	0	689,749	18	83,418	2	6,099	<1	3,171,173	80

	High		Moderate		Low		Not Rated[1]	
	Acres	**Percent**	**Acres**	**Percent**	**Acres**	**Percent**	**Acres**	**Percent**
Scenic Integrity Objectives	28,866	1	48,240	1	702,160	18	3,171,173	80

[1] Areas categorized as not rated are within the BLM jurisdiction.

3.15.3.4 Visual Resource Inventory Classes and Existing Scenic Integrity

The BLM scenic quality evaluation, sensitivity level analysis, and delineation of distance zones are combined to develop VRI Classes (**Figure 3.15-5**), which represent the relative value of the visual resources. Classes I and II are the most valued, Class III represents a moderate value, and Class IV represents the least valued landscape. VRI classes are informational in nature and provide the baseline data for considering visual values in the ***establishment of visual resource management classes through the*** RMP process. USFS landscape character analyses indicates the degree of intactness and wholeness of the landscape and result in scenic integrity levels. Scenic integrity is expressed and mapped as very high, high, moderate, low, very low, and unacceptably low.

3.15.3.5 Visual Resource Management Classes and Scenic Integrity Objectives

The assignment of BLM VRM classes and USFS SIOs are based on the management decisions made in the respective BLM and USFS planning processes, which must take into consideration the value of visual resources and management priorities for land uses. During development of the BLM RMP and USFS LRMP, inventory class boundaries can be adjusted as necessary to reflect resource allocation decisions made in the RMP or LRMP. Management objectives established for each VRM class (BLM Handbook H-8410-1 Visual Resource Inventory [BLM 1980]) are summarized in **Table 3.15-3**. Management objectives established for the USFS SIOs (USFS Scenery Management Handbook 701) are summarized in **Table 3.15-4**. The distribution of BLM VRM class and USFS SIOs are illustrated on **Figure 3.15-6**, while the acreages and percent of the analysis area for each are summarized in **Table 3.15-1** and **Table 3.15-2**.

Table 3.15-3 BLM Visual Resource Management Class Objectives

Class I Objective	The objective of this class is to preserve the existing character of the landscape. This class provides for natural ecological changes; however, it does not preclude very limited management activity. The level of change to the characteristic landscape should be very low and must not attract attention.
Class II Objective	The objective of this class is to retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer. Any changes must repeat the basic (design) elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape.
Class III Objective	The objective of this class is to partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention, but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.
Class IV Objective	The objective of this class is to provide for management activities, which require major modification of the existing character of the landscape. The level of change to the characteristic landscape can be high. These management activities may dominate the view and be the major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic (design) elements.

Source: BLM 1986b.

Table 3.15-4 USFS Scenic Integrity Objectives

Very High	Very high scenic integrity refers to landscapes where the valued landscape character "is" intact with only minute if any deviations. The existing landscape character and sense of place is expressed at the highest possible level.
High	High scenic integrity refers to landscapes where the valued landscape character "appears" intact. Deviations may be present but must repeat the form, line, color, texture, and pattern common to the landscape character so completely and at such scale that they are not evident.
Moderate	Moderate scenic integrity refers to landscapes where the valued landscape character "appears slightly altered." Noticeable deviations must remain visually subordinate to the landscape character being viewed.
Low	Low scenic integrity refers to landscapes where the valued landscape character "appears moderately altered." Deviations begin to dominate the valued landscape character being viewed but they borrow valued attributes such as size, shape, edge effect, and pattern of natural openings, vegetative type changes, or architectural styles outside the landscape being viewed. They should not only appear as valued character outside the landscape being viewed, but also compatible or complimentary to the character within.
Very Low	Very low scenic integrity refers to landscapes where the valued lands "appears heavily altered." Deviations may strongly dominate the valued landscape character. They may not borrow from valued attributes such as size, shape, edge effect and pattern of natural openings, vegetative type changes or architectural styles within or outside landscape being viewed. However deviations must be shaped and blended with the natural terrain (landforms) so that elements such as unnatural edges, roads, landings, and structures do not dominate the composition.

Source: USFS 1995.

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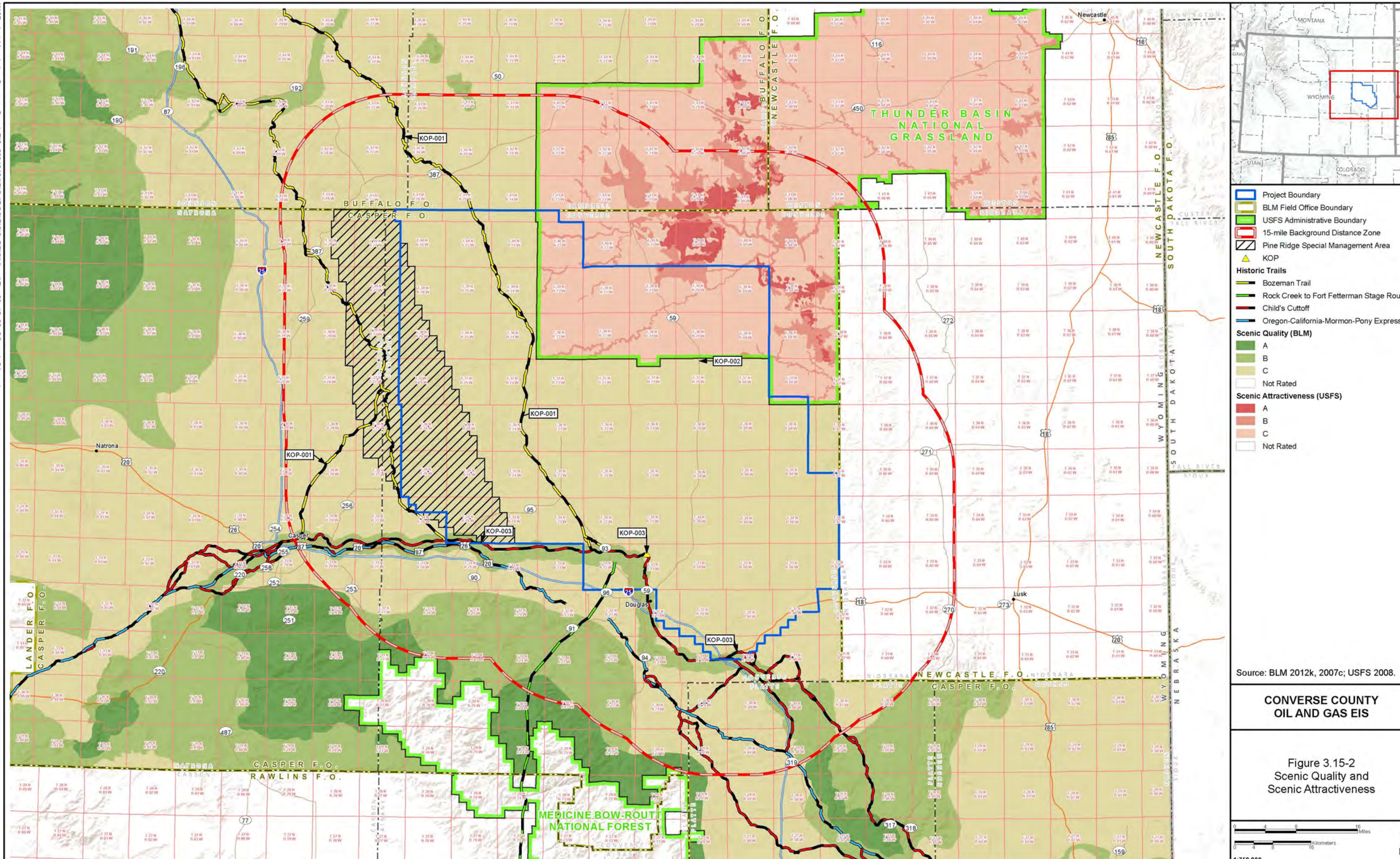

CONVERSE COUNTY OIL AND GAS EIS

Figure 3.15-2
Scenic Quality and Scenic Attractiveness

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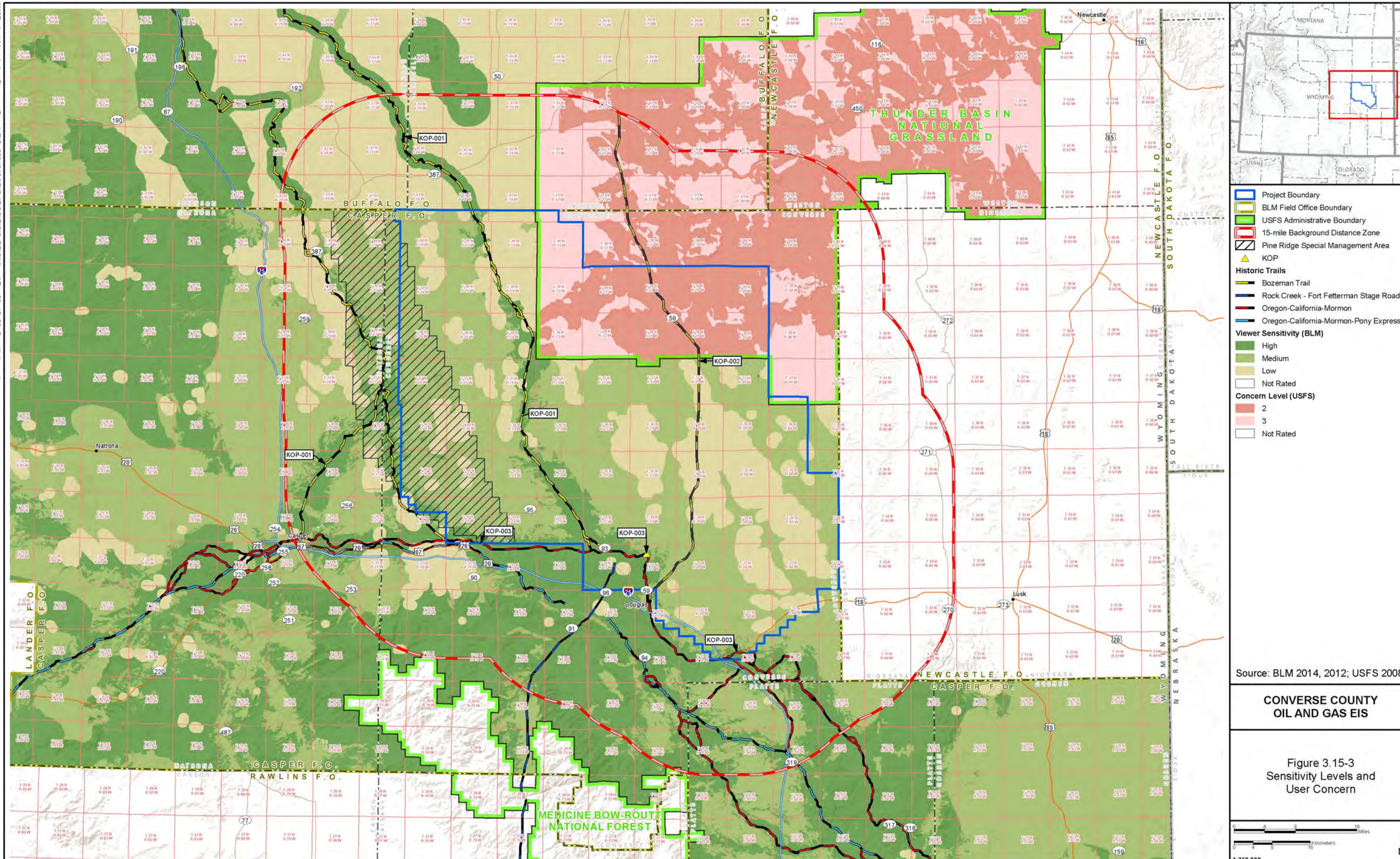

Figure 3.15-3
Sensitivity Levels and User Concern

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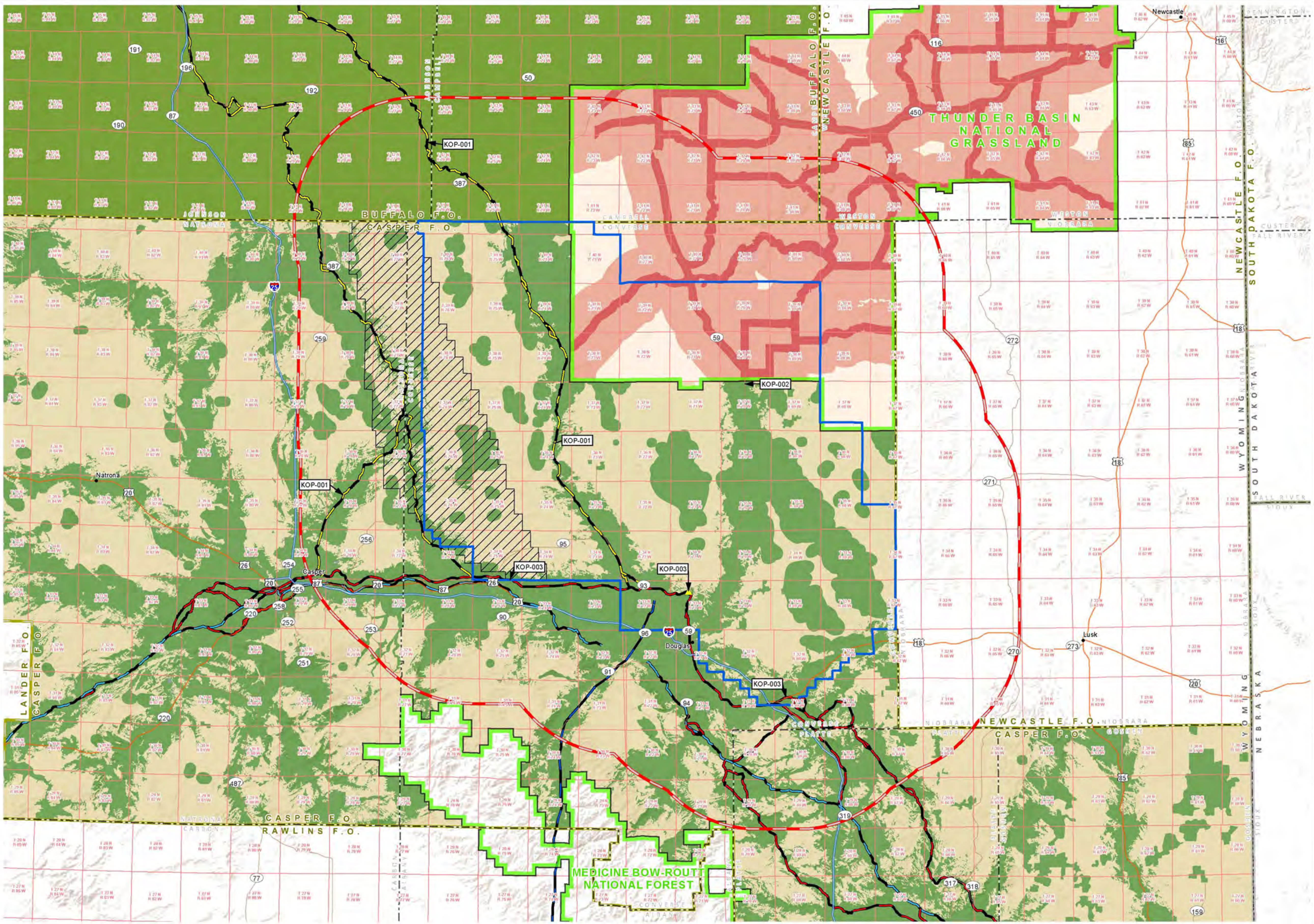

Source: BLM 2014, 2012; USFS 2008.

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Figure 3.15-4

Distance Zones

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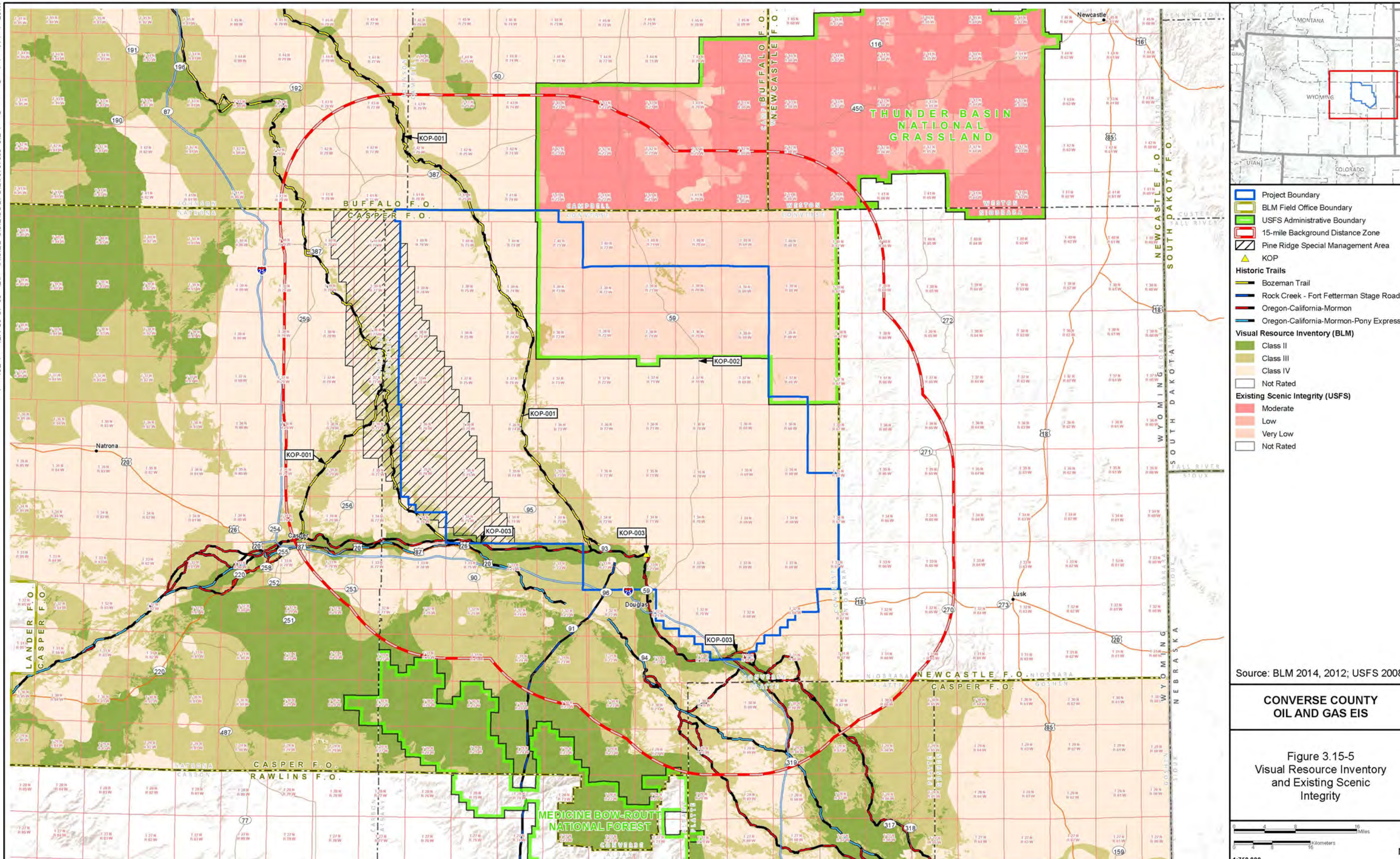

Figure 3.15-5
Visual Resource Inventory and Existing Scenic Integrity

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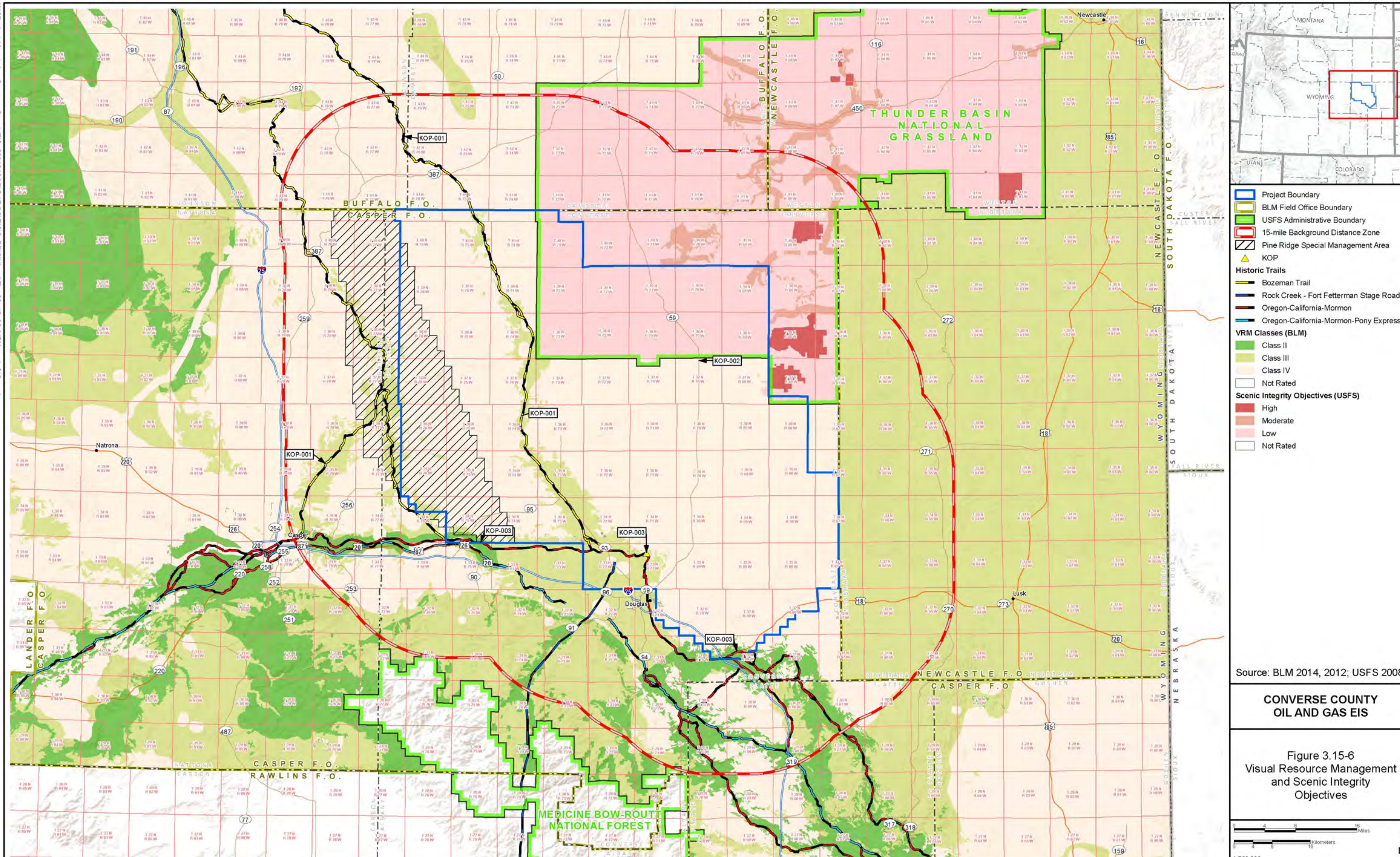

Source: BLM 2014, 2012; USFS 2008.

CONVERSE COUNTY OIL AND GAS EIS

Figure 3.15-6 Visual Resource Management and Scenic Integrity Objectives

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3.16 Water Resources

The affected environment section for water resources discusses both surface water and groundwater. Included are the governing laws and regulations, existing hydrologic and hydrogeological conditions, water quality, and water use for each.

3.16.1 Surface Water

Surface water resources include rivers, streams, lakes, reservoirs, and springs. The analysis area considered for surface water resources includes all hydrographic subwatersheds as defined by the Watershed Boundary Dataset (NRCS et al. 2010) that contain a portion of the CCPA within them (**Figure 3.16-1**). Each of these subwatersheds are nested within larger hydrographic watersheds and hydrographic basins, which in turn are each within an even larger hydrographic region (NRCS et al. 2010).

The entire CCPA is within the Missouri River Region, and drains to three basins: Cheyenne River Basin, North Platte River Basin, and Powder River Basin (**Table 3.16-1**). Each of the three basins are further subdivided into watersheds, which are in turn divided into subwatersheds. Subwatersheds included in the analysis area are listed on **Table D-1** in **Appendix D**.

Table 3.16-1 Hydrographic Units within the Analysis Area

Basin	Watershed	Subwatershed Count[1]	Analysis Area Acreage	Acres within CCPA
Cheyenne River	Sand Creek	6	190,222	175,651
	Upper Antelope Creek	6	215,312	132,445
	Upper Dry Fork Cheyenne River	6	171,227	171,107
	Lower Dry Fork Cheyenne River	5	145,293	122,528
	Lightning Creek	8	196,229	182,260
	Dry Creek	4	135,947	100,449
	Walker Creek	4	127,738	102,012
	Twentymile Creek	3	95,024	57,181
North Platte River	Sand Spring Creek	2	56,917	8,725
	Sand Creek-North Platte River	10	261,818	139,781
	Deer Creek	1	25,141	36
	Sage Creek	3	95,268	94,735
	La Prele Creek	1	34,532	4,978
	Antelope Creek-North Platte River	4	114,384	81,870
	Glendo Reservoir-North Platte River	3	95,568	27,871
	Shawnee Creek	3	77,397	74,439
	Lost Creek	3	73,145	15,319
Powder River	Dry Fork Powder River	1	24,677	1,436
	Upper Salt Creek	2	71,901	9,564

[1] Count of subwatersheds shown in **Table D-1** in **Appendix D**.

3.16.1.1 Laws and Regulations

The CWA, originally the Federal Water Pollution Control Act of 1948 (with major amendments in 1972 and 1977), is the framework that regulates water quality standards and pollutant discharges into waters of the U.S. Sections 303(d) and 305(b) of the CWA require that water quality of streams, rivers, and lakes are assessed by the states on a regular basis; that waters found to be in violation of water quality standards are listed as impaired; and that priorities are set for actions to improve water quality. Section 402 of the CWA created the NPDES, which is administered by the State of Wyoming and includes stormwater permits and requirements for construction areas. Section 404 of the CWA regulates dredging and filling of waters of the U.S., and permits for such activities are issued by the USACE. ***Section 401 of the CWA requires WDEQ to certify any federal license or permit that may result in discharge into Waters of the U.S., including discharges permitted by USACE under Section 404.***

Surface water use classifications, as set by the WDEQ (2013), present in the analysis area are as follows:

- 2AB – Drinking Water, Cold Water Game Fish, Non-Game Fish, Fish Consumption, Other Aquatic Life, Recreation, Wildlife, Agriculture, Industry, Scenic Value;
- 2C – Non-Game Fish, Fish Consumption, Other Aquatic Life, Recreation, Wildlife, Agriculture, Industry, Scenic Value;
- 3B – Other Aquatic Life, Recreation, Wildlife, Agriculture, Industry, Scenic Value.

Water use is administered by the State of Wyoming through the State Engineers Office under the prior appropriation doctrine as defined in the Wyoming Statutes under Wyoming Title 41. In 2001, the U.S. Supreme Court settled a series of legal actions regarding water rights in the North Platte River within the states of Wyoming, Colorado, and Nebraska (Wyoming Water Development Commission 2006). The final settlement stipulation resulted in the Modified North Platte Decree and Cooperative Agreement for Platte River Research and other Efforts relating to Endangered Species Habitats along the Central Platte River, Nebraska (Cooperative Agreement), which places restrictions on diversions in the Platte River Basin from surface water and groundwater wells that are hydrologically connected to the river. The Cooperative Agreement was executed by the Governors of Colorado, Nebraska, and Wyoming as well as the Secretary of the Department of Interior. The Platte River Recovery Implementation Program describes the basin-wide cooperative program envisioned in the Cooperative Agreement. Wyoming's Depletions Plan serves to mitigate the adverse impacts of new water related activities on USFWS target flows and measure the effectiveness of the program.

The federally administered land in the CCPA is managed according to the BLM Casper RMP (BLM 2007b) and the TBNG LRMP (USFS 2002). These management plans include requirements such as NSO and CSU areas around waterways, as well as goals, objectives, standards, and guidelines to protect water resources.

3.16.1.2 Existing Hydrologic Conditions

The analysis area has an arid climate with approximately 12 to 14 inches of average annual precipitation according to five nearby NOAA weather stations (WRCC 2014b). The University of Wyoming Water Resources Data System online mapper estimates that the higher elevations in the northwest portion of the CCPA and the southeastern portion along the Cheyenne River – North Platte River basins divide may receive 17 or more inches of precipitation as an annual average (University of Wyoming 2014c). As shown on **Table 3.16-2**, more than half of the average annual precipitation occurs during the months of April, May, June, and July; while approximately a quarter of the average annual precipitation falls during each of the periods from August to October and November through March (WRCC 2014b). The National Weather Service estimates that average annual free water (pond) evaporation in this area is approximately 45 inches (Farnsworth et al. 1982).

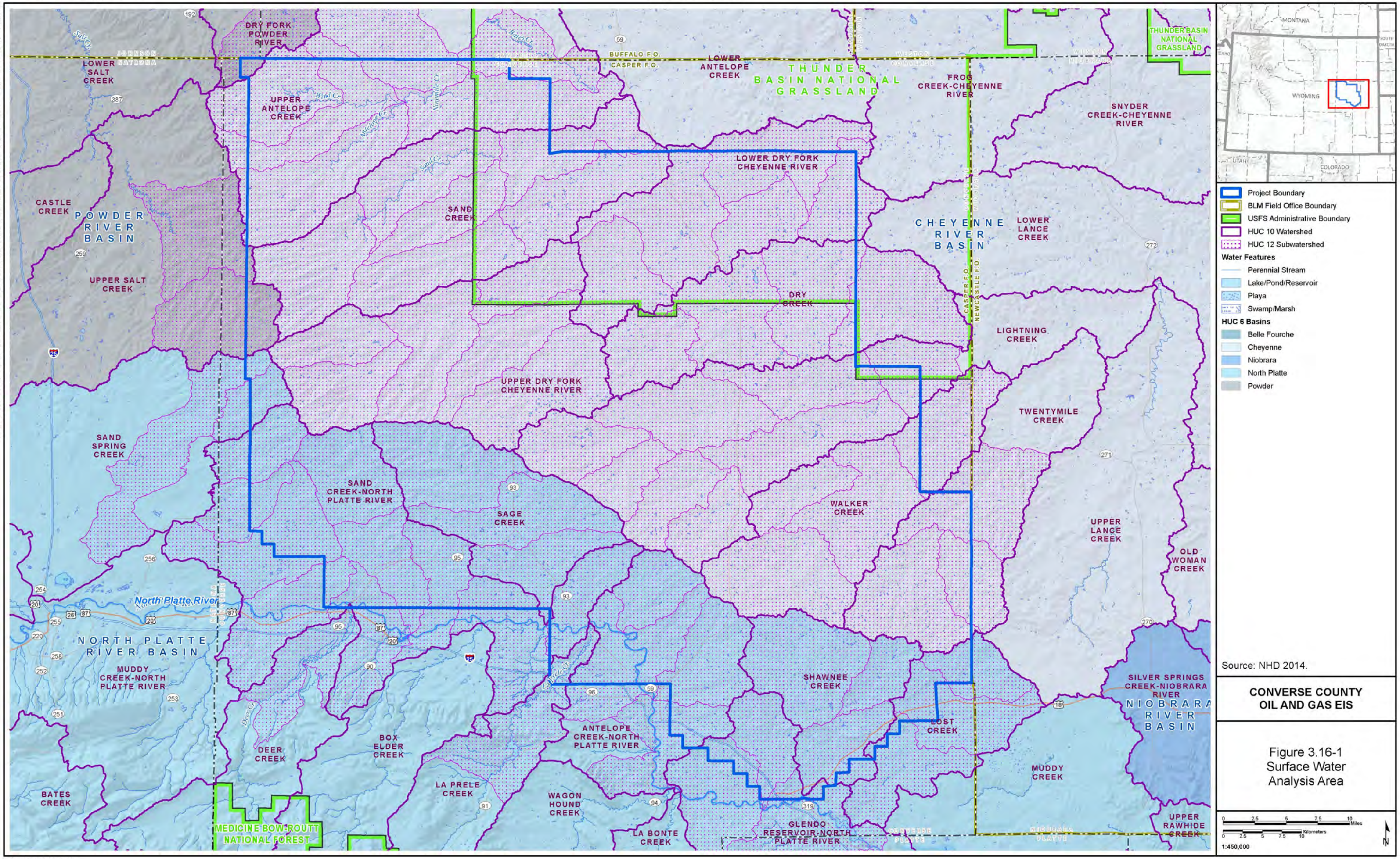

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Table 3.16-2 Average Precipitation Amounts from Nearby NOAA Weather Stations

Station Name	Precipitation (inches)													Record Period (years)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average Annual	
Midwest	0.5	0.6	0.9	1.6	2.5	1.8	1.2	0.7	1.0	1.0	0.6	0.6	13.1	74
Douglas	0.5	0.6	0.9	1.8	2.4	1.8	1.3	1.1	1.2	1.3	0.6	0.5	13.9	104
Glenrock 5 ESE	0.4	0.4	0.8	1.5	2.3	1.7	1.1	0.7	1.1	1.1	0.6	0.4	12.1	71
Bill	0.4	0.3	0.6	1.4	2.7	1.8	1.6	0.9	0.9	0.7	0.4	0.5	12.1	29
Dull Center 1 SE	0.2	0.4	0.7	1.4	2.4	2.2	1.7	1.3	1.0	0.9	0.5	0.3	12.9	86

Source: WRCC 2014b.

The Cheyenne River Basin drains the northern portion of the CCPA, generally toward the east to the Cheyenne River. The Cheyenne River flows to South Dakota where it empties into Lake Oahe and the Missouri River. Perennial streams within the CCPA in this basin include Antelope Creek, Bates Creek, Wind Creek, Sand Creek, Ninemile Creek, North Fork Wind Creek, and South Fork Wind Creek. See **Table D-2** in **Appendix D** for of the miles of perennial streams by subwatershed in the analysis area.

The North Platte River Basin is found along the southern edge of the CCPA, where the North Platte River passes into the CCPA in several locations for up to 15 miles. The CCPA drains toward the North Platte River, with one perennial stream (Cole Creek) found north of the North Platte River. South of the North Platte River, the analysis area contains a number of perennial streams including Dry Creek, East Fork Dry Creek, Middle Fork Dry Creek, Fivemile Creek, Indian Creek, Little Indian Creek, Spring Creek, Deer Creek, Willow Creek, Buckshot Creek, Bulls Run, Deadwood Creek, Harris Creek, La Prele Creek, and Spring Canyon Creek. Southeast of the CCPA, Glendo Reservoir is located downstream on the North Platte River. The North Platte River flows into Nebraska and eventually joins the Missouri River.

The CCPA drains to the Powder River Basin in a few relatively small portions along the eastern and northeastern edges. No perennial streams are found in this basin within the CCPA and only one (Salt Creek) is found downstream in the analysis area outside of the CCPA. Salt Creek drains to the Powder River, which flows north into Montana and joins the Yellowstone River, which then joins the Missouri River after flowing into North Dakota.

Except for the perennial streams listed above, stream flows in the analysis area largely are intermittent or ephemeral (not year-round), where the majority of streams only flow in response to snow melt or precipitation events. A complete listing of water resources in the analysis area is included as **Appendix D**. Average monthly flows for four stream gages within or near the analysis area are provided in **Table 3.16-3**. There are three gages reported on the North Platte River and one on the Dry Fork Cheyenne River. The North Platte River gage near Glenrock has recorded streamflow near the southwestern corner of the CCPA for 33 years (between 1960 and 1992), the Douglas gage has recorded streamflows near the south-central portion of the CCPA for 30 years (between 1919 and 1959), and the Orin gage has recorded streamflow to the southwest of the CCPA just above Glendo Reservoir for 63 of the years since 1895. The maximum annual flow recorded on the North Platte River at one of these gages was 3,512 cfs, and the minimum annual flow was 750 cfs. The Dry Fork Cheyenne River gage near Bill, Wyoming recorded flows for 8 years (between 1976 and 1987); the maximum annual flow recorded was 3.48 cfs, and the minimum annual flow was 0.17 cfs (USGS 2014c).

Stream channel density was calculated based on defined stream lengths (USGS 2011) and hydrographic basin boundaries (NRCS et al. 2010). As shown in **Table 3.16-4**, the majority of stream channels are intermittent; however, the Cheyenne River Basin also contains a large fraction of ephemeral streams.

There also are numerous reservoirs and a multitude of small waterbodies within the analysis area. Named reservoirs larger than 10 acres in surface area include the Betty Reservoir and Reed Reservoir in the Cheyenne River Basin and Glendo Reservoir, La Prele Reservoir (south of the North Platte River), and Wintermote Number 1 Reservoir in the North Platte River Basin. There are no large reservoirs in the Powder River Basin portion of the analysis area. According to the National Hydrography Dataset, there are 866 waterbodies less than 10 acres in surface area in the Cheyenne River Basin portion of the analysis area, 149 waterbodies less than 10 acres in the North Platte River Basin portion, and 14 waterbodies less than 10 acres in the Powder River Basin portion (USGS 2011).

The National Hydrography Dataset identifies 52 springs or seeps within the analysis area in the Cheyenne River Basin, 31 springs or seeps within the analysis area in the North Platte River Basin, and 6 springs or seeps within the analysis area in the Powder River Basin (USGS 2011).

Table 3.16-3 Average Monthly Streamflow as gaged by USGS Gaging Stations Near the CCPA

USGS Gage	Average Monthly Flow (cfs)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
06646800 North Platte River Near Glenrock, WY	889	977	1,110	1,520	2,170	2,240	2,350	2,230	1,590	1,180	1,060	881
06650000 North Platte River Near Douglas, WY	152	173	220	729	2,180	3,740	4,420	4,080	2,190	425	215	167
06652000 North Platte River At Orin, WY	832	906	1,160	1,900	3,170	3,180	2,670	2,240	1,510	1,060	961	817
06365300 Dry Fork Cheyenne River Near Bill, WY	0.07	0.49	1.2	0.54	5.2	1	0.79	0.21	0.02	0.07	0.15	0.14

Source: USGS 2014c.

Table 3.16-4 Density of Stream Channel Network by Hydrographic Basin

Hydrographic Basin	Stream Type							
	Perennial		Intermittent		Ephemeral		Total	
	Miles	Miles/ Sq. Mi.	Miles	Miles/ Sq. Mi.	Miles	Miles/ Sq. Mi.	Miles	Miles/ Sq. Mi.
Cheyenne River	100	0.1	6,930	3.5	1,527	0.8	8,556	4.3
North Platte River	238	0.2	2,598	2.0	78	0.1	2,914	2.2
Powder River	8	0.1	609	4.0	9	0.1	626	4.2

Source: NRCS et al. 2010; USGS 2011.

3.16.1.3 Surface Water Quality

The majority of streams in the analysis area are classified as Class 3B in all three hydrographic basins. The Cheyenne River Basin has one Class 2AB stream within the analysis area (Phillips Creek), the North Platte River has six Class 2AB streams within the analysis area (Box Elder Creek, Deer Creek, La Bonte Creek, La Prele Creek, North Platte River, and Wagon Hound Creek) and the Powder River Basin contains one Class 2C stream within the analysis area (Salt Creek) (WDEQ 2013).

There are no impaired waters within the analysis area according to the WDEQ (2014) Integrated 305(b) and 303(d) Report. However, Antelope Creek in the Cheyenne River Basin portion of the analysis area is noted in the 2014 Integrated Report as containing a diverse community of fishes; therefore, it has been recommended to be reclassified as a Class 2ABww stream instead of a Class 3B (WDEQ 2016c).

3.16.1.4 Surface Water Use

Surface water use is dominated by agricultural needs in the analysis area. Within the Cheyenne River Basin, agricultural use accounts for greater than three-quarters of the total surface water consumption, with reservoir and stock pond evaporation accounting for the remainder (Wyoming Water Development Commission 2002a). In the North Platte River Basin, greater than 80 percent of the total consumed surface water is used for agriculture, approximately 10 percent is used for industrial purposes, and 3 percent is used for municipal and domestic water supply (Wyoming Water Development Commission 2006). Available surface water in the North Platte River Basin has been fully appropriated, meaning that water rights are in place for all available flow (Wyoming Water Development Commission 2006). There still are substantial portions of the annual surface water volumes available for new uses in the Powder and Cheyenne river drainages. Approximately 40 percent or less of the surface water is being utilized in the river basins where these drainages are located (Wyoming Water Development Commission 2002a,b,c).

The Wyoming Source Water Assessment Program identifies two public water supply systems with intakes within the analysis area. Both have sources on the North Platte River. The water supply intakes for the Dave Johnston Generating Station (Public Water Supply 5600291) are located south of the CCPA boundary, just downstream from the western portion of the North Platte River within the CCPA. The municipal water system for the Town of Douglas (Public Water Supply 5600137) diverts water from the North Platte River approximately 2 miles downstream of the CCPA north of Douglas (WDEQ 2004).

3.16.2 Groundwater Resources

This section provides a general review of the groundwater resources in the CCPA. Given the large size of the area, the natural variability within the aquifers, and the available data, this discussion is meant to provide only a general description of groundwater conditions.

There are five major aquifer systems in the CCPA (Feathers et al. 1981), with the shallowest systems utilized the most. With some exceptions, the water quality in these uppermost aquifers generally ranges from fresh to slightly saline, or less than 1,000 up to 3,000 milligrams per liter (mg/L) total dissolved solids (TDS). Groundwater is used for industrial and agricultural purposes, but is the primary source of domestic water.

The direction of groundwater flow in the aquifer systems is highly variable. In the case of alluvial aquifers, the flow is governed by local conditions (i.e., topographic gradient) of the drainage system in which they occur. For bedrock aquifers, groundwater flow generally is to the north.

Water also is a major by-product of oil and gas production. Such water is referred to as produced water and the quality ranges from moderate to very saline (i.e., 3,000 to over 10,000 mg/L). Without treatment, water of this quality generally is not useable and has to be disposed in a manner that is protective of surface and groundwater resources. Two main disposal options in the CCPA are deep well injection and evaporation in specially permitted pits.

3.16.2.1 Hydrostratigraphic Unit Descriptions

Groundwater occurs in underground aquifers that may consist of unconsolidated (e.g., loose materials like gravel, sand, and clay) or consolidated (e.g., cemented materials like sandstone and siltstone) sediment. Unconsolidated alluvial aquifers, which are usually unconfined, generally are found in recent geologic formations and underlying streambeds. An unconfined aquifer is an aquifer where the water level is at atmospheric pressure (Lohman 1972). In other words, the water level in a well rises to the same elevation as water in the aquifer. Confined aquifers, which tend to be found in older and often deeper geologic formations, generally are under confined conditions where the water is under pressure (i.e., the aquifer is confined above and below between layers of varying degrees of lower permeability). Due to the pressure in confined aquifers, the water in wells that penetrate the aquifer will rise above the top of the aquifer. In cases where the pressure is great enough to cause the water to rise to the surface so that the well flows, it is considered an artesian well. However, at the location of a confined formation outcrop, the aquifer will be under unconfined conditions.

Surface water/groundwater interactions occur in a number of ways. Unconfined aquifers may be recharged from surface water across their aerial extent. This occurs through percolation of surface water where streams cross an aquifer in locations where the groundwater level is lower than the stream water level. They also recharge from upland areas during precipitation and runoff events. Unconfined aquifers discharge water to the surface at locations where the groundwater level meets the ground level. These locations create springs or seeps in upland areas and areas along stream banks, and create gaining stream reaches when located within stream channels. Confined aquifers interact with surface water at their outcrop locations, where they either receive recharge if the water level is below the surface, or they discharge if the water level is at or higher than the surface. The mechanisms for the interactions are similar to those of the unconfined aquifers but are limited to the geographic area of the outcrops. The aquifers in this basin generally are found with the youngest as the shallowest and the oldest as the deepest. They include:

- Quaternary/Alluvial
- Lower Tertiary Wasatch/Fort Union
- Fox Hills/Hell Creek
- Dakota Aquifer
- Madison Aquifer

The Lower Tertiary (Wasatch/Fort Union) and Fox Hills/Hell Creek aquifer systems commonly are used for the production of fresh water because of water availability, depth, and common use. The lithostratigraphic-hydrologic relationships in the Lower Tertiary aquifer and upper Cretaceous aquifer systems are shown on **Figure 3.16-2**. The Quaternary/Alluvial, Dakota, and Madison aquifer systems are not commonly used for freshwater due to poor water quality and depth in the case of the Dakota and Madison aquifers. The Quaternary/Alluvial, Lower Tertiary, and Fox Hills/Hell Creek aquifers have no oil and gas potential in the CCPA. The Dakota and Madison aquifer systems potentially contain oil and gas resources.

The aquifer systems in the Powder River Basin that are of interest to the analysis are those aquifers and confining units composed of Upper Cretaceous, Lower Tertiary, and Quaternary/Holocene units that are located stratigraphically above the Pierre/Lewis Shale (**Figure 3.16-2**). The hydrogeologic framework used for this analysis followed that of Lewis and Hotchkiss (1981) and Long et al. (2014). The lithostratigraphic and corresponding hydrogeologic units are consistent with Long et al. (2014). Lithostratigraphic units include (in descending order): Quaternary terrace deposits and Holocene alluvium, Tertiary Wasatch and Fort Union formations, and Upper Cretaceous Hell Creek Formation, and Fox Hills Sandstone. The Hell Creek Formation is equivalent to the Lance Formation and is used in this analysis in order to be consistent with Long et al (2014).

The Quaternary/Alluvial aquifer system is found adjacent to stream channels and primarily is composed of a clay-rich mixture of sandy silt and gravel. It generally is less than 50 feet thick but can be thicker locally. When composed of a higher percentage of gravel and coarse sand, the aquifer may have very high permeability and storage capacity. Wells completed in this aquifer commonly yield up to 75 to 450 gallons per minute (gpm), but alluvial aquifers may be limited in aerial extent (Wyoming Water Development Commission 2002a). These aquifers often are in hydrologic communication with underlying Tertiary aquifers or surface water. TDS concentrations in the Quaternary/Alluvial aquifers in the northeast Wyoming water basins (including drainages in Converse County not part of the Platte River drainage) ranged from 100 to 4,000 mg/L (Wyoming Water Development Commission 2002a). The quality of water in these aquifers is highly variable due to the underlying rock type and the quality of surface water (Wyoming Water Development Commission 2002a).

<table>
<tr><th>Era</th><th>System</th><th>Series</th><th colspan="2">Lithostratigraphic Units</th><th>Hydrogeologic Units</th></tr>
<tr><td rowspan="5">Cenozoic</td><td rowspan="5">Lower Tertiary</td><td></td><td colspan="2">Quaternary terrace deposits and Holocene Alluvium</td><td>Quaternary/Alluvial</td></tr>
<tr><td>Eocene</td><td colspan="2">Wasatch Formation</td><td rowspan="2">Wasatch/Tongue River Aquifer</td></tr>
<tr><td rowspan="3">Paleocene</td><td rowspan="3">Fort Union Formation</td><td>Tongue River Member</td></tr>
<tr><td>Lebo Member</td><td>Lebo Confining Unit</td></tr>
<tr><td>Tullock Member</td><td>Tullock Aquifer</td></tr>
<tr><td rowspan="4">Mesozoic</td><td rowspan="4">Upper Cretaceous</td><td rowspan="4"></td><td colspan="2">Upper Hell Creek Formation</td><td>Upper Hell Creek Confining Unit</td></tr>
<tr><td colspan="2">Lower Hell Creek Formation</td><td rowspan="2">Fox Hills/Lower Hell Creek Aquifer</td></tr>
<tr><td colspan="2">Fox Hills Sandstone</td></tr>
<tr><td colspan="2">Pierre/Lewis Shale</td><td>Pierre/Lewis Basal Confining Unit</td></tr>
</table>

Source: Lewis and Hotchkiss 1981; Long et al. 2014; Thamke et al. 2014.

Figure 3.16-2 Upper Cretaceous - Lower Tertiary Lithostratigraphic and Hydrogeologic Units for the Southern Powder River Basin

In the Lower Tertiary Wasatch/Fort Union aquifer system, the rock units are combined into hydrogeologic units consisting of aquifers and aquitards. In descending order, the Wasatch Formation and the Tongue River Member of the Fort Union Formation are combined into one aquifer referred to as the Wasatch/Tongue River aquifer, which is the same as the Tongue River aquifer of Lewis and

Hotchkiss (1981) and the Upper Fort Union aquifer of Long et al. (2014). The Lebo Shale Member of the Fort Union Formation is an aquiclude referred to as the Lebo confining unit and is analogous to the Middle Fort Union hydrogeologic unit of Long et al. (2014). The Tullock Member of the Fort Union Formation is an aquifer referred to as the Lower Fort Union aquifer by Long et al. (2014). The upper portion of the Hell Creek Formation is an aquiclude that is termed the Upper Hell Creek confining unit (Long et al. 2014). The lower portion of the Hell Creek Formation and the Fox Hills Sandstone are combined into one aquifer termed the Fox Hills/Lower Hell Creek aquifer (Long et al. 2014). ***Note that the Wyoming SEO considers the Tertiary Wasatch, Tertiary Fort Union, Cretaceous Lance and Cretaceous Fox Hills to be separate aquifers and cannot be commingled when completing a well.***

The geological outcrop and contacts between the Lower Tertiary and Upper Cretaceous aquifers are shown on **Figure 3.16-3. Figure 3.16-4** is a geological cross section depicting the hydrogeological relationships of the various aquifers and aquitards of the Lower Tertiary and Upper Cretaceous aquifer systems in the CCPA.

The Wasatch/Tongue River aquifer is present at the surface throughout the CCPA and is more than 3,900 feet thick (Wyoming Water Development Commission 2002a). Water-bearing units in the aquifer are composed of permeable sandstones and coalbeds. The Lebo Member of the Fort Union Formation primarily is composed of shale and thin coal beds. Due to this composition, it is considered an aquiclude and is designated as the Lebo Confining Member. However, the Lebo Member contains isolated sandstones that yield water (Lewis and Hotchkiss 1981). The Tullock aquifer is composed of medium- to fine-grained sandstones.

Recoverable groundwater resources were estimated to be 1.4 billion acre-feet in the Wasatch/Tongue River sandstones, Lebo Confining Member sandstones, and the Tullock Aquifers in the Wyoming portion of the Powder River Basin (BLM 2002b). Based on the aerial extent of these aquifers in the county, there would be a potential recoverable water resource of approximately 261 million acre-feet of groundwater in the Wasatch/Lower Tertiary aquifers in Converse County.

Most wells in the CCPA draw from the Lower Tertiary aquifer system. Well depths typically are less than 1,000 feet, although the WSEO records indicate a few deeper wells (WSEO 2014). Well yields in the Lower Tertiary aquifers are variable and range from 15 gpm to more than 500 gpm (Feathers et al. 1981). The aquifer system also contains uranium and coal deposits along with minor amounts of oil and gas. Water quality generally is good in the aquifer, as evidenced by the heavy use of this zone as a domestic and municipal water source. The dominant TDS component is sodium sulfate or sodium bicarbonate, and TDS concentrations range from 228 to 3,200 mg/L (Wyoming Water Development Commission 2013a). Based on these data, aquifers of the Lower Tertiary generally would contain usable water or potential underground source of drinking water (USDW) (i.e., waters with TDS less than 10,000 mg/L). An aquifer that is considered a USDW must be protected unless it has been granted an exemption under the Safe Drinking Water Act.

In some areas, the Lower Tertiary aquifers exhibit elevated concentrations of radium-226, which is a daughter product of the uranium decay chain. The USEPA standard for radium is 5 picocuries per liter (USEPA 2012a; WDEQ 2005). Concentrations of radium in the analysis area have been reported above USEPA primary drinking water standards. Analyses conducted for a proposed uranium-leaching project showed concentrations ranging from 0.3 to 2,598 picocuries per liter (BLM 2010c).

The Fox Hills/Lower Hell Creek aquifer system underlies the Lower Tertiary aquifer system and consists of a series of fine- to coarse-grained sandstones up to 3,700 feet thick (Wyoming Water Development Commission 2002a). The Fox Hills/Lower Hell Creek aquifer generally lies at depths greater than 6,000 feet and, given this depth, is not commonly used as a water supply aquifer in the Powder River Basin (Wyoming Water Development Commission 2013a). Where the Fox Hills/Lower Hell Creek aquifer System is deeply buried, generally only wells that were drilled for oil and gas are completed in the aquifer

(Wyoming Water Development Commission 2013a). Water yields can be high, reportedly up to 705 gpm (Wyoming Water Development Commission 2002a).

TDS in the Fox Hills/Lower Hell Creek aquifer commonly is 3,000 mg/L or less over widespread areas of northeast Wyoming, eastern Montana, North Dakota, and South Dakota (Whitehead 1996). In the northeast Powder River Basin of Wyoming that includes portions of the CCPA, TDS concentrations in the Fox Hills/Lance aquifer ranges from 600 to 3,300 mg/L in shallow areas near the outcrop (Wyoming Water Development Commission 2002a). Elevated levels of fluoride and localized high concentrations of sodium and radionuclides also have been detected.

In portions of the CCPA in the southern Powder River Basin in areas that drain to the North Platte River, samples from the Lance aquifer had TDS concentrations ranging from 264 to 1,950 mg/L, and six samples from the Fox Hills aquifer had TDS concentrations ranging from 943 to 2,050 mg/L (Wyoming Water Development Commission 2013a). Based on these data, the waters of the Fox Hills/Lower Hell Creek aquifer system would be considered potentially usable waters (i.e., waters with TDS less than 10,000 mg/L) and would be protected unless an aquifer exemption has been granted under the Safe Drinking Water Act.

The Dakota aquifer system is similar in geologic makeup and character to the Fox Hills/Lower Hell Creek aquifer. It is approximately 400 feet thick and not commonly targeted as a source of water because of its depth, low yield, and TDS concentrations greater than 10,000 mg/L (Feathers et al. 1981). This zone is a potential oil and gas reservoir, and water quality may be affected by the presence of naturally occurring petroleum compounds.

The Madison aquifer system is the deepest aquifer system in the CCPA and is composed of Paleozoic rocks ranging from the Cambrian Flathead aquifer to the Pennsylvanian-Permian Tensleep aquifer (Feathers et al. 1981). Water quality in the Madison aquifer system generally is poor because of elevated TDS concentrations, and some of the rock formations within the system have oil and gas production potential (e.g., Tensleep Sandstone and Minnelusa Formation). The Madison Limestone is an important aquifer of the Madison aquifer system, but in the CCPA it is thousands of feet below the base of the Fox Hills/Hell Creek aquifer, the deepest practical aquifer in the CCPA. A major recharge area (i.e., outcrop) of the Madison aquifer lies more than 40 miles east of the CCPA where the outcrop of the Madison follows the southwestern flank of the Black Hills. Madison limestone outcrops are present approximately 15 miles southwest of Douglas, Wyoming, in the northernmost portion of the Laramie Mountains (Love and Christiansen 1985). However, these outcrops likely do not have a hydraulic connection to the Madison aquifer in the Powder River Basin because the outcrops are on the south side of the North Platte River and are separated from the Powder River Basin by complex folding and faulting (Blackstone 1996; Feathers et al. 1981; Weston Groundwater-Engineering, Inc. 2008). The proposed target zones for oil and gas production are all stratigraphically above the Madison, and wells drilled to these zones would not penetrate the Madison. The deepest proposed oil and gas objective (i.e., the Dakota Sandstone) is more than 2,500 feet above the Madison aquifer (Lyndes 2013).

3.16.2.2 Wyoming Groundwater Quality Standards

The State of Wyoming has groundwater quality standards based on a variety of constituents that include inorganic chemicals, radionuclides, and physical characteristics (Taboga et al. 2018). The quality classifications listed below are based on the concentration of TDS expressed in mg/L (WDEQ 2018).

- Class I groundwater is suitable for domestic use ***(500)***.
- Class II groundwater is suitable for agricultural (irrigation) use if soil conditions and other factors, such as physical characteristics and constituents (e.g., pH, ions, nutrients, etc.), are adequate ***(1,000)***.

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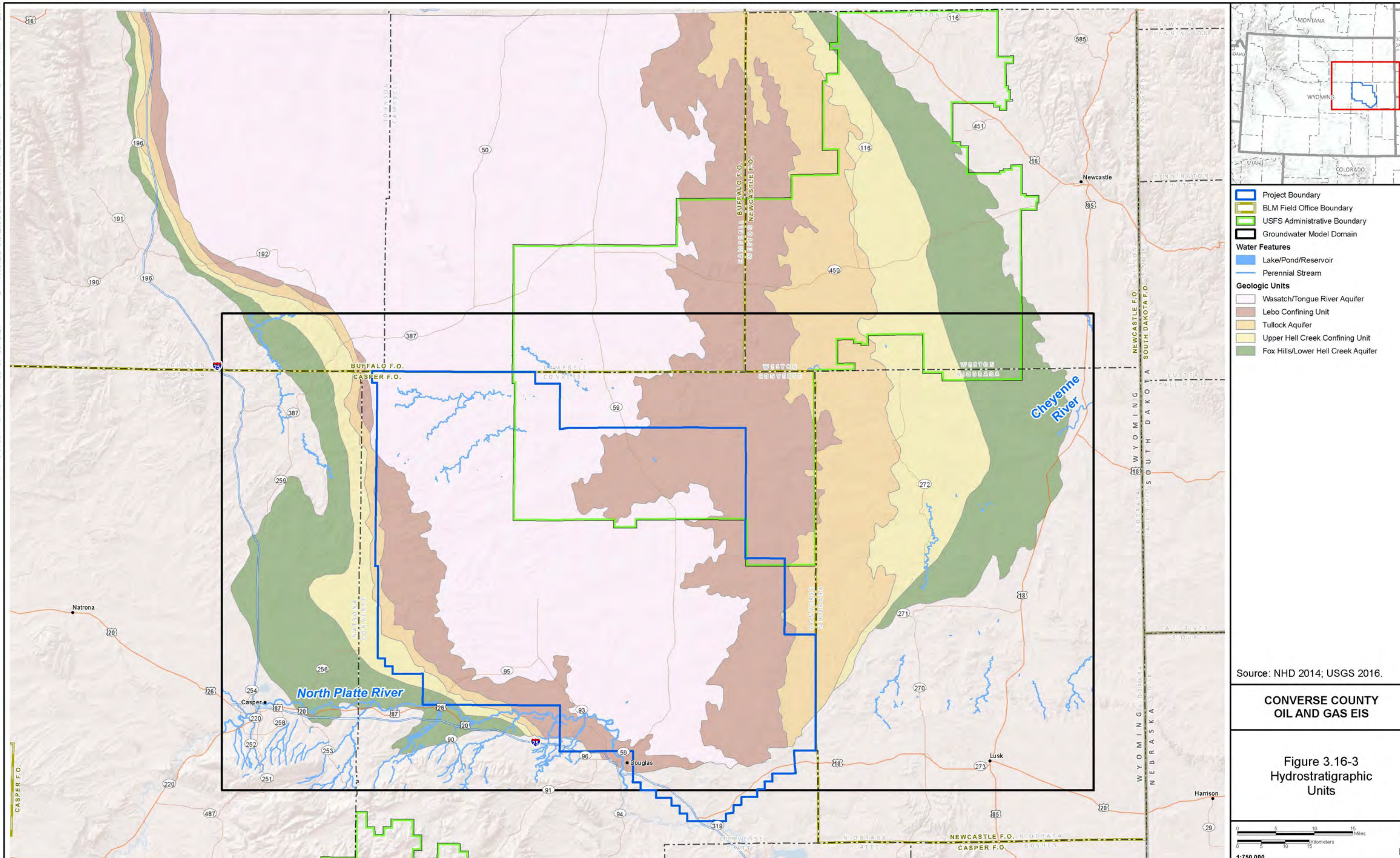

Figure 3.16-3
Hydrostratigraphic Units

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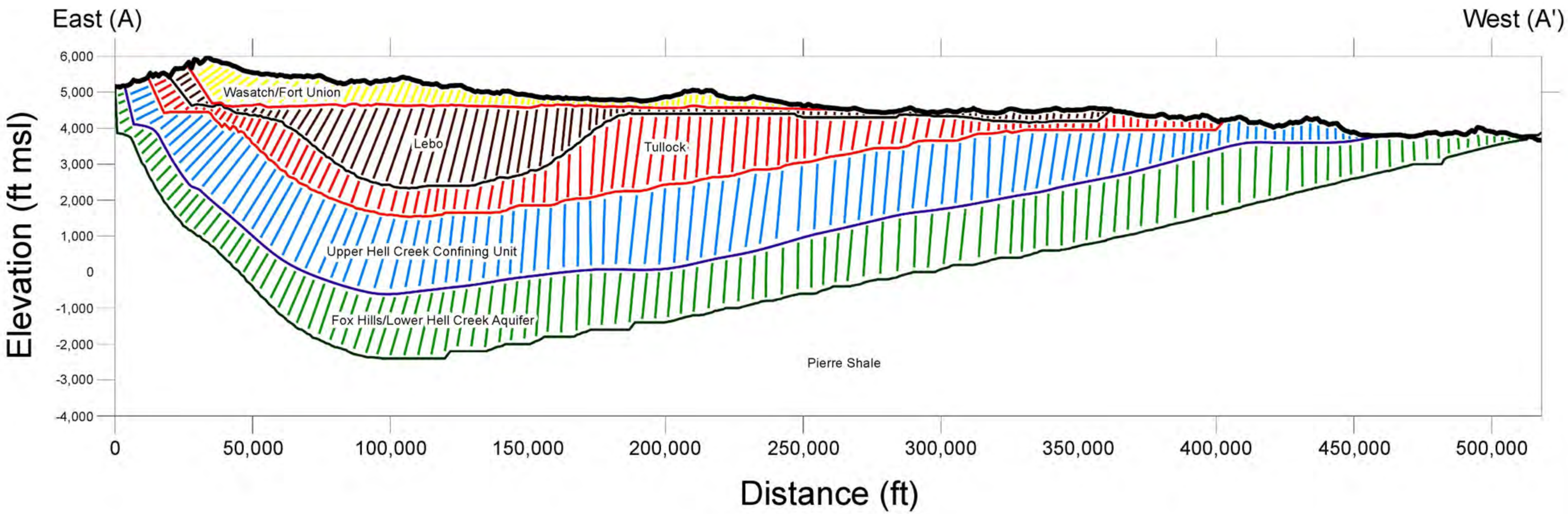

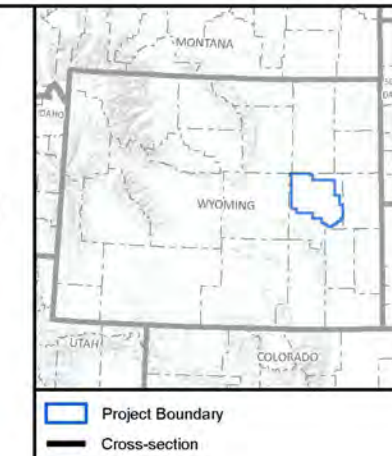

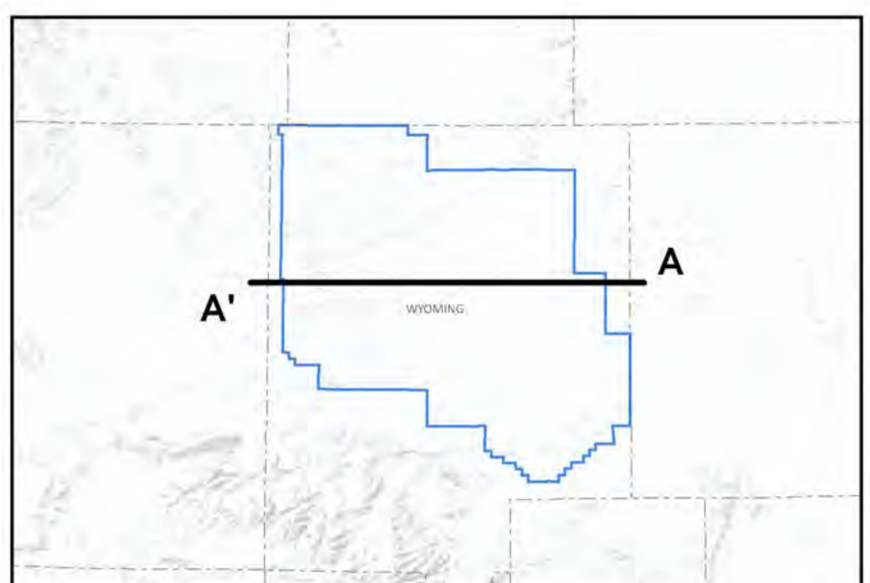

Source: USGS 2014b.

CONVERSE COUNTY OIL AND GAS EIS

Figure 3.16-4
Geologic Cross Section
East to West
through Model Domain

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- Class III groundwater is suitable for stock use ***(1,500)***.
- Class Special (A) groundwater is suitable for fish and aquatic life ***(500-2,000)***.
- Class IV groundwater is suitable for industrial use ***(Class IVA less than 1,000; Class IVB greater than 1,000)***.
- Class V groundwater has commercial deposits of hydrocarbons or other minerals or is considered a geothermal resource.
- ***Class VI groundwater is considered unusable or unsuitable for use due to excessive constituents, contamination, or located as to be economically or technologically impractical for use.***

3.16.2.3 Groundwater Flow, Recharge, and Aquifer Sensitivity

Groundwater flow in the entire CCPA is not well documented due to a lack of monitoring wells (Taboga et al. 2017). A summary of current published conceptual models for groundwater flow in the Powder River Basin is available in the reports for the Powder River Basin Coal Review that was conducted for the BLM (AECOM 2012a, 2011; ESI 2014). In addition, potentiometric maps were published by Hotchkiss and Levings (1986) and included in Thamke et al. (2014). These studies concentrated on flow in the northern portions of the Powder River Basin because of the high intensity of coalbed natural gas production and groundwater pumping associated with coal mining. Groundwater flow in the CCPA, being located in the southern part of the basin, is considered to be speculative (Hotchkiss and Levings 1986).

According to ESI (2014), groundwater flows generally from south to north in the Powder River Basin, discharging either into Montana or into the Powder River, its tributaries, and other drainages. Most of the flow in 2008 (72 percent) discharged into these drainages in the northern reaches of the basin, and only approximately 3 percent of the flow travels north from the CCPA. According to Hotchkiss and Levings (1986), groundwater flow mostly is toward the east in the aquifers in the CCPA (i.e., in the general direction of the flow of Antelope Creek). However, based on the surface water analysis conducted in this analysis, Antelope Creek is an ephemeral stream; therefore, it would not be expected to influence groundwater flow direction. In the northern portion of the CCPA near the Converse-Campbell County line, regional groundwater flow turns northward, flowing from Converse County in the southeast to the northwest across the Powder River Basin. The shallow local groundwater flow system in the Quaternary/Alluvial and Wasatch/Tongue River aquifers is topographically controlled by drainage divides and streams in the CCPA. The descriptions of Thamke et al. (2014) and Long et al. (2014) are based on Hotchkiss and Levings (1986); therefore, they are similar: “flow is generally northerly, except where it flows easterly and discharges to Antelope Creek.” Locally in the Wasatch/Tongue River aquifer, groundwater flows toward and discharges into streams, primarily the Powder and Tongue rivers. Regionally, Thamke et al. (2014) considered the Tullock aquifer to be confined were it was overlain by the Lebo. Long et al. (2014) also considered the Tullock aquifer to be confined were it was overlain by the Lebo, and they support this by pointing to the difference in potentiometric gradients between the Wasatch/Tongue River and Tullock aquifers, which are mostly downward in the CCPA.

Precipitation recharge may account for as much as 15 percent of total recharge to the Powder River Basin, with larger rates in the northern portion of the basin and lesser amounts in the CCPA. Long et al. (2014) assumed that most of the recharge discharges to streams (i.e., Powder and Tongue rivers) with some flowing downward into the deeper aquifers (i.e., Tullock and Fox Hills/Lower Hell Creek aquifers). Precipitation recharge in the southwestern portion of the Powder River Basin contributes to eastward groundwater flow in the CCPA before it turns northward.

Groundwater recharge occurs as infiltration of precipitation (i.e., rainfall and snowmelt) and streams crossing aquifers or aquifer boundaries (Long et al. 2014). The total recharge to the Powder River Basin is estimated to be 1,500 cubic feet per second. Estimated recharge is from precipitation and is 15 percent of the total recharge to the basin. Estimated recharge from streams is 80 percent of total recharge for the Powder River Basin. Groundwater discharge to surface water is estimated to be approximately 92 percent of total discharge for the Powder River Basin. Groundwater pumping accounted for most for the remaining discharge.

The influence of the North Platte River on recharge to the southern Powder River Basin is not discussed or included in any of the previous models or reports (ESI 2014; Hotchkiss and Levings 1986; Long et al. 2014; Thamke et al. 2014). While it is not known if the river is hydrologically connected to the Powder River Basin, it does border the southern edge of the basin. It may be that the North Platte River likely is hydrologically connected to the geologic units it flows across and would either recharge or discharge the aquifers depending on whether the river elevations were higher than the potentiometric surface of the aquifers or lower.

The sensitivity of an aquifer to contamination is a function of the availability of contaminants at the surface and the characteristics of the aquifer (e.g., depth, permeability of surface materials, topography, and permeability of the aquifer). Aquifers that are near the surface and have direct contact with sources of contamination through permeable layers or faults are more vulnerable to contamination. Maps have been created to rate the sensitivity of aquifers for the Platte River Basin, the Northeast Wyoming River Basins (includes the Cheyenne River Basin) and the Powder/Tongue River (Wyoming Water Development Commission 2013a, 2002b,c). Aquifer sensitivities in Converse County are shown in **Figure 3.16-5**. Within the Platte River Basin, the North Platte River and adjoining creeks around the towns of Glenrock and Douglas are rated as having medium-high to high sensitivity, whereas the rest of the area is in the low to medium range. Within the Northeast Wyoming River Basin, there are several streams in portions of Converse County that also are rated as high or medium-high sensitivity because of their interaction with groundwater, including Antelope Creek, Dry Fork Cheyenne River, the confluence of Dry and Lightning creeks, and Box Creek. The majority of the remaining area is considered to have low to medium sensitivity (WDEQ 2012b). There are no areas of high sensitivity in Converse County in the Powder/Tongue River Basin (Wyoming Water Development Commission 2002b).

3.16.2.4 Water Development and Current Uses

Most of the water used for agriculture in the Cheyenne River Basin is surface water, with approximately 17 to 25 percent coming from groundwater (Wyoming Water Development Commission 2002a). Evaporation from key reservoirs and stock ponds is a minor contributor to water consumption, and industries are large users of surface water in the Cheyenne River Basin. Additional uses of water include municipal and domestic uses, which is exclusively from groundwater, and recreational and environmental uses, which are non-consumptive uses (Wyoming Water Development Commission 2002a). Similar uses of water occur for the North Platte River Basin, except for municipal and industrial uses, which rely on both surface water and groundwater sources (Wyoming Water Development Commission 2006).

Industry is the largest user of groundwater in the CCPA, accounting for approximately 68 and 75 percent for the Cheyenne and North Platte River basins, respectively (Wyoming Water Development Commission 2006, 2002a). Other uses of groundwater in the area include agricultural, municipal, and domestic uses, which generally rely on a combination of both surface water and groundwater resources. Groundwater is the source of most domestic and rural water sources in the CCPA (Wyoming Water Development Commission 2006, 2002a). The City of Glenrock uses an average of 1.8 acre-feet per day, which is sourced from groundwater. Douglas also uses groundwater at an average rate of approximately 3.4 acre-feet per day (Lidstone et al. 2005).

Only small plots within the CCPA are irrigated, and these plots occur along the Dry Fork Cheyenne and Antelope creeks within the Cheyenne River watershed. However, most of the irrigation uses surface water. In the Cheyenne River watershed, approximately 24,500 acre-feet per year of surface water is used to irrigate 23,295 acres (Wyoming Water Development Commission 2002a). Groundwater is used to irrigate only approximately 514 acres and consumes 550 to 610 acre-feet per year.

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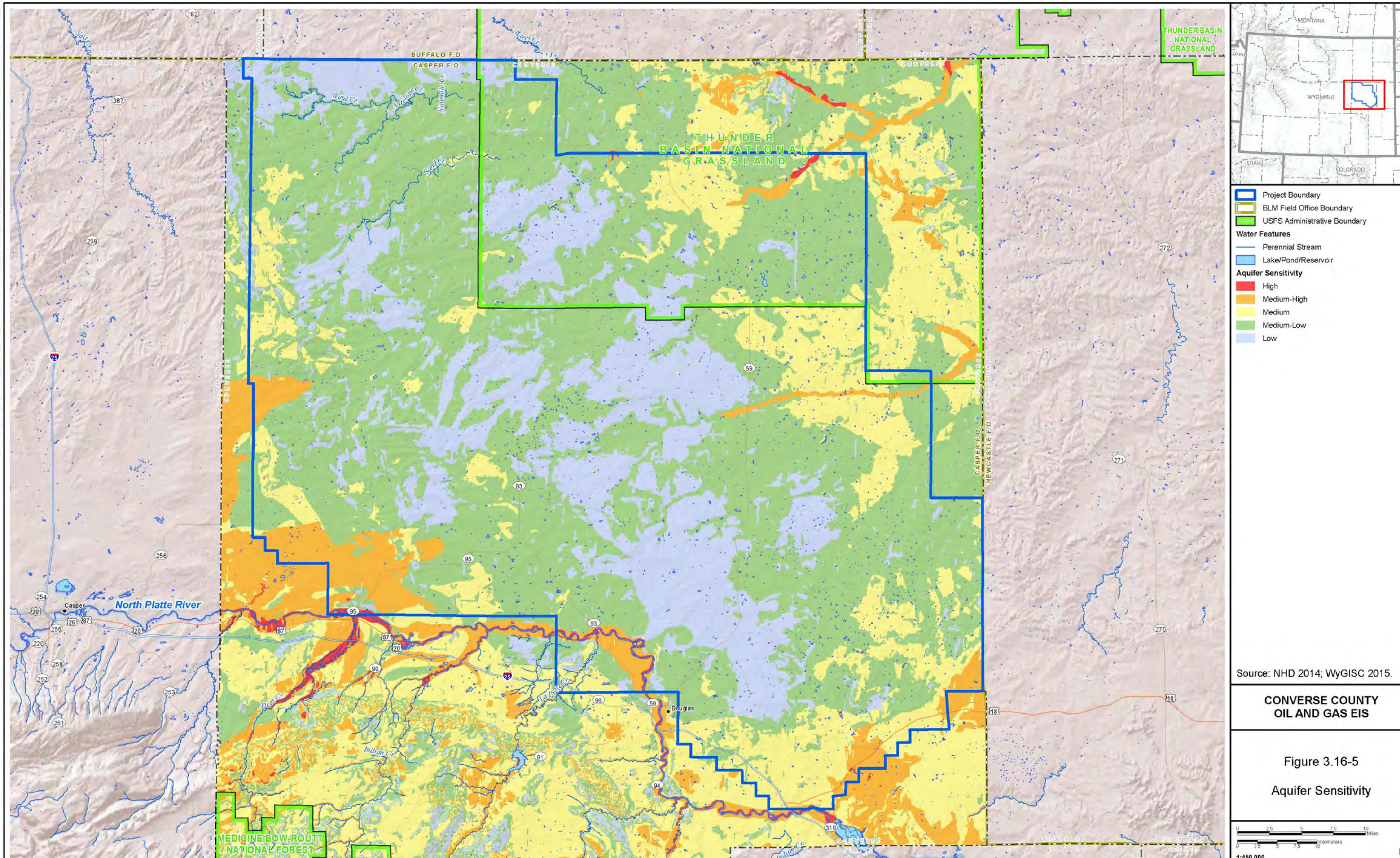

CONVERSE COUNTY OIL AND GAS EIS

Figure 3.16-5

Aquifer Sensitivity

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The North Platte River is fully appropriated, meaning that water rights are in place for all available flow in the river (Wyoming Water Development Commission 2006). Studies have determined that shallow groundwater (e.g., Quaternary and Lower Tertiary aquifers) in an area around the river is hydrologically connected to the river, and extraction of groundwater from wells within these linked areas will affect river flow. Per the Platte River Recovery Implementation Program, the WSEO (2014) publishes maps of "Green Areas," which are areas where groundwater ***is not hydrologically connected to the North Platte River*** (**Figure 3.16-6**). Groundwater used within hydrologically connected areas ***outside (south of) the "Green Areas"*** is considered river water and ***use of this groundwater is subject to replacement or mitigation***. Replacement or mitigation can be implemented in several ways as specified in Chapter II of the Wyoming Platte River Depletions Plan (WSEO 2006). Regarding future use of the groundwater, the Wyoming Water Development Commission states that source depletions resulting from development may have to be offset to avoid adverse effects downstream (Wyoming Water Development Commission 2006). Also water activities that are classified as new may require the prospective user to consult with the USFWS regarding potential impacts. Groundwater development in the Cheyenne River and Powder River basins are not limited under the Platte River Recovery Implementation Program.

Uranium

Several operating uranium mines are located in or near the CCPA (**Table 3.16-5**), and more than 40 percent of Wyoming's uranium was produced in Converse County in 2015 (Wyoming Department of Revenue 2017). In the CCPA, uranium minerals occur in roll-front deposits in sandstones. Roll-front deposits occur when uranium minerals are deposited in sandstone and the deposits have a characteristic curved appearance in the outcrop. The mineralization occurs as coatings on sand grains and is extracted using an in-situ recovery process involving a combination of injection and production wells. Oxygen and carbon dioxide (or other additives) are added to the injection water to dissolve the uranium minerals. This results in a solution of less than 0.1 percent uranium, which is then pumped to the surface. Uranium minerals are extracted from the water using an ion exchange process and then deposited on resin beads. The uranium mineral is then removed from the resin beads and is precipitated and dried, resulting in an intermediate product called yellowcake (Gregory 2015).

Table 3.16-5 Uranium In-situ Leach Plants in or Near the CCPA at the End of 2016

In-situ Leach Plant Owner	In-situ Leach Plant Name	County	Production Capacity (pounds per year)	Operating Status - End of 2016
AUC, LLC	Reno Creek	Campbell[1]	2,000,000	Partially Permitted and Licensed
Power Resources Inc., dba Cameco Resources	Smith Ranch-Highland Operation	Converse	5,500,000	Operating
Uranerz Energy Corporation	Nichols Ranch In-situ Recovery Project	Johnson and Campbell	2,000,000	Operating
Uranium One Americas, Inc.	Moore Ranch	Campbell[1]	500,000	Permitted and Licensed
Uranium One USA, Inc.	Willow Creek Project (Christensen Ranch and Irigaray)	Campbell and Johnson	1,300,000	Operating

[1] Planned location.

Source: U.S. Energy Information Administration 2017.

Wells used to extract uranium typically are less than 1,000 feet deep and draw water from multiple sandstone lenses within the Fort Union and Wasatch Formations (Freeman and Stover 1999). After processing, the water is treated and reused for the injection and extraction process. The largest mine in the CCPA, the Smith Ranch–Highland Uranium Project, began commercial uranium production operations in 1988 using in situ recovery processes (Cameco USA 2014). As of 2006, the Smith Ranch–Highland Uranium mines were the largest operating uranium producers in the U.S. and were permitted for groundwater use of 12,461 gpm in the Platte River Basin (Wyoming Water Development Commission 2006). Mining permits require quarterly groundwater monitoring and restoration of the well fields after mining has ceased. Over the past several years, there has been an increase in the number of uranium mining permit applications, including several in Converse County, and the trend is expected to continue (University of Wyoming 2010). **Table 3.16-5** lists the in-situ recovery uranium operations in and near the CCPA.

Mining permits require quarterly groundwater monitoring during operation and restoration of the well fields after mining has ceased. Monitoring requirements are found in Section 14 of Wyoming in-situ mining rules and involves monitoring of water quality, water levels, pressure changes, flow rates, and other parameters. After cessation of mining, the aquifer must be restored according to permit-specified conditions. Restoration is accomplished through groundwater transfer, sweeps (i.e., pumping water without injection), and water treatment (NRC 2006).

Water quality concerns in uranium leaching operations are related to mobilization of uranium minerals and the time frame required for the aquifer to return to pre-mining conditions. Generally, this restoration process requires several years. In 2008, the NRC and WDEQ conducted an audit of the Smith Ranch–Highland Uranium mine and noted that the groundwater restoration process is taking two to three times longer than initial estimates of 3 to 4 years (World Information Service on Energy 2014).

Oil and Gas

Oil and gas operations use groundwater primarily for drilling, completions, and secondary recovery projects in older oil fields (Wyoming Water Development Commission 2002a). Water may be sourced from any of the aquifer systems described above or derived from produced water from oil and gas wells. Within the CCPA, the majority of the oil and gas operations are in the Cheyenne River Basin, with a few fields in the North Platte River Basin. With the advent of unconventional shale plays, oil and gas completions require much more water because of the need for greater hydraulic fracturing. ***W***ater requirements per well ***may*** range from ***19.7 to 26.2 acre-feet (153,000 to 203,000 barrels)***. Secondary recovery consumes large amounts of water. In 2014, 411 acre-feet (3.2 million barrels) of water were injected for secondary recovery in Converse County (WOGCC 2015b). Source water for secondary recovery can either be produced water that is re-injected or water from surface or groundwater sources. Enhanced oil recovery in shale zones is not anticipated or proposed.

Coalbed Natural Gas

The CCPA contains coalbed natural gas resources in coals of the Fort Union Formation. In order to produce the methane, groundwater is pumped out of the coal seam to reduce the hydrostatic pressure, which allows for the release of methane gas from the coal. Although the Fort Union Formation contains numerous coal seams, coalbed natural gas activity uses minimal water supplies from either the Cheyenne or North Platte River basins (Wyoming Water Development Commission 2006, 2002a). After the water is removed from the coal seam, it is either re-injected into deeper aquifers under a Class II Underground Injection Permit or discharged to the surface in accordance with an NPDES permit. In 2015 CBNG gas production was 15,205,000 cubic feet of gas, but as of 2017, no production was reported (WOGCC 2017).

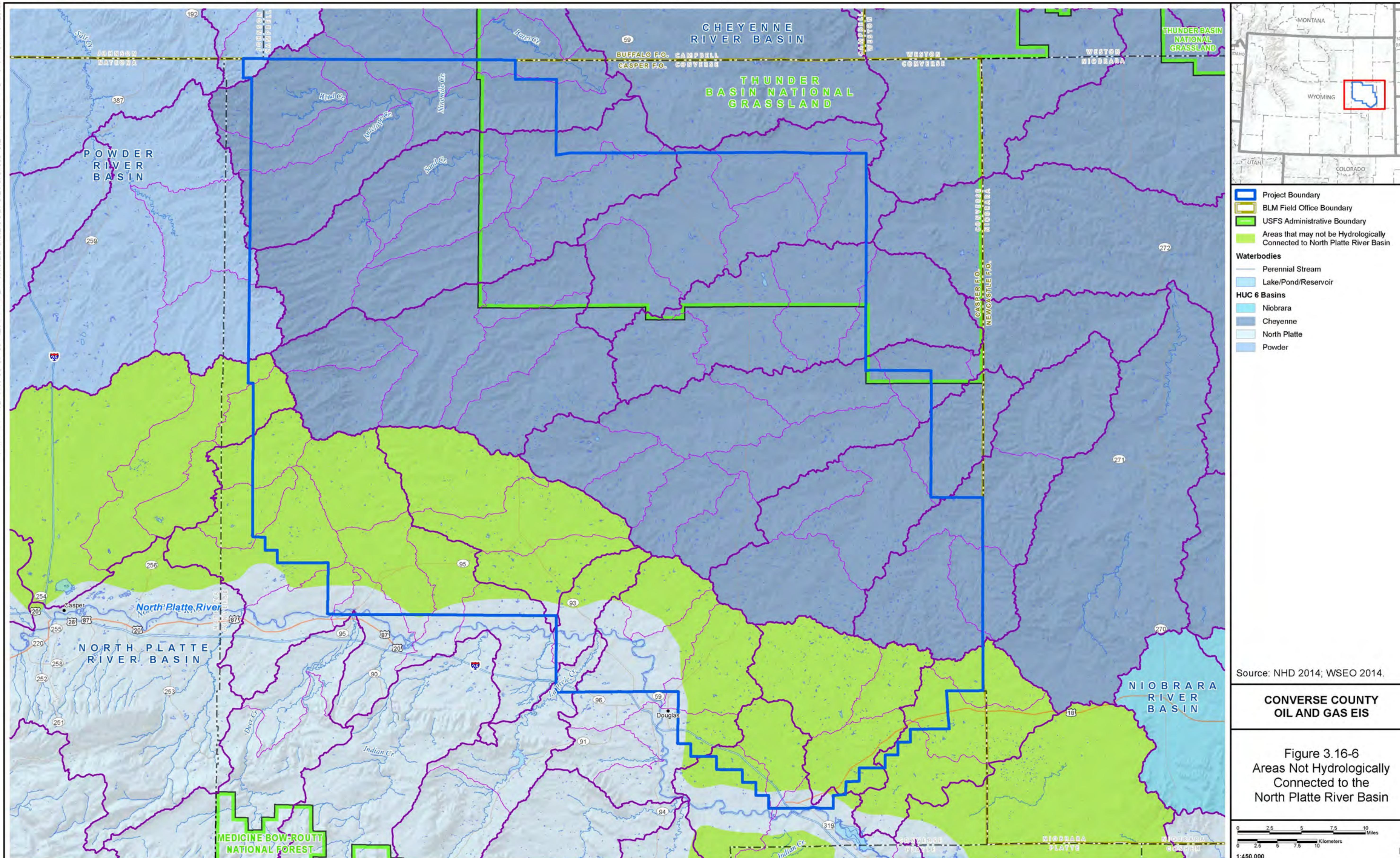

Figure 3.16-6
Areas Not Hydrologically Connected to the North Platte River Basin

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Coal Mining

Coal mining in the Powder River is an important user of groundwater. The mines that are closest to the CCPA (i.e., Antelope, Black Thunder, Jacobs Ranch, and North Antelope/Rochelle mines) consume approximately 3,000 acre-feet per year (AECOM 2014b). Most of the water is pumped for pit dewatering and depressurization.

Other Uses

Outside of the CCPA, groundwater and surface water also are used for power generation at the Dave Johnston Power Plant in Glenrock, Wyoming (Wyoming Water Development Commission 2006).

3.16.2.5 Water Supply Wells in the CCPA

General Groundwater Use

The WSEO has defined water use for wells in the following categories: domestic, stock watering, irrigation, municipal, industrial, miscellaneous, coalbed natural gas (water produced in association coalbed natural gas), monitor, and observation (WSEO 1974). There are almost 4,500 groundwater appropriation applications in the CCPA (WSEO 2014).

Not all of these applications may represent individual wells because of expansions on original appropriations. Most of the applications are for monitoring wells and involve a very small amount of appropriated water. Other common use categories include stock, industrial, and domestic. There is a miscellaneous category that can include a variety of uses not included in other use categories such as oil and gas. There are very few irrigation or coalbed natural gas appropriations. Four municipal wells in the CCPA serve the Town of Rolling Hills and reportedly produce water from the Hell Creek aquifer that ranges from approximately 700 to 1,800 feet deep (WSEO 2014; Wyoming Water Development Commission 2013b).

The majority of the applications are deemed complete, meaning that the appropriations process has culminated in the granting of a water right to an applicant. In the groundwater appropriation application process, the WSEO allows an applicant to request multiple uses, and this ambiguity may obscure the primary or specific use for a particular groundwater appropriation.

When the WSEO issues a well permit, a limit on the amount of water that can be used is assigned to a given appropriation. The appropriated capacity may be far more than the actual use. In the CCPA, the appropriated groundwater capacity is approximately 184,138 gpm or 297,000 acre-feet per year (WSEO 2014). A water supply and yield analysis of the CCPA has not been conducted by the WSEO in order to validate the sustainability of appropriated groundwater (WSEO 2015).

Seventy***-one*** existing wells have been identified as water sources for oil and gas activity in Converse County (OG 2014). Most of the wells are completed in the Wasatch/Tongue River aquifer (53 percent), the Lebo Confining Unit/Tullock aquifer (44 percent), and the remainder (3 percent) are completed in the Fox Hills/Lower Hell Creek aquifer. These wells have a total appropriated capacity of 7,000 gpm or 12,400 acre-feet per year.

Public Water Supply

A public water supply is defined as a system that serves water to 15 service connections or an average of 25 people per day for a period of at least 60 days each year (WDEQ 2016a). Public water supplies are divided into three major categories as follows:

- A community water system serves 15 service connections or an average of 25 residents per day all year long. Examples include municipalities, water districts, and homeowners associations. This type of public water supply is defined in Wyoming Statute at WSS 35-11-103.

- A non-transient, non-community water system serves 15 service connections or an average of 25 of the same non-resident people per day for at least 6 months a year. Examples include schools, mines, office buildings or industrial parks. This type of public water supply is defined in Wyoming Statute at WSS 35-11-103.
- A transient, non-community water system serves 15 service connections or an average of 25 different people each day for at least 60 days a year. Examples include restaurants, campgrounds, lodges, or resorts. This type of public water supply is defined in Federal Statute at 40 CFR 141.2.

Table 3.16-6 lists the various public water supplies in the CCPA, all of which are active and sourced by groundwater (USEPA 2016c; WDEQ 2016b). The State of Wyoming provides a voluntary Source Water Wellhead Protection Program for public water supplies. For this program, the state will delineate the area of contribution to the well(s), inventory sources of contamination in the area, and analyze the likelihood of these sources affecting the water supply (**Figure 3.16-7**). An outcome of the assessment may be a Wellhead Protection Zone, where limitations on certain activities are recommended. There are surface water intakes along the North Platte River that serve the Town of Douglas, but these are just outside of the CCPA. The Town of Douglas also is served by drinking water sources from the Sheep Mountain #1 well and the Boxelder Spring, which are located outside of the CCPA south of the North Platte River. These sources do not have a hydrogeologic connection to the Lower Tertiary-Upper Cretaceous aquifers in the CCPA (Weston Groundwater Engineering, Inc. 2015; Wyoming Water Development Commission 1999).

Table 3.16-6 Public Water Supplies in the CCPA

Public Water Supply[1]			Wellhead Protection Zone
ID Number	**Type**	**Name**	
WY5600918	Community Water System	Fairway Estates	Yes
WY5600782	Community Water System	Town of Rolling Hills	Yes
WY5601610	Non-transient, Non-community	Oak Tree Inn and Penny's Diner	Not Determined
WY5601500	Non-transient, Non-community	Power Resources Inc./Smith Ranch	Not Determined
WY5601463	Non-transient, Non-community	Progress Rail Services	Not Determined
WY5601001	Transient, non-community	Broken Wheel Truck Stop	Not Determined
WY5680174	Transient, non-community	Fort Fetterman State Historic Site	Yes
WY5600978	Transient, non-community	Union Pacific Railroad (Bill)	No
WY5601061	Transient, non-community	WYDOT- Cheyenne River Rest Area	Not Determined

[1] All public water supplies in the CCPA are active and sourced by groundwater.

Source: USEPA 2016c; WDEQ 2016b; Wyoming Water Development Commission 2016.

3.16.2.6 Waste Water

<u>Produced Water and Flow Back Water</u>

As part of the Safe Drinking Water Act, the USEPA regulates the injection of fluids into the subsurface through the Underground Injection Control Program and has delegated the authority for the program to the WDEQ and WOGCC. There are six classifications of underground injection wells that are regulated based on the type and depth of injected fluids, design, and operating practices (USEPA 2012b). Class II wells are used for the injection of oil and gas fluid production waste, the injection of fluids to assist in the recovery of hydrocarbons, and the injection and retrieval of hydrocarbons at underground storage facilities. Class II wells are regulated by the WOGCC. All other underground injection well classes are regulated by WDEQ.

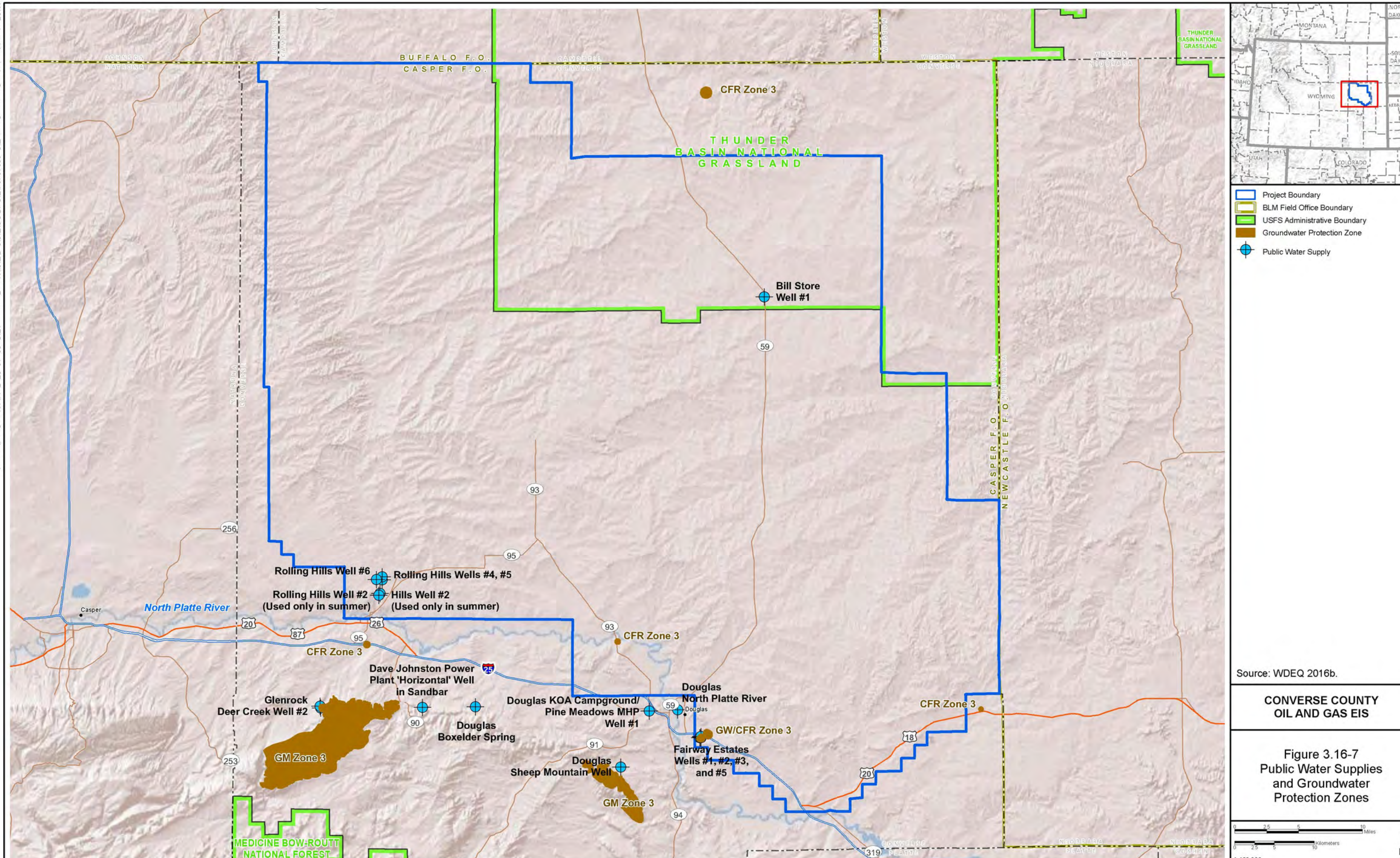

Figure 3.16-7 Public Water Supplies and Groundwater Protection Zones

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By volume, the largest waste associated with oil and gas production is water (Clark and Veil 2009). Referred to as produced water, it originates from the same subsurface formations from which oil and gas also are produced. Most produced water is saline with TDS concentrations ranging from greater than 1,000 mg/L up to 400,000 mg/L (Produced Water Society 2010). A practical, cost-effective, and environmentally protective method of disposing of produced water is to inject it back into the subsurface, either into the formation from which it came or into zones designated by permit for the disposal of waste water. It is estimated that 65 percent of produced water is injected for hydrocarbon recovery, and 30 percent is disposed into deep formations (Produced Water Society 2010).

Produced water is defined as water that exists in subsurface formations and is brought to the surface during oil and gas production (Guerra et al. 2011). The USEPA defines flowback water as recovered fracturing fluids (USEPA 2012c). Operators manage flowback and produced water in the same manner. Approximately 1,019 acre-feet (7.9 million barrels) of water were produced in Converse County in 2013 (WOGCC 2015b). In the CCPA, total produced water estimates also include flowback water. Data for produced water were available for 92 wells in the CCPA that are operated by members of the OG. From 2009-2013, these wells produced a per-well average of approximately 2,100 gallons (0.01 acre-feet or 50 barrels) of water per day.

Normally, an aquifer cannot be used for injection disposal if the TDS concentration is 10,000 mg/L or less. However, under the Underground Injection Control Program rules, an aquifer can be exempted from protection as usable waters if the aquifer can meet certain criteria, including: the aquifer does not currently serve as a source of drinking water; it cannot now, and will not in the future, serve as a source of drinking water; TDS concentration of the groundwater is more than 3,000 mg/L and less than 10,000 mg/L; and it is not reasonably expected to serve a public water system (USEPA 2002). The aquifer exemption is important because it allows disposal injection into deep aquifers that would not normally be used for any other purpose.

Produced Water Quality

Produced water may contain variable concentrations of ions, dissolved metals, and hydrocarbons. **Table 3.16-7** provides a sampling of water quality analyses of produced water from representative wells in the CCPA. All but one sample (Marys Draw 435-16H) had pH near neutral levels (6.5 to 8.5). The Marys Draw sample was acidified before analysis, likely contributing to its acidic pH of 1.89. TDS for the samples range from 7,387 to 63,000 mg/L, indicating that the water from these wells generally is not usable as a water supply, but may have limited application for drilling and completing oil and gas wells. Iron was detected in five wells at concentrations ranging from 1 to 230 mg/L, and chloride concentrations ranged from 4,067 to 42,000 mg/L. Produced water may be classified as either Class IV (B), which is water with TDS greater than 10,000 mg/L and suitable for industrial use, or Class VI, which is unusable or unsuitable for use. In Wyoming, Naturally Occurring Radioactive Materials are present at background or marginally detectable levels (USGS 1999).

Table 3.16-7 Produced Water Quality

Sampling Date	Facility (Well) Name Sampled	pH (Standard Units)	TDS (mg/L)	Iron (mg/L)	Chloride (mg/L)
1/28/2014	Clausen Ranch 19-34-70 C SX 10H	6.99	32,192	0	18,850
9/9/2013	Combs Ranch 29-3 H	6.79	23,149	0	13,650
7/18/2014	Graham 26-35-71 A SX 10H	7.37	33,018	0	19,200
10/7/2009	Wagonhound 23-1H	6.62	36,480	0	21,800
12/9/2009	Morton Ranch 1-25H	6.54	52,950	76	31,800
9/26/2012	Wallis 23-33-71 A 3H	7.71	19,688	0	11,100
1/28/2014	NW Fetter 28-34-71	7.52	17,108	0	9,300

Table 3.16-7 Produced Water Quality

Sampling Date	Facility (Well) Name Sampled	pH (Standard Units)	TDS (mg/L)	Iron (mg/L)	Chloride (mg/L)
4/14/2014	Hardy 12-27-39-7458H	6.95	31,773	0	18,800
4/1/2014	Blackjack Fed 3774-22-27-1FH	6.64	31,869	0	18,650
1/28/2014	Bridger Fed 23-14-15H	7.00	35,842	0	21,150
10/4/2013	Loco 4076-9-4-1 FM	6.81	7,387	0	4,270
8/8/2008–5/9/2009 (13 samples)	Hageman 11-22 UK	7.01 - 8.41	9,221 - 18,255	0 - 230	4,067 - 26,250
9/6/2013	Bolt 1-3526H	6.49	63,000	10	42,000
5/9/2014	Marys Draw 435-16H	1.89	19,380	10.9	13,150
8/9/2013	Crossbow 32-19H	6.45	29,000	4	19,000

mg/L = milligram per liter; TDS = total dissolved solids.

Source: OG 2014.

Disposal Wells

The UIC program regulates the injection disposal of waste into deep geological formations (USEPA 2002). The UIC program has several classes of waste disposal wells, but the wells of concern for this analysis include Class I and Class II wells, which are briefly described as follows:

- Class I – Inject hazardous wastes beneath the lowermost underground source of drinking water (USDW); inject industrial non-hazardous liquid beneath the lowermost USDW; and inject municipal wastewater beneath the lowermost USDW.
- Class II – Dispose of fluids associated with the production of oil and natural gas; inject fluids for enhanced oil recovery; and inject liquid hydrocarbons for storage.

The Class I wells are commercial operations and are permitted to inject waste from above ground storage tanks, sump waste, mining waste , potable water well waste, miscellaneous non-hazardous waste, and certain corrosion inhibitors. **Table 3.16-8** lists the Class I wells proposed or active in Converse County and also permitted to inject oil field waste (WDEQ 2017). The wells are permitted by the WDEQ Water Quality Division UIC program. Injection data for the 2 active wells indicates that the wells average approximately 1,000 barrels of oil field waste per day (Fischer 2017). In addition to these Class I wells shown in **Table 3.16-9**, there are nine active Class I wells associated solely with uranium mining, all operated by Cameco for the Smith-Highland and Reynolds Ranch operations. The permitted injection zones for the Class I wells are the Teckla Sandstone Member of Lewis shale and the Teapot and Parkman sandstones.

Table 3.16-8 Commercial Class I Disposal Wells in Converse County

Company Name	Facility Name	Permit Number	Permit Status	Well Name	Well Status
Expedition Water Solutions, CO, LLC	#1 Lemay SWD	14-260	Authorized	#1 Lemay SWD	Proposed
Grasslands Environmental	Grasslands Disposal Facility	14-279	Authorized	DW No. 1	Proposed

Table 3.16-8 Commercial Class I Disposal Wells in Converse County (State Subclass I-1I Non-Hazardous Industrial) Permitted to inject Oil Field Waste

Company Name	Facility Name	Permit Number	Permit Status	Well Name	Well Status
Grasslands Environmental	Grasslands Disposal Facility	14-279	Authorized	DW No. 2	Proposed
North Bill Disposal, LLC	Riehle #1 and Hartnett #1	14-352	Authorized	Riehle #1	Active
North Bill Disposal, LLC	Riehle #1 and Hartnett #1	14-352	Authorized	Hartnett No. 1	Active
North Bill Disposal, LLC	SWD #1 and #2	16-185	Pending	North Bill SWD #1	Inactive
North Bill Disposal, LLC	SWD #1 and #2	16-185	Pending	North Bill SWD #2	Inactive

Source: WDEQ 2017.

Table 3.16-9 Permitted Class II Disposal Wells in Converse County

API Number	Permitted Formation	Depth (feet bgs)	Township	Range	Section	Quarter-Quarter
49-09-20409	Teapot	7,118	35	69	27	SWSE
49-09-20513	Frontier	9,739	37	74	7	NWSW
49-09-20797	Teapot	6,130	34	68	34	NWNW
49-09-20935	Parkman	8,883	36	72	24	SWSW
49-09-21265	Parkman	8,577	39	73	17	SESE
49-09-21506	Teapot	7,603	35	70	25	SESW
49-09-21655	CPKM	8,968	35	71	18	SENW
49-09-21921	Parkman	8,357	40	73	34	SWNW
49-09-22392	Parkman	12,950	40	76	23	NESW
49-09-22480	Teckla	6,484	37	69	6	NWSE
49-09-22489	Parkman	13,685	34	72	19	NWSE
49-09-28211	Teapot	8,540	33	71	22	NESW
49-09-29484	Teapot-Parkman	10,141	36	73	33	NESE
49-09-29607	Teapot	8,978	33	70	32	SENW
49-09-29608	Teckla	6,745	37	70	3	SWSW
49-09-29712	Teckla	6,763	37	70	3	SENE
49-09-29713	Teckla	6,888	37	70	3	SWNW

API = American Petroleum Institute.

bgs = below ground surface

D = Disposal.

NA = not available.

Source: WOGCC 2016c.

The Class II wells are regulated by the WOGCC for the disposal of waste from oil and gas operations and are not permitted for commercial use (Scott 2017). The Class II wells in Converse County are listed in **Table 3.16-9**. According to the USEPA (2002), waste that can be injected into Class II wells includes "produced water from oil and gas production; waste fluids from the actual drilling operation; pigging fluids from the cleaning of collection and injection lines within the field; used workover and stimulation fluids recovered from production, injection, and exploratory wells; gas, such as methane, carbon dioxide or nitrogen used for enhanced recovery/pressure maintenance of production reservoirs; and brine reject from water softeners associated with enhanced recovery." The average injection rate for Class II wells in Converse County just over 1,000 barrels per day (WOGCC 2016b).

As of May 2016, there were 17 active Class II disposal wells recorded in the WOGCC database in Converse County (**Figure 3.16-8**, WOGCC 2016c). The numbers and depths of disposal wells injecting into each formation are listed in **Table 3.16-9**, with the majority of wells injecting into the Teapot and Parkman formations. The depths of the disposal wells range from 6,130 to 12,950 feet below ground surface.

<u>Evaporation Ponds</u>

There are ***9*** commercial oil field waste management facilities that utilize evaporation ponds within a 15-mile buffer of the CCPA (**Table 3.16-10; Figure 3.16-8**). ***The estimated annual evaporation volumes were obtained from WDEQ Air Quality Division permit waivers (WDEQ 2019). The actual throughputs may be less depending on seasonal variations with loss of evaporative efficiency during cold weather months.***

Commercial evaporation ponds are required to have an adequate monitoring program to protect groundwater (WDEQ Water Quality Rules Chapter 3, Section 17). Requirements provide for a pre-construction subsurface investigation to characterize a potential site. A facility must have suitable operational monitoring, post-discharge or post-operational monitoring, and record keeping and reporting. The WOGCC permits non-commercial oil field waste retention ponds under its Chapter 4 environmental rules. The WOGCC, at its discretion, can require monitoring depending on site conditions.

Flowback and produced water would be stored in nominal 400- or 500-bbl capacities and would be placed inside of containment. The containment would consist of compacted subsoil or lined structures and would hold a minimum of 110 percent of the capacity of the largest tank. Flowback and produced water would be transported to authorized disposal wells or evaporation facilities within or adjacent to the project area. Operators would measure, test, and report all produced water according to BLM Onshore Order Nos. 4 and 5, and applicable State of Wyoming rules.

Table* 3.16-10 *Commercial Evaporation Disposal Facilities within the CCPA plus 15-mile Buffer

County	***Facility Name***	***Operator***	***Township-Range-Section***	***Annual Estimated Throughput (Barrels)***
Campbell	***Clarkelen Facility, LLC***	***Oilfield Water Logistics, LLC***	***43-73-30***	***1,825,000***
Converse	***Werner Ranch***	***Jim's Water Service***	***36-70-28***	***73,000***
Converse	***Cannon Land and Livestock***	***Jim's Water Service***	***36-71-34***	***Undetermined***
Converse	***Hornbuckle Ranch***	***Industrial Water Solutions***	***36-74-10***	***Undetermined***
Converse	***Grasslands***	***Grasslands Environmental***	***38-70-21***	***5,840,000***
Converse	***Ross Recovery***	***Ross Recovery***	***39-75-13***	***302,950***
Converse	***North Bill Disposal***	***North Bill Disposal***	***38-71-1***	***1,095,000***
Johnson	***Linch Pit***	***Sierra Construction Company***	***42-78-14***	***Undetermined***
Converse	***Thunder Basin***	***Oilfield Water Logistics, LLC***	***37-70-34***	***1,502,144***
Total Estimated Annual Throughput				***10,638,094***

Source: OG 2014; WDEQ 2019, 2014d.

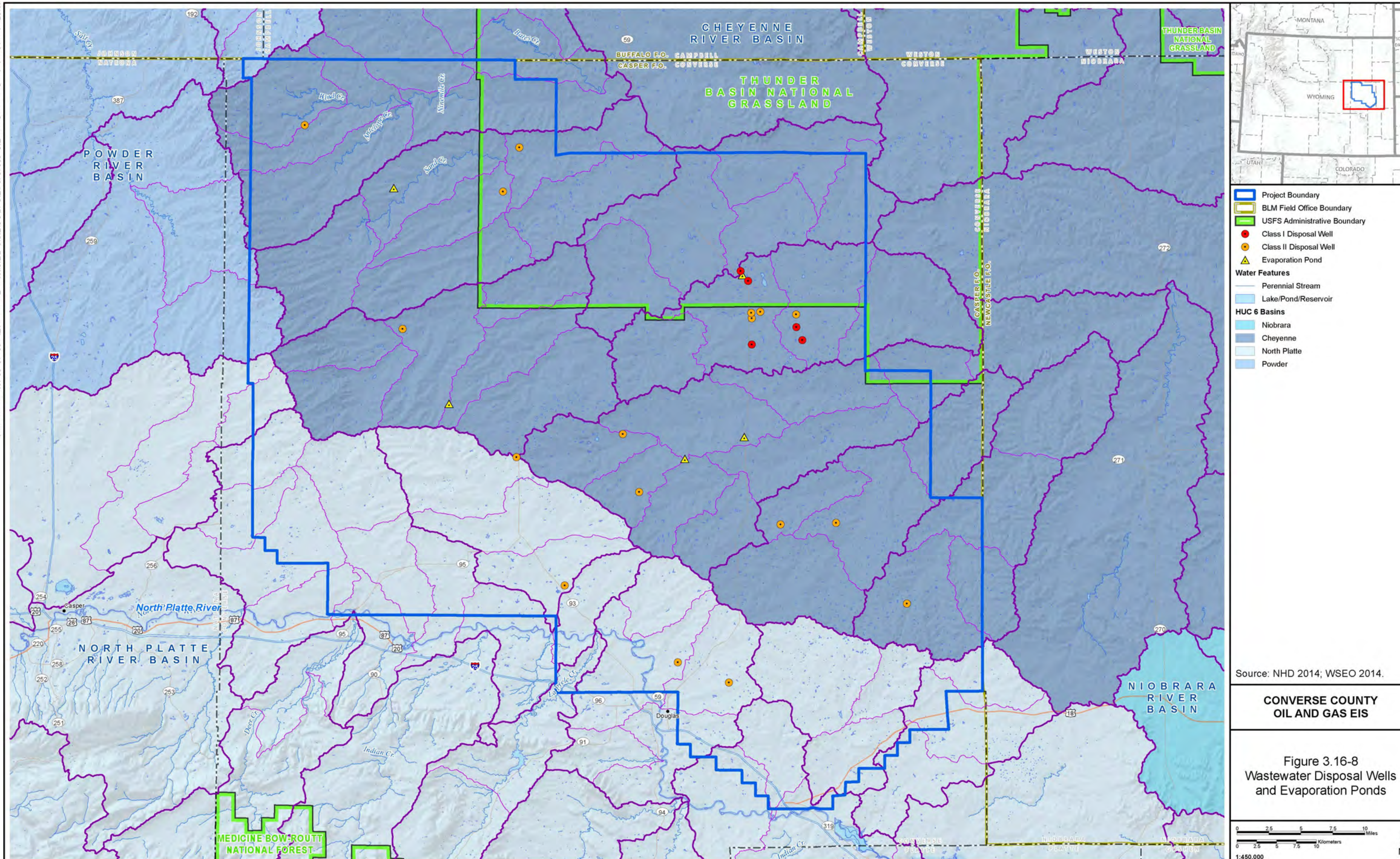

Figure 3.16-8
Wastewater Disposal Wells and Evaporation Ponds

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3.17 Wetland and Riparian Areas

3.17.1 Summary

Although wetlands and riparian areas comprise a very small percentage of the vegetation communities in the West, they are of great importance to the surrounding ecosystems and associated species. Most wildlife species use riparian areas at some point in their life cycles, and some depend almost entirely on the health of these systems (e.g., migratory birds during breeding season and amphibians). Riparian areas are the transition between water sources and uplands, and often are rich in vegetation diversity and structure. In arid and semiarid regions, riparian areas can be especially important for wildlife because they can provide excellent refuge, critical wildlife habitat for local species and migrants, abundant water, and migration corridors (Mitsch and Gosselink 2007; Tiner 1999). As reported in the State Wildlife Action Plan for Wyoming (WGFD ***2017a,*** 2010a), approximately 90 percent of Wyoming's wildlife species utilize wetland habitats on a daily or seasonal basis, and 70 percent of Wyoming's bird species are wetland obligates (Nicholoff 2003). Both riparian and wetland areas serve a wide variety of other functions and values, including groundwater recharge, flood attenuation, flow moderation, water filtration, wildlife and stock forage, and streambank stabilization (Tiner 1999). See Section 3.18, Wildlife and Aquatic Biological Resources, for detail regarding species associated with wetland and riparian areas.

3.17.2 Resource Overview

The analysis area for wetlands and riparian areas is the CCPA. The CCPA includes both herbaceous and forested wetlands and riparian communities adjacent to intermittent streams, reservoirs, stock water ponds, and some perennial waterways. Wetlands and riparian areas compose approximately 0.6 percent of the CCPA (LANDFIRE 2014). All wetlands and riparian areas in the CCPA are subject to federal protection under the CWA) and EOs that require avoidance of adverse impacts to wetlands and floodplains. In addition, ***as required under RMP Decision 1035,*** surface-disturbing activities are prohibited within 500 feet of ***Class 1 and Class 2 water (Wyoming DEQ water quality standard)*** on BLM-managed lands in the CFO.

3.17.3 Laws, Ordinances, Regulations, and Standards

3.17.3.1 U.S. Army Corps of Engineers

USACE regulates the discharge of dredged or fill material into waters of the U.S., including jurisdictional wetlands, under Section 404 of the CWA. Wetlands are defined by USACE (33 CFR 328.3) and USEPA (40 CFR 230.3) as "areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." Discharge of fill material is defined as the addition of fill material into waters of the U.S., including, but not limited to, the following: placement of fill that is necessary for the construction of any structure, infrastructure, or impoundment requiring rock, sand, dirt, or other material for its construction; site- development fills for recreational, industrial, commercial, residential, and other uses; causeways or road fills; fill for structures such as sewage treatment facilities, intake or outfall pipes, and sub-aqueous utility lines (33 CFR 323.2(f)). The CWA requires USACE to review and consider the issuance of a permit for the discharge of dredged or fill material into such waters. Guidelines promulgated under CWA Section 404(b)(1) require that permits for discharges of dredged or fill material into waters of the U.S. and jurisdictional wetlands authorize only the least environmentally damaging practicable alternative.

Under the USACE 1987 Wetland Delineation Manual, a three-parameter approach is required for delineating wetlands. Based on this approach, areas are identified as wetlands if they exhibit hydrophytic plants, hydric soils, and at least periodically saturated conditions at some time during the growing season of the prevalent vegetation (USACE 1987). Final regulatory authority and delineation boundaries for wetlands within the CCPA lie with the USACE. For the purpose of this discussion, references to wetlands are not restricted to the legal definition of jurisdictional wetlands as defined by USACE (USACE 1987), but also may include other areas that provide enough available water to the root zone to establish and maintain riparian/wetland vegetation.

3.17.3.2 Executive Orders

Wetlands and floodplains are protected by two EOs. EO 11990, Protection of Wetlands (42 FR 26961, 3 CFR, 1977), states that federal agencies should "avoid to the extent possible the long and short term adverse impacts associated with the destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative." EO 11988, Floodplain Management (42 FR 26951, 3 CFR, 1977), states that federal agencies should "avoid to the extent possible the long- and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct or indirect support of floodplain development wherever there is a practicable alternative."

3.17.3.3 BLM Casper Field Office and TBNG Requirements

The BLM Casper RMP requires lotic and lentic riparian areas on BLM-managed lands to be managed toward proper functioning condition, which is a qualitative measure of the functionality and resiliency of lentic wetlands/riparian areas and wetlands. The Casper RMP also prohibits surface disturbance within 500 feet of surface water, and riparian areas (BLM 2007b). For portions of the CCPA within the TBNG, USFS requests that activities and facilities from any proposed action be located away from the water's edge and outside of wetlands/riparian areas unless impacts are deemed acceptable or capable of being adequately mitigated (USFS 2002).

3.17.4 Existing Conditions

Wetlands are habitats where the soil is annually saturated with water or covered by water at some time during the growing season. Wetlands are an important vegetation community, disproportionately contributing to the diversity of Wyoming wildlife and plants relative to the land base that they occupy.

Riparian areas are immediately adjacent to creeks, streams, and rivers and are the interface between aquatic and terrestrial ecosystems. The riparian area is the distinct ribbon of green delineating streams from uplands across much of the West. They are important areas that provide linkages across landscapes and support both plants and animals. Less than 2 percent of the surface area of Wyoming consists of wetland and riparian systems, yet a majority of species depend upon them (WGFD 2017a).

3.17.4.1 Wetland/Riparian Community Types and Distribution

Two datasets were used to identify wetlands and riparian communities in the CCPA: the LANDFIRE vegetation classification dataset (LANDFIRE 2014) and the USFWS National Wetlands Inventory (NWI) (USFWS 2013c). The total acreage of wetlands/riparian areas varies between these data sources because of different methods of data collection and processing as well as the inclusion of riparian vegetation communities in the LANDFIRE data. Locations of wetlands and riparian areas based on these two datasets are provided in **Figure 3.17-1**.

Based on LANDFIRE data, riparian/wetland areas within the CCPA are comprised of both montane and plains riparian forest, wetland, shrubland, floodplain herbaceous, wooded draw, and ravine communities. The LANDFIRE data estimates that 9,108 acres (0.6 percent) in the CCPA are riparian/wetland communities including approximately 132 acres of wetlands on BLM-managed lands and 443 acres on USFS-managed lands. The USFWS NWI data identify wetland communities on approximately 11,503 acres of the CCPA, including 290 acres on BLM-managed lands and 233 acres on USFS-managed lands. Although a difference of over 2,000 acres, this equates to approximately 0.6 percent and 0.7 percent of the vegetation communities within the CCPA, respectively.

Palustrine emergent wetland communities and forested riparian areas are present in the CCPA, primarily in association with intermittent streams, reservoirs, stock water ponds, seeps and springs, and some perennial waterways, including the North Platte River and Antelope, Bear, La Prele, Sand, and Stinking Water creeks. Ephemeral streams and drainages present throughout the northeast portion of the CCPA typically do not support riparian or wetland habitats due to the infrequency of precipitation and lack of continually saturated soils. The types and locations of surface water features in the CCPA are discussed in detail in Section 4.16.1, Surface Water Resources.

3.17.4.2 Data Limitations

For the purposes of this analysis, the riparian and wetland habitats and acreages discussed serve as approximate locations for these communities. Wetlands in the CCPA have not been field-verified to determine extent or if mapped wetlands meet the three diagnostic criteria described in Section 3.17.3.1 for protection under Section 404 of the CWA. Size and extent of riparian habitat also has not been field-verified. Therefore, the actual size and presence of riparian and wetland communities may be less or more than estimated by the LANDFIRE or NWI data sources. Wetland delineations and riparian habitat surveys may be required during site-specific analysis. Information obtained from these surveys would improve accuracy of environmental impacts where proposed actions intersect riparian/wetland locations.

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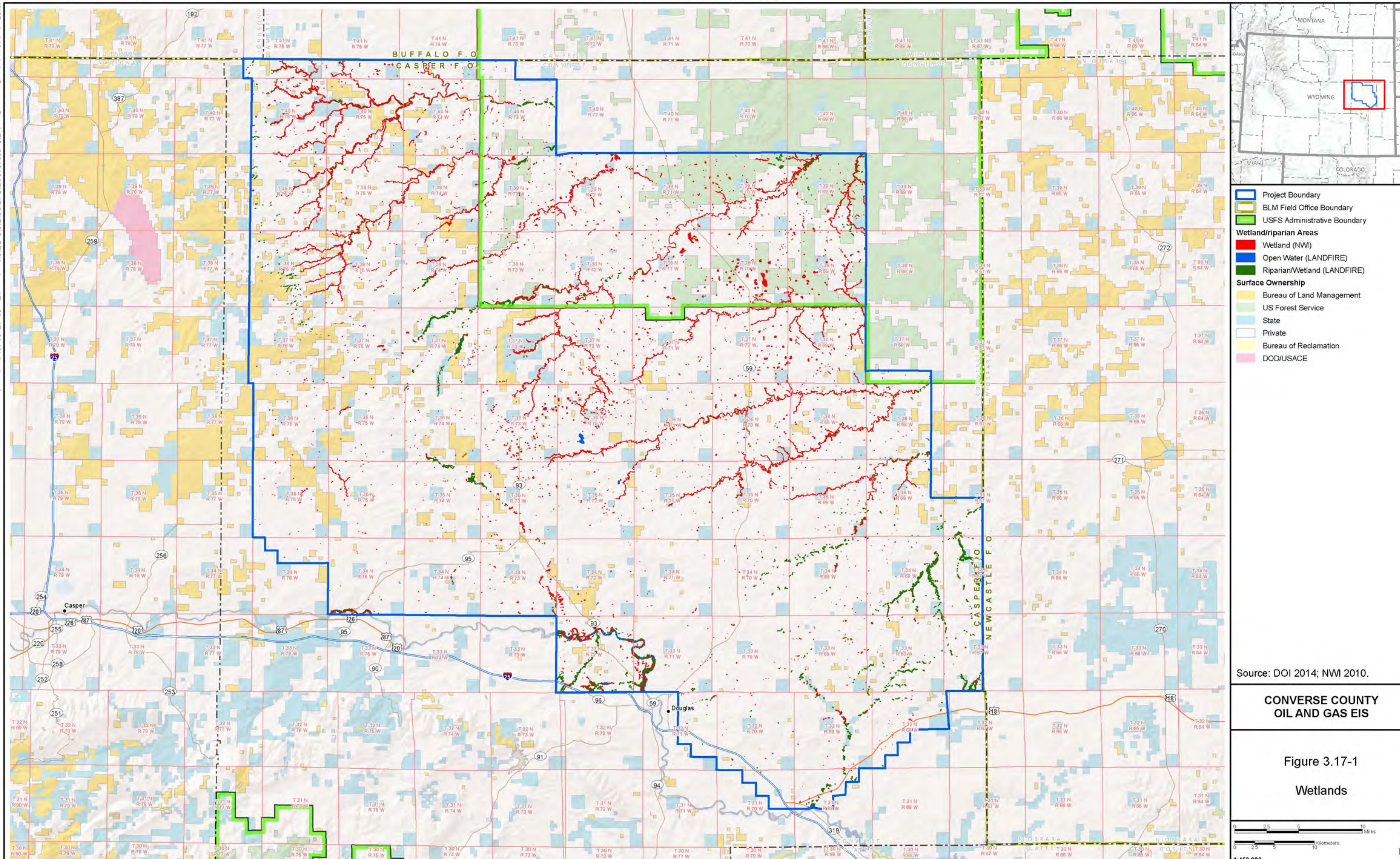

Source: DOI 2014; NWI 2010.

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Figure 3.17-1

Wetlands

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3.18 Wildlife and Aquatic Biological Resources

3.18.1 Terrestrial Wildlife

3.18.1.1 Regulatory Background

Laws, regulations, and policies that directly influence wildlife management decisions for the Project primarily are implemented by the BLM, USFWS, USFS, and the WGFD. The following regulations and legal requirements provide protection for terrestrial wildlife occurring in the CCPA.

- General Wildlife
  - BLM CFO RMP
  - FSM 2670
  - BLM Manual 6500
  - USFS TBNG LRMP
  - Wyoming Statutes 23-1-101, 23-1-103, 23-1-302 and 23-3-108
- Big Game
  - Wyoming Statutes 23-3-102
- Small Game
  - Wyoming Statutes 23-3-103

Federal Regulations

The FLPMA states that public lands will be managed to "provide food and habitat for fish and wildlife" (Sec. 101. [43 USC 1701]), and fish and wildlife are a resource value to which the principles of multiple use and sustained yield, as defined under the Act, apply (Sec. 103. [43 USC 1702]). The National Forest Management Act of 1976 amends the Forest and Rangelands Renewable Resources Planning Act of 1974 to ensure that USFS plans provide for multiple use and sustained yield of wildlife and fish (Sec. 2. [16 USC 1600]).

State Policies

State policies regarding the protection of wildlife species and crucial habitats exist under the jurisdiction of the WGFD. Wyoming State Statute Title 23, defines the authority and responsibility of WGFD for managing state wildlife and crucial habitats. The WGFD recommendations tier to the aforementioned federal policies and aid in supporting the enforcement of all laws and policies designed to protect wildlife. In addition, WGFD has implemented a Strategic Habitat Plan (WGFD 2015c) that delineates Crucial Habitat Areas. These designations incorporate not only crucial areas for game species, but also sensitive non-game habitats for SGCN across the entire state. WGFD also regulates activities for managing game species by authorizing hunting permits and enforcing the rules and regulations under which those activities are conducted. For the identification and conservation of sensitive big game habitats, statewide range designations and migration corridors also have been delineated (WGFD 2013a).

3.18.1.2 Information Sources

Information regarding wildlife species and their habitats within the analysis areas was obtained from a review of existing published sources including:

- BLM CFO geospatial data depicting big game ranges;
- Wyoming Geographic Information Science Center Wyoming Interagency Spatial Database and Online Management (WISDOM) online application, containing information on species occurrence, range, distribution, federal and state agency status, and crucial habitat designations (WISDOM 2012);
- Wyoming Natural Diversity Database (WYNDD 2017);
- WGFD Job Completion and Annual Harvest Reports, containing harvest and population information on game animals (WGFD 2013c);
- Wyoming State Wildlife Action Plan (WGFD 2017a, 2010) and WGFD Strategic Habitat Plan (WGFD 2015c); and
- USFS TBNG Management Indicator Species (MIS) list.

3.18.1.3 Wildlife Analysis Area

The terrestrial wildlife analysis area for small game species and nongame species (**Figure 3.18-1**) includes the Hydrologic Unit Code (HUC)-12 units intersected by the CCPA (2,206,155 acres). This analysis area was chosen for these species because it represents the combination of geographic areas containing contiguous habitat that would be impacted by the Project, as well as the management regimes to which this habitat is subject. Accordingly, this analysis area provides a clear disclosure of the context of project impacts in light of the management considerations for the area. Additionally, the HUC-12 watershed areas provide a clear bio-geographical delineation of vegetation communities and wildlife habitats.

The big game analysis area (**Figure 3.18-2**) includes WGFD big game herd units (based on pronghorn herd units) that intersect the CCPA. The WGFD manages big game herds in the analysis area, including pronghorn (*Antilocapra americana*), mule deer (*Odocoileus hemionus*), white-tailed deer (*Odocoileus virginianus*), and elk (*Cervus canadensis*), for which it designates seasonal ranges and tracks population trends and objectives. This analysis area provides the context for Project impacts on habitat specifically managed by WGFD for big game populations. Pronghorn units were selected for use because they are the most abundant ungulate in the region with many more individuals than deer or elk.

3.18.1.4 Wildlife Habitat

The predominant wildlife habitat types occurring within the wildlife analysis area are grassland and sagebrush shrubland. The wildlife analysis area also contains limited riparian and wetland habitat, as well as aquatic habitat in the form of rivers, ponds, and springs that support a diversity of wildlife species. In general, the wildlife analysis area comprises an arid landscape with few mesic habitats. A variety of terrestrial wildlife is associated with sagebrush shrubland and grassland communities, with a greater species diversity occurring in areas exhibiting greater vegetative structure and soil moisture, such as riparian communities. Nine vegetation cover types have been defined for the Project, based on the LANDFIRE dataset as described in Section 3.14, Vegetation. These include: grassland, sagebrush shrubland, barren/sparsely vegetated land, conifer forest, agricultural land, developed land, wetland/riparian areas, and mixed shrubland. Although developed land is not considered to be typical wildlife habitat, some species utilize these areas. A summary of the general vegetation types in the wildlife analysis area and CCPA are shown in **Table 3.18-1**. **Figure 3.14-1** (in Section 3.14, Vegetation) provides a display of vegetation types within the CCPA.

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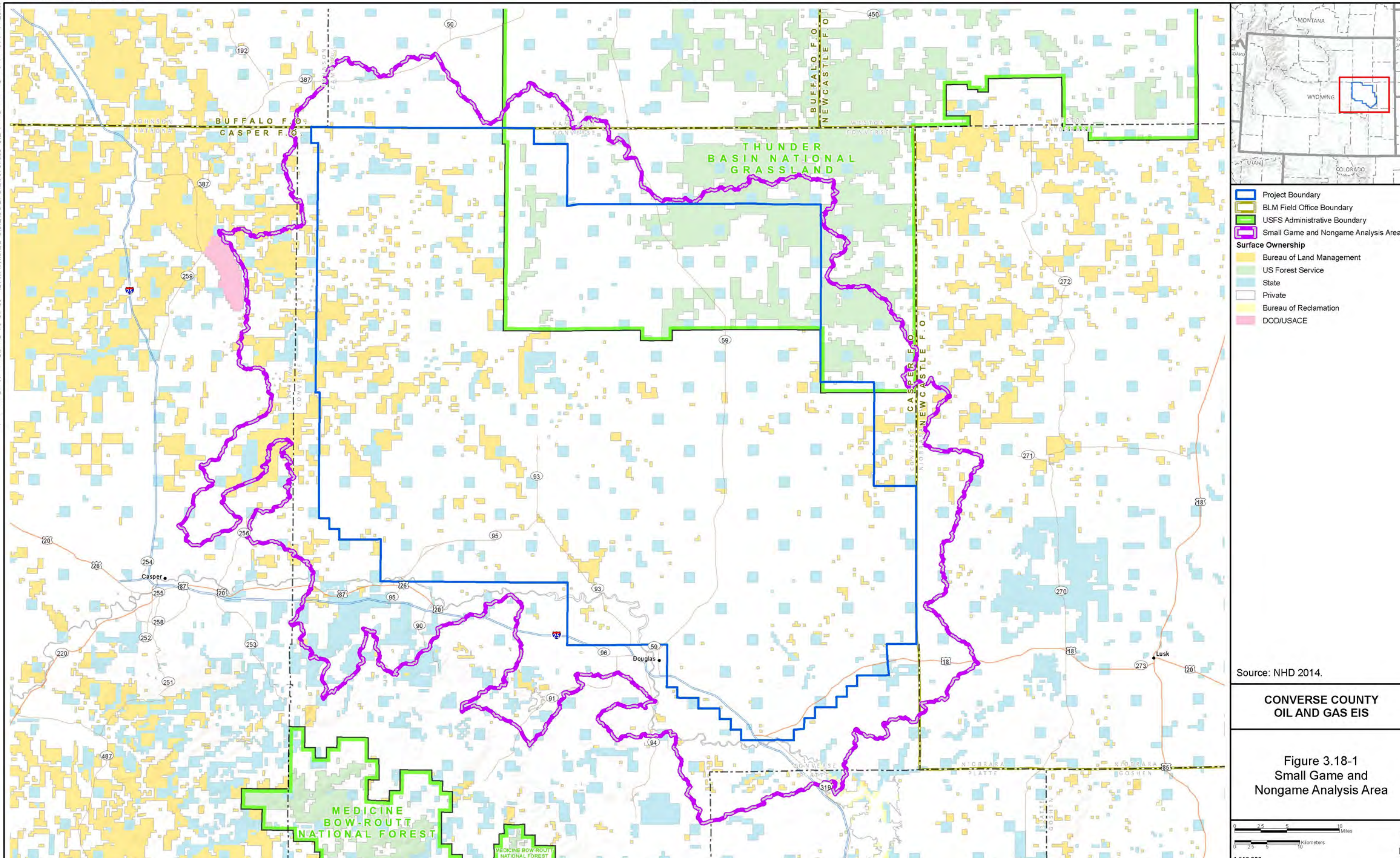

Source: NHD 2014.

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Figure 3.18-1
Small Game and
Nongame Analysis Area

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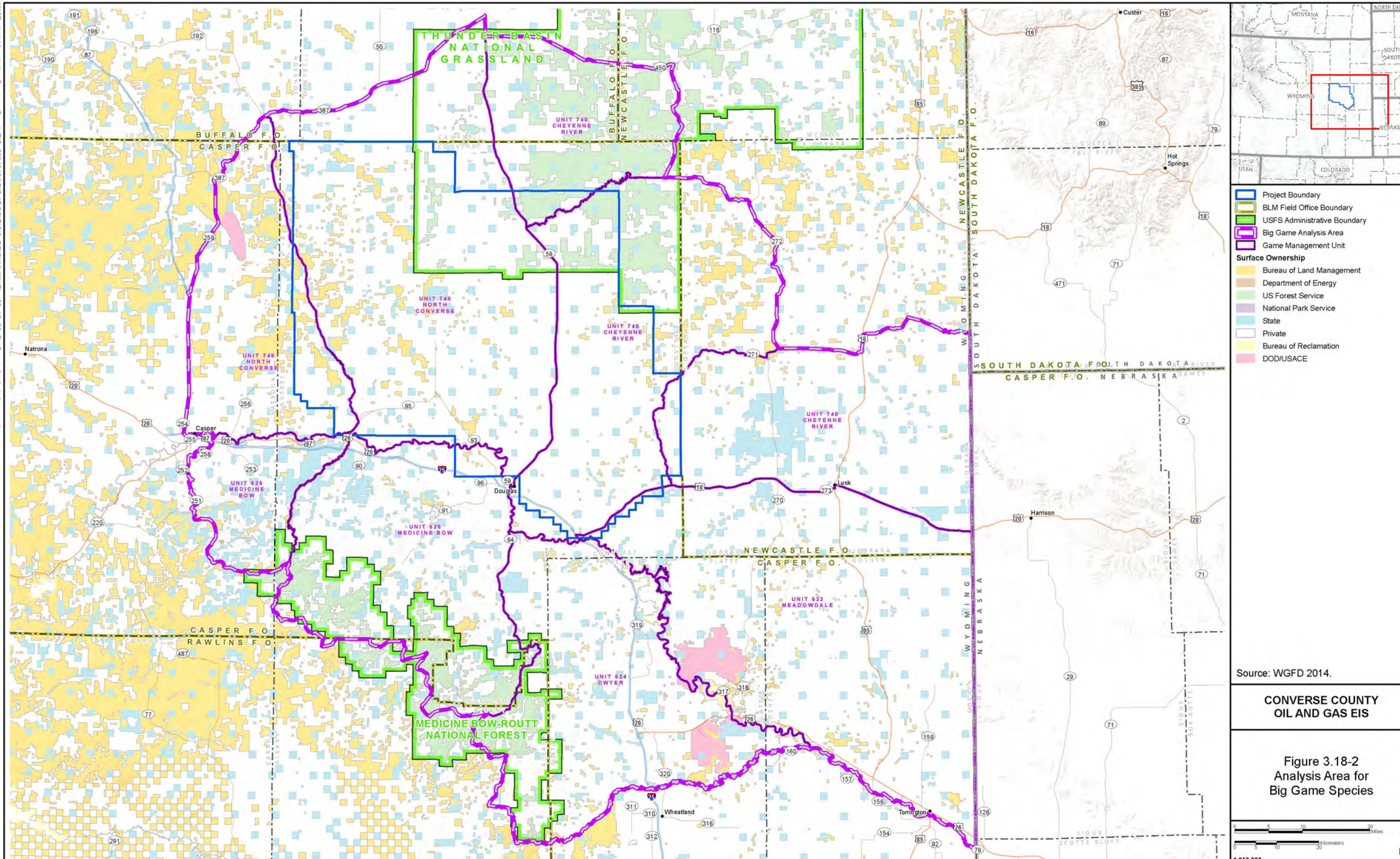

Figure 3.18-2
Analysis Area for Big Game Species

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Table 3.18-1 Vegetation Cover Types within the CCPA and the Wildlife Analysis Area

Vegetation Cover Type	CCPA		Analysis Area (HUC-12 Boundary)	
	Acres	Percent of CCPA	Acres	Percent of Area
Grassland	995,706	66	1,370,493	62
Sagebrush shrubland	330,463	22	531,791	24
Barren/sparsely vegetated	126,016	8	180,050	8
Conifer	11,240	1	20,266	1
Agriculture	10,273	1	31,966	1
Developed	10,320	1	27,070	1
Wetland/riparian	9,108	1	21,593	1
Mixed shrubland	7,417	<1	19,916	1
Open water	1,838	<1	2,970	<1
Deciduous Forest	0	0	39	<1
Total	**1,502,381**	**100**	**2,206,155**	**100**

Source: LANDFIRE 2014.

<u>WGFD Strategic Habitat Plan</u>

WGFD has implemented a Strategic Habitat Plan (WGFD 2015c) that delineates Crucial Habitat Areas and Enhancement Areas. Crucial Habitat Areas are based on biological and ecological values including habitats that support important life stages needed for maintaining game species, sensitive native non-game species, unique species assemblages and ecologically important species or communities. Crucial Habitat Areas have been delineated under the WGFD Strategic Habitat Plan Goal 1, which is designed to "conserve and manage wildlife habitats that are crucial for maintaining terrestrial and aquatic wildlife populations for the present and future" (WGFD 2015c). Enhancement Areas are areas delineated by WGFD where natural or man-caused habitat degradation is occurring or has occurred and where the WGFD can work with partners to improve habitat condition. Enhancement Areas have been delineated under the WGFD Strategic Habitat Plan Goal 2, which is designed to "enhance, improve and manage priority wildlife habitats that have been degraded" (WGFD 2015c).

Terrestrial Crucial Habitat Areas that overlap with the wildlife analysis area include Ormsby, Thunder Basin, greater sage-grouse (*Centrocercus urophasianus*) core population areas (Core Areas), big game crucial range, and land protection areas (WGFD 2015b). Of these crucial habitat areas within the wildlife analysis area, only Thunder Basin and sage-grouse core areas overlap with the CCPA. Two Enhancement Areas, Thunder Basin and Sand Hills, overlaps with the wildlife analysis area and CCPA. Habitat Priority Areas and Enhancement Areas overlapping the CCPA are presented in **Figure 3.18-3**.

3.18.1.5 Big Game

Big game species are managed by WGFD, with range designations for each species delineated across the entire state. Pronghorn, mule deer, white-tailed deer, and elk have been documented in the CCPA. None of these big game species have a crucial range designation or delineated parturition range (calving habitat) within the CCPA; although it should be noted that there is a large area of crucial winter range for mule deer just to the south of the CCPA, within the big game analysis area. WGFD big game range designations used across all species and relevant to the big game analysis area include the following definitions (WGFD 2015b).

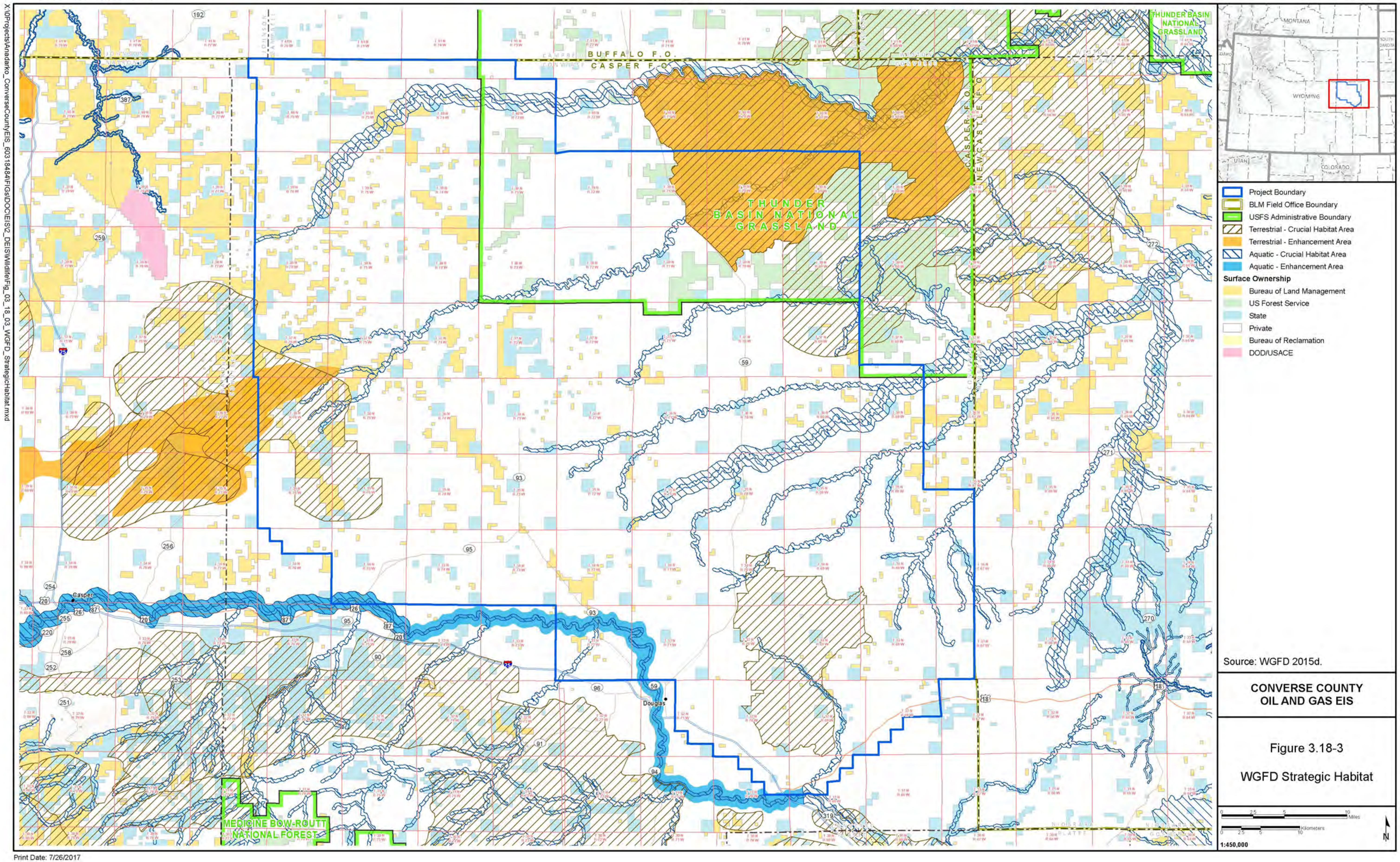
- Crucial ranges are defined as any particular seasonal range habitat component that has been documented as the determining factor in a population's ability to maintain itself at a certain level (theoretically, at or above the WGD population objective) over the long term.
- Winter range is defined as a population or portion of a population of animals that use the documented suitable habitat within this range annually in substantial numbers only during the winter (variable, but commonly between December 1 and April 30).
- Winter/Yearlong range is defined as a population or a portion of a population of animals that makes general use of the documented suitable habitat within this range on a year-round basis, but during the winter months (commonly between December 1 and April 30), there is substantial influx of additional animals into the area from other seasonal ranges.
- Spring/Summer/Fall range is defined as a population or portion of a population of animals that use the documented habitats within this range annually only from the end of the previous winter to the onset of persistent winter conditions (variable, but usually between May 1 and November 30).
- Severe Winter Relief is defined as a survival range that may or may not be considered a crucial range area. To a great extent, the area is used only in occasionally extremely severe winters. It may lack habitat characteristics that would make it attractive or capable of supporting major portions of the population during normal years but is used by and allows at least a substantial portion of the population to survive the occasional extremely severe winter.
- Yearlong range is defined as a population of animals that makes general use of suitable habitat within the range on an annual basis, but occasionally under severe conditions (e.g., extremely severe winters or drought) animals may leave the area.
- Parturition areas indicate documented birthing areas commonly used between May 15 and June 30 by the female segment members of a population. These areas also may be used as nursery areas by some species.

There are no designated big game migration corridors in the big game analysis area. Moose have been documented but do not regularly occur within the big game analysis area, and WGFD does not designate any range for moose in the area. The following subsections describe big game range designations, habitat, and population trends for WGFD big game herds that regularly occur within the CCPA. **Table 3.18-2** identifies the big game ranges in the CCPA and big game analysis area.

Pronghorn

Figure 3.18-4 shows pronghorn herd units and habitat within the CCPA. Pronghorn use the CCPA year-round, and three different WGFD range designations are delineated within and near the CCPA. The majority of the approximately 1.5 million-acre CCPA is yearlong range (**Table 3.18-2**). A limited amount of severe winter relief range is present along the northeastern boundary of the CCPA, and areas of winter/yearlong habitat occur just outside of the CCPA to the south.

The pronghorn population within the CCPA primarily is part of the Black Thunder (Herd Unit-750) and North Converse (Herd Unit-748) pronghorn antelope herd units. The Black Thunder herd unit encompasses much of northeast Wyoming and is approximately 8,315 square miles (5,321,600 acres), of which WGFD considers approximately 7,300 square miles as occupied pronghorn habitat (WGFD 2015b). The CCPA overlaps 488,347 acres of this herd unit east of Wyoming SH 59. The west-central portions of the herd unit overlapping the CCPA contain the highest quality contiguous sagebrush habitat in the herd unit (WGFD 2013c).


THUNDER BASIN NATIONAL GRASSLAND
BUFFALO F.O.
CASPER F.O.
NEWCASTLE F.O.
MEDICINE BOW-ROUTT NATIONAL FOREST
Casper
Douglas
MONTANA
WYOMING
UTAH
COLORADO
Project Boundary
BLM Field Office Boundary
USFS Administrative Boundary
Terrestrial - Crucial Habitat Area
Terrestrial - Enhancement Area
Aquatic - Crucial Habitat Area
Aquatic - Enhancement Area
Surface Ownership
Bureau of Land Management
US Forest Service
State
Private
Bureau of Reclamation
DOD/USACE
Source: WGFD 2015d.
CONVERSE COUNTY OIL AND GAS EIS
Figure 3.18-3
WGFD Strategic Habitat
Miles
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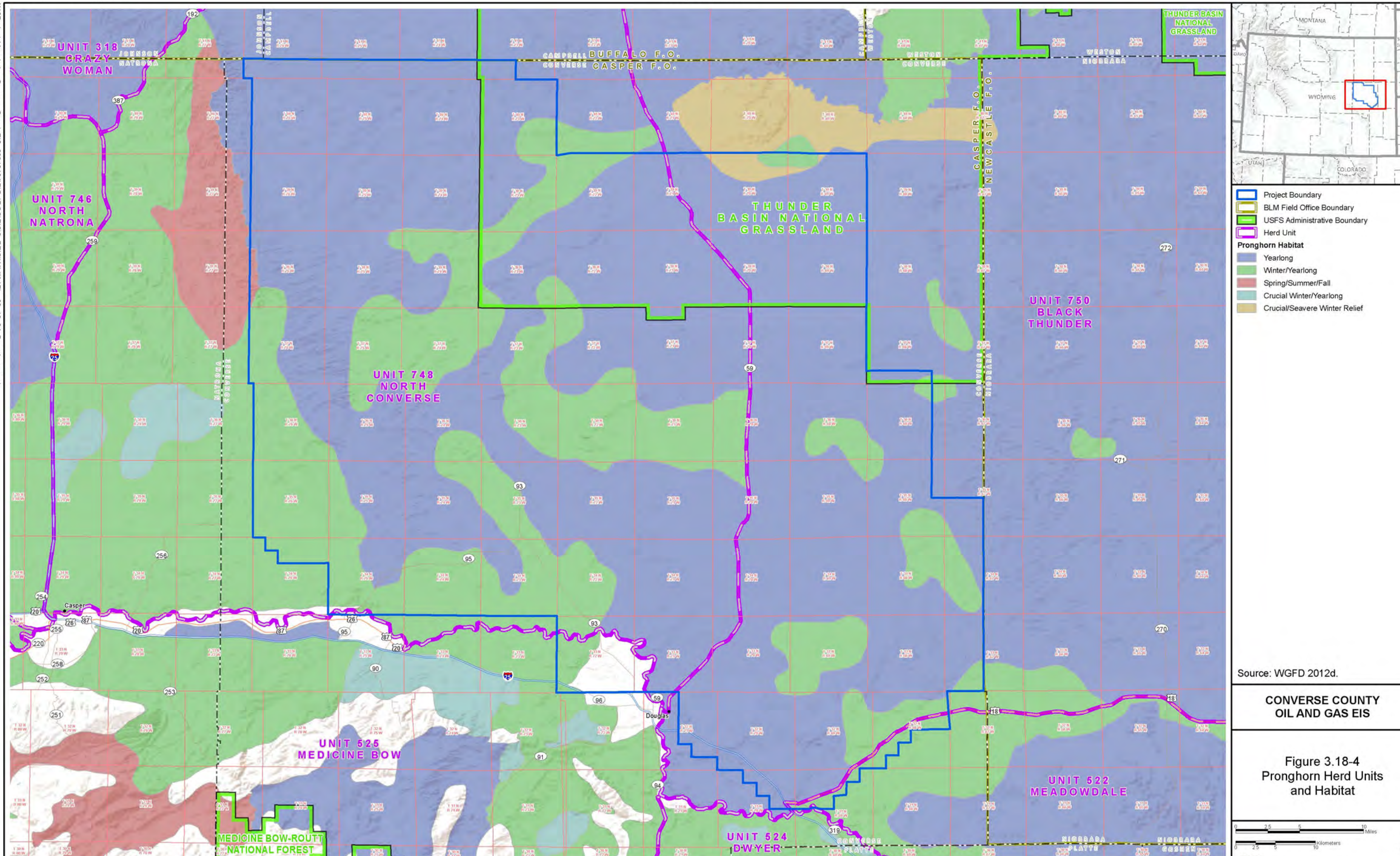

Source: WGFD 2012d.

CONVERSE COUNTY OIL AND GAS EIS

Figure 3.18-4
Pronghorn Herd Units and Habitat

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Table 3.18-2 Big Game Ranges within the CCPA and Big Game Analysis Area

Species / Range Type	Analysis Area			
	Big Game Analysis Area		CCPA	
	Acres	Percent	Acres	Percent
Pronghorn				
Yearlong	3,336,981	53.7	1,073,959	71.5
Winter / Yearlong	1,862,614	30.0	407,574	27.1
Spring / Summer / Fall	154,020	2.5	0	0.0
Winter	0	0.0	0	0.0
Crucial Winter / Yearlong	161,341	2.6	0	0.0
Crucial Winter	0	0.0	0	0.0
Severe Winter Relief	94,991	1.5	6,504	0.4
Parturition	0	0.0	0	0.0
Mule Deer				
Yearlong	3,646,668	58.7	1,122,614	74.7
Winter / Yearlong	1,479,234	23.8	374,498	24.9
Spring / Summer / Fall	455,190	7.3	0	0.0
Winter	0	0.0	0	0.0
Crucial Winter / Yearlong	241,869	3.9	0	0.0
Crucial Winter	255,672	4.1	0	0.0
Severe Winter Relief	0	0.0	0	0.0
Parturition	0	0.0	0	0.0
White-tailed Deer				
Yearlong	1,522,735	24.5	51,297	4.8
Winter / Yearlong	268,371	4.3	1,922	0.1
Spring / Summer / Fall	122,887	2.0	0	0.0
Winter	0	0.0	0	0.0
Crucial Winter / Yearlong	0	0.0	0	0.0
Crucial Winter	0	0.0	0	0.0
Severe Winter Relief	0	0.0	0	0.0
Parturition	0	0.0	0	0.0

Table 3.18-2 Big Game Ranges within the CCPA and Big Game Analysis Area

Species / Range Type	Analysis Area			
	Big Game Analysis Area		CCPA	
	Acres	Percent	Acres	Percent
Elk				
Yearlong	1,018,926	16.4	39,360	2.6
Winter / Yearlong	366,896	5.9	0	0.0
Spring / Summer / Fall	295,083	4.8	0	0.0
Winter	21,247	0.3	0	0.0
Crucial Winter / Yearlong	74,842	1.2	0	0.0
Crucial Winter	47,840	0.8	0	0.0
Severe Winter Relief	0	0.0	0	0.0
Parturition	13,258	0.2	0	0.0

Source: WGFD 2012c.

From 2010 to 2014, pronghorn population estimates for the Black Thunder herd unit averaged 37,533 individuals with a 2015 population estimate of 37,577 individuals. However, in 2016 the population was 23 percent below the management objective of 49,000 individuals, with an estimated population of 40,300 pronghorn (WGFD 2015c). This population objective was reviewed and set in 2014 when this herd was created by combining the Cheyenne River (Herd Unit-740) and Highlight (Herd Unit-316) pronghorn herd units (WGFD 2015c). Tougher conditions between 2008 and 2013 as well as hunting seasons that were, until recently, designed to reduce pronghorn numbers likely influenced population decline in the Black Thunder Herd Unit. However, weather conditions in this herd unit generally have been favorable for antelope over the past two years and have resulted in abundant forage and high over-winter survival and the resulting increase in herd unit population numbers (WGFD 2015c).Furthermore, WGFD field data indicate that annual productivity of the herd over the last 20 years, as measured by preseason fawn to doe ratios, generally has declined with an average of only 62 fawns per 100 does. This is thought to be the result of as a result of a reduction in habitat quality and quantity intensified by long-term drought conditions (WGFD 2015). However, the population within this herd unit rebounded in 2014 and 2015 with increased fawn production and survival as demonstrated by an observed, preseason fawn:doe ratio of 91:100 for 2014 and an 87:100 ration in 2015 (WGFD 2015c).

The CCPA overlaps 985,666 acres of the North Converse Herd Unit. Pronghorn habitat conditions in the North Converse Herd Unit had been exceptionally poor through 2012 due to extreme drought. However, improved conditions and moisture have allowed this unit to recover, and it is anticipated that habitat conditions are improving. From 2010 to 2014, pronghorn population estimates for the North Converse Herd Unit averaged 28,605 individuals. However, in 2016 the population was approximately 41 percent below the management objective of 28,000 individuals, with an estimated population of 16,600 pronghorn (WGFD 2015c). The decline in this population is thought to be a result of the increase in development within this herd unit (WGFD 2015c). Weather conditions in the recent years have been favorable to fawn survival, which has improved substantially over the previous 5-year average of 70 fawns per 100 does to ratios of 83:100 and 92:100 in 2014 and 2015, respectively (WGFD 2015c). However, despite higher fawn ratios observed in this herd unit, the overall population trend declined from 2010 through 2013 from what is thought to be the result of poor over-winter fawn survival in this herd (WGFD 2015c). Mortality during the winter of 2010/2011 and the following drought through 2012, expansion of energy development, and over-grazing by wildlife and domestic livestock likely have contributed to the population decline of this herd (WGFD 2013c).

Mule Deer

Figure 3.18-5 shows mule deer herd units and habitat within the CCPA. Mule deer use the CCPA year-round, and WGFD designates most of the CCPA as yearlong range (**Table 3.18-2**). There is an area of winter/yearlong range for mule deer to the southwest of the CCPA and a large area of crucial winter range just to the south of the CCPA.

The mule deer population within the CCPA primarily is part of the Cheyenne River (Herd Unit-740) and North Converse (Herd Unit-755) mule deer herd units. The Cheyenne River herd unit is approximately 6,350 square miles (4,064,000 acres); 5,485 square miles (3,510,400 acres) of which WGFD considers occupied mule deer habitat. The CCPA overlaps 488,347 acres of this herd unit east of Wyoming SH 59, all of which is designated as yearlong range.

From 2010 to 2014, mule deer estimates for the Cheyenne River herd unit averaged 19,883 individuals. In 2015, the population was 9 percent below the management objective of 27,000 individuals, with an estimated population of 24,580 mule deer (WGFD 2015c). Annual productivity of the Cheyenne River herd unit, as indicated by the trend in the fawn to doe ratio, has generally declined since 1991 from approximately 80 fawns per 100 does to less than 60 fawns per 100 does (WGFD 2013c). Annual productivity of the Cheyenne River herd unit, as indicated by the trend in the fawn to doe ratio, generally has declined since 1991 from approximately 80 fawns per 100 does to less than 60 fawns per 100 does in 2013. This was a result of generally poor range conditions due to drought coupled with substantial use by domestic and wild ungulates (WGFD 2015c, 2013c). The ratio increased in 2014 to 84:100, but dropped again in 2015 by approximately 13 percent to a ratio of 73:100. This drop is thought to be due to an artifact of high numbers of yearling does without fawns in the population rather than to reduced productivity compared to the previous year (WGFD 2015). In general, the current population estimates for this herd unit represents an increase of approximately 26 percent since 2013 due to an increase in reproduction and survival.

The North Converse Herd Unit is approximately 6,350 square miles (4,064,000 acres); of this, WGFD considers 5,485 square miles (3,510,400 acres) occupied mule deer habitat. The CCPA overlaps 985,666 acres of this herd unit west of Wyoming SH 59, all of which is designated as yearlong range. From 2010 to 2014, mule deer population estimates for the North Converse Herd Unit averaged 7,237 individuals. In 2015, the population was 22 percent below the management objective of 9,000 individuals, with an estimated population of 7,036 mule deer (WGFD 2015c). Fawn survival has increased for this herd, with the 2013 ratio of 64 per 100 does being just slightly below the 5-year average of 67 per 100 does. Ratios increased to 92:100 and 89:100 in 2014 and 2015, respectively (WGFD 2015c, 2013c). Mortality during the 2010/2011 winter and subsequent drought through 2012, expansion of energy development, and over-grazing by wildlife and domestic livestock likely have contributed to the population decline of this herd (WGFD 2013c). However, increased fawn production has created an upward trend in recent years (WGFD 2015c). Despite the population decline of this herd and lack of public access to this herd unit, hunter success and satisfaction remained high, and WGFD predicted a stable population through 2013 (WGFD 2013c).

White-tailed Deer

White-tailed deer use a small portion of the CCPA year-round, including riparian areas along the Cheyenne River and North Platte River drainages and irrigated hay fields (**Table 3.18-2**). There are no crucial habitats or severe winter relief range for white-tailed deer in the big game analysis area.

Figure 3.18-6 shows white-tailed deer herd units within the CCPA. The white-tailed deer population within the CCPA is part of the Central White-tailed Deer Herd Unit (Herd Unit-707). There is no population objective for this herd unit. WGFD indicates fawn to doe ratios typically are good for this herd and range, usually 60 to 70 fawns per 100 does (WGFD 2015c). The 2014 and 2015 seasons were above average, with observed fawn ratios of 80 and 88 per 100 does, respectively (WGFD 2015c). However, white-tailed deer appear to be at a low point in their population within this herd unit due to disease outbreak, harsh winters in 2010 and 2011, and the severe drought of 2012. There is no population estimate for this herd because access to perform ground surveys is inconsistent and highly variable from year-to-year as most white-tailed deer inhabit private lands (WGFD 2013c). White-tailed deer densities in this herd within the CCPA are highest along major cottonwood riparian communities of the North Platte and Cheyenne rivers.

Elk

Figure 3.18-7 shows elk herd units and habitat within the CCPA. Elk use portions of the CCPA year-round, and WGFD has designated 39,360 acres of the CCPA as yearlong range (**Table 3.18-2**). The WGFD does not designate any other ranges within the CCPA; however, there is a small area of crucial winter range elk outside of the CCPA to the north as well as areas to the south; and a small area of parturition range to the north of the CCPA.

The Pine Ridge Herd Unit (Herd Unit-743) is the primary elk herd unit overlapping the CCPA. The Pine Ridge Herd Unit is approximately 6,350 square miles (4,064,000 acres), of which the CCPA overlaps 386,377 acres. The northeast corner of the CCPA overlaps with the Rochelle Hills Herd Unit (Herd Unit-344), and the very southern extent of the CCPA overlaps the Laramie Peak/Muddy Mountain (Herd Unit-741) and Rawhide (Herd Unit-730) herd units. Nearly all elk in the Pine Ridge Herd Unit reside in and along the timbered Pine Ridge escarpment in the north-central portion of the herd unit within the far west extent of the CCPA, which the WGFD designates as yearlong range (**Figure 3.18-7**). There is no population objective for the Pine Ridge Herd Unit. Past trend counts of this herd typically have observed between 150 and 350 elk. Winter counts in 2013 were conducted under optimum conditions and found 840 elk. A trend count in February 2014 only found 454 elk and only 276 elk in 2015, but trend count conditions were not ideal (WGFD 2015c). WGFD estimates that there likely are 900 to 1,000 elk in this herd, if not more (WGFD 2015c, 2013c).

3.18.1.6 Small Mammals

A variety of small game and nongame mammals either occur or have the potential to occur in the terrestrial wildlife analysis area. Small mammal species occur in a variety of habitats within the analysis area; the distributions of these associated habitats are identified in **Table 3.18-1**. Special status species are discussed in Section 3.18.3; however, other small mammal species that may occur in the CCPA include:

- Small game species include the cottontail rabbit (*Sylvilagus* spp.), snowshoe hare (Lepus americanus), red squirrel (*Tamiasciurus hudsonicus*), fox squirrel (*Sciurus niger*), and gray squirrel (*Sciurus carolinensis*) (BLM 2007b). These species occupy a wide variety of habitats from high-elevation conifer forests to low elevation sagebrush shrubland. Most of these species are fairly abundant within suitable habitat, and their populations typically follow a cyclical pattern that exhibits highs and lows (BLM 2007b).
- Mesopredator/furbearing mammals include beaver (*Castor canadensis*), muskrat (*Ondatra zibethica*), long-tailed weasel (*Mustela frenata*), mink (*M. vison*), American badger (*Taxidea taxus*), coyote (*Canis latrans*), raccoon (*Procyon lotor*), red fox (*Vulpes vulpes*), striped skunk (*Mephitis mephitis*), spotted skunk (*Spilogale putorius*), and bobcat (*Lynx rufus*). Similar to other small game mammals, these species are habitat generalists and occupy a variety of habitats (BLM 2007b).

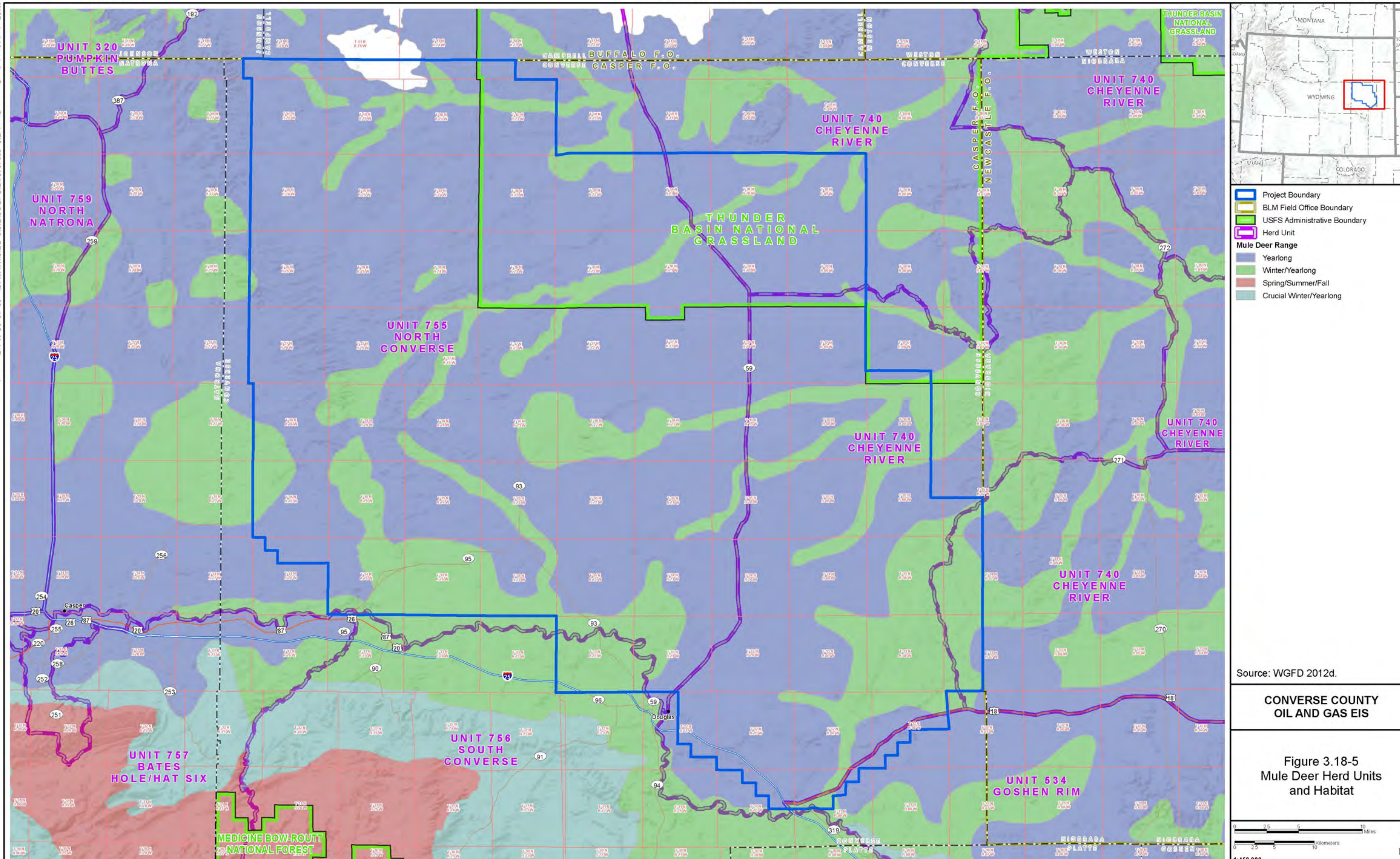

Figure 3.18-5
Mule Deer Herd Units and Habitat

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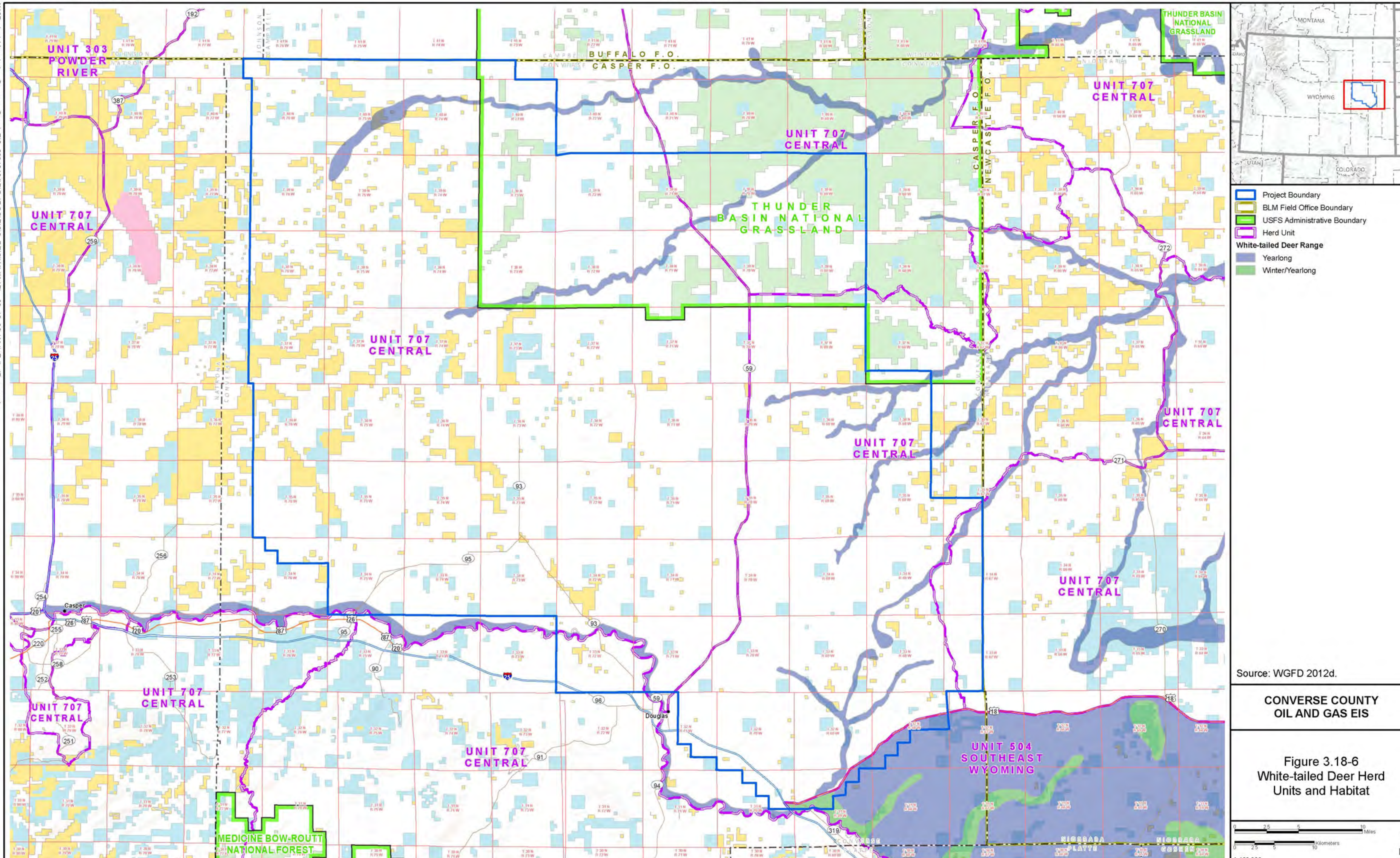
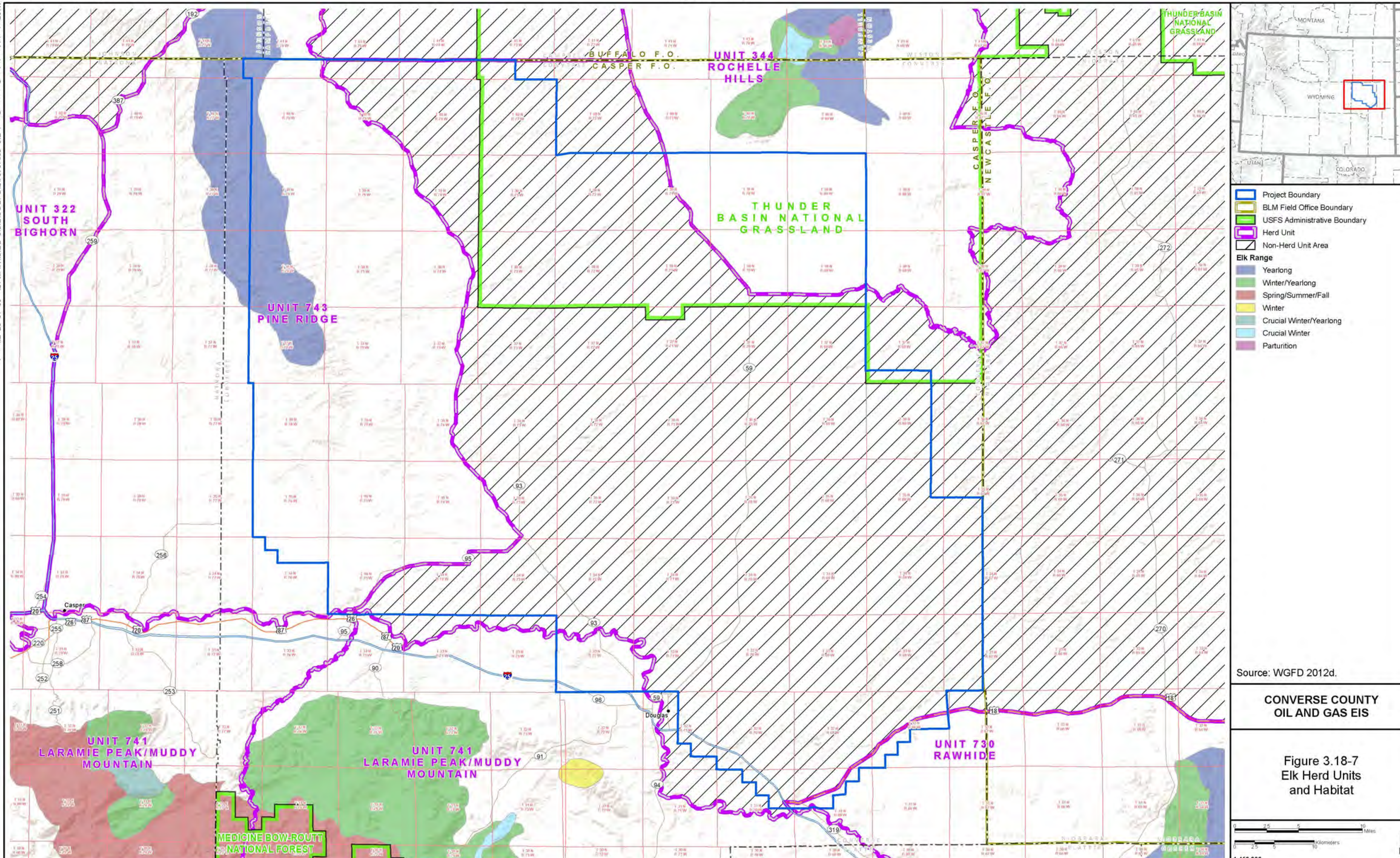


Figure 3.18-6
White-tailed Deer Herd Units and Habitat

Print Date: 8/1/2017



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- Small nongame mammals commonly occurring throughout the terrestrial wildlife analysis area include voles, chipmunks, gophers, woodrats, ground squirrels, and mice that provide a substantial prey base for predators within the wildlife analysis area including larger mammals and raptors. Representative species include deer mouse (*Peromyscus maniculatus*), least chipmunk (*Neotamias minimus*), northern grasshopper mouse (*Onychomys leucogaster*), plains pocket gopher (*Geomys bursarius*), olive-backed pocket mouse (*Perognathus fasciatus*), sagebrush vole (*Lemmiscus curtatus*), silky pocket mouse (*Perognathus flavus*), thirteen-lined ground squirrel (*Spermophilus tridecemlineatus*), western harvest mouse (*Reithrodontomys megalotis*), and Wyoming ground squirrel (*Spermophilus elegans*). A complete list of these species can be found in the BLM Casper RMP (BLM 2007b). These species occupy a variety of habitats within the analysis area.
- Bats are insectivores that utilize trees, caves, buildings, and rock crevices as day and maternal roost sites, as well as hibernacula. Bat species are most vulnerable to disturbance at birth and during hibernation. Representative bat species most likely to occur in the region include the big brown bat (*Eptesicus fuscus*), little brown bat (*Myotis lucifugus*), silver-haired bat (*Lasionycteris noctivagans*), eastern pipistrelle (*Pipistrellus subflavus*), and hoary bat (*Lasiurus cinereus*) (BLM 2007b).
- Some of these small mammal species are considered Wyoming SGCN, including the olive-backed pocket mouse, plains pocket mouse, silky pocket mouse, little brown myotis, and spotted skunk. These SGCN as well as other special status mammal species are addressed in Section 3.18.3, Special Status Wildlife Species.

3.18.1.7 Game Birds

Avian species are analyzed based on potential habitat associations. The distribution of these vegetation communities across the CCPA is presented in **Table 3.18-1**.

Upland game birds that have been documented in the wildlife analysis area include ring-necked pheasant (*Phasianus colchicus*), wild turkey (*Meleagris gallopavo*), gray partridge (*Perdix perdix*), chukar partridge (*Alectoris chukar*), and greater sage-grouse. Greater sage-grouse is discussed in detail in Section 3.18.3, Special Status Wildlife Species. Sharp-tailed grouse (*Tympanuchus phasianellus*) also is known to occur within the terrestrial wildlife analysis area.

The ring-necked pheasant is a non-native game bird in Wyoming that generally occupies river-bottom agricultural lands and adjacent habitats on which BLM has minimal management authority. Wild turkeys generally are associated with river-bottom habitats and in the pine savannahs and foothills throughout the terrestrial wildlife analysis area (BLM 2007b). Gray partridge and chukar partridge also are non-native game birds that occupy grassland habitats within the CCPA. Gray partridge often are associated with agricultural strip farming and mountain shrub communities. Habitats for the chukar partridge typically are broken topography and steep terrain. The sharp-tailed grouse is found within grasslands, shrublands, and irrigated native meadows.

Migratory game birds protected under the MBTA include waterfowl, mourning dove (*Zenaida macroura*), sandhill crane (*Grus canadensis*), Sora (*Porzana carolina*), Virginia rail (*Rallus limicola*), and Wilson's snipe (*Gallinago delicata*). These species are discussed in detail in Section 3.18.2, Migratory Birds.

3.18.2 Migratory Birds

3.18.2.1 Regulatory Background

Laws, regulations, and policies that directly influence migratory bird management decisions for the Project primarily are implemented by the BLM, USFWS, USFS, and the WGFD. In addition to those discussed for terrestrial wildlife (Section 3.18.1.1), the following regulations and legal requirements provide protection for migratory birds and raptors with potential to occur in the CCPA.

- MBTA (16 USC 703 et seq.)1;
- EO 13186 (66 FR 3853);
- BGEPA (16 USC 668 et seq.);
- USFS Memorandum of Understanding 08-MU-1113-2400-264;
- BLM IMs WY-2013-005 and WY-2010-156;
- BLM and USFWS 2010 Memorandum of Understanding to Promote Conservation of Migratory Birds***; and***
- ***USFS and USFWS 2008 Memorandum of Understanding to Promote Conservation of Migratory Birds*****.**

Federal Regulations

Migratory Bird Treaty Act

The MBTA is the cornerstone of migratory bird conservation and protection in the U.S. The MBTA implements four treaties that provide for international protection of migratory birds. It is a strict liability statute, meaning that proof of intent, knowledge, or negligence is not an element of an MBTA violation.

The MBTA (16 USC 703) states, "Unless and except as permitted by regulations … it shall be unlawful at any time, by any means, or in any manner to pursue, hunt, take, capture, kill … possess, offer for sale, sell … purchase … ship, export, import … transport or cause to be transported … any migratory bird, any part, nest, or eggs of any such bird …. [The MBTA] prohibits the taking, killing, possession, transportation, import and export of migratory birds, their eggs, parts, and nests, except when specifically authorized by the Department of the Interior." The word "take" is defined by regulation 50 CFR 10.12 as "to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect."

The MBTA provides criminal penalties for persons or entities who commit any of the acts prohibited by the statute (i.e., 16 USC 703) on any of the species protected by the statute. The USFWS maintains a list of all species protected by the MBTA at 50 CFR 10.13. This list includes over one thousand native species of migratory birds, including eagles. The USFWS maintains a list of introduced species not protected by the MBTA.

Executive Order 13186 – Responsibilities of Federal Agencies to Protect Migratory Birds

EO13186 directs federal agencies that take actions that either directly or indirectly affect migratory birds to develop a Memorandum of Understanding, and to work with the USFWS and other federal agencies to promote the conservation of migratory bird populations. The 2010 Memorandum of Understanding between BLM and USFWS ***and the 2008 Memorandum of Understanding between the USFS and USFWS*** promotes the conservation of migratory birds, as directed through EO 13186 (FR V. 66, No. 11). Of particular focus are the species identified in the USFWS Birds of Conservation Concern (BCC) 2008 (USFWS 2008). In accordance with the Fish and Wildlife Conservation Act (16 USC 2912 (a)(3)), this report identifies "species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing" under the ESA. The BCC list is intended to facilitate coordinated and proactive conservation actions among federal, state, and private partners.

Bald and Golden Eagle Protection Act

Under authority of the BGEPA (16 USC 668–668d), bald eagles and golden eagles are afforded additional legal protection. BGEPA prohibits the take, sale, purchase, barter, offer of sale, purchase, or barter, transport, export or import, at any time or in any manner of any bald or golden eagle, alive or dead, or any part, nest, or egg thereof. BGEPA also defines take to include "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb" (16 USC 668c) and includes criminal and civil penalties for violating the statute. The USFWS further defined the term "disturb"(50 CFR 22.3) as agitating or bothering an eagle to a degree that causes, or is likely to cause, injury, or a decrease in productivity or nest abandonment by substantially interfering with normal breeding, feeding, or sheltering behavior.

BGEPA authorizes the USFWS to permit the take of eagles for certain purposes and under certain circumstances (16 USC 668a), including scientific or exhibition purposes, religious purposes of Indian tribes, and the protection of wildlife, agricultural, or other interests as long as that take is compatible with the preservation of eagles.

In 2009, the USFWS promulgated a final rule on two new permit regulations that, for the first time, specifically authorized the non-purposeful (i.e., incidental) take of eagles and eagle nests in certain situations under BGEPA (50 CFR 22.26 and 22.27). The permits authorize limited take of bald and golden eagles, authorizing individuals, companies, government agencies, and other organizations to disturb or otherwise take eagles in the course of conducting lawful activities. Before USFWS can authorize such take, it must determine that the take is compatible with the preservation of the bald and golden eagle and cannot practicably be avoided. In December 2016, the USFWS further revised the 2009 Eagle Act regulations (81 FR 91494). These regulations apply broadly and equally to all entities and industries at risk of taking eagles.

3.18.2.2 Information Sources

In addition to the information sources listed in Section 3.18.1.2, information regarding migratory bird species and habitats also was obtained from a review of existing published sources and public databases including:

- WGFD Atlas of Birds, Mammals, Amphibians, and Reptiles in Wyoming (Orabona et al. 2012);
- Wyoming Natural Diversity Database (WYNDD 2017);
- USFWS BCC (USFWS 2008);
- USFWS IPaC (USFWS ***2017,*** 2014c); and
- Birds of Wyoming (Faulkner 2010).

3.18.2.3 Migratory Bird Analysis Area

The analysis area for migratory birds represents the geographic areas of contiguous habitat within the CCPA. Accordingly, this analysis area provides clear disclosure of the context of Project impacts in light of management considerations for these areas. The migratory bird analysis area is based on HUC-12 watershed boundaries encompassed in or intersected by the CCPA (**Figure 3.18-1**). These watershed areas provide a clear bio-geographical delineation of vegetation communities and avian habitats. The analysis area also provides context for the Rochelle Hills IBA that intersects the CCPA. Raptor nests were analyzed within the CCPA plus a 1-mile buffer. A variety of avian species occur in the analysis area. These species primarily are associated with mixed grass prairie, sagebrush shrubland, wetlands, and riparian habitats. The USFWS and WGFD manage migratory bird populations in the analysis area.

3.18.2.4 Migratory Bird Habitat

As with the terrestrial wildlife analysis area, the dominant habitats occurring within the migratory bird analysis area are mixed grass prairie and sagebrush shrubland. The analysis area also contains riparian and wetland habitat, and aquatic habitat in the form of rivers, ponds, and springs that support a diversity of species. A variety of avian species are associated with sagebrush shrubland and mixed grass prairie communities, with a greater species diversity occurring in areas exhibiting greater vegetative structure and soil moisture, such as riparian communities. Section 3.14, Vegetation, discusses the vegetation communities defined for the Project. For the purposes of this analysis, migratory bird habitats will be defined according to the cover types provided on **Table 3.18-1** and shown on **Figure 3.14-1**. Although developed land is not considered to be typical migratory bird habitat, some disturbance-tolerant species utilize these areas.

Audubon Important Bird Area

In the U.S., the Audubon Important Bird Area (IBA) program is administered by the National Audubon Society. IBAs are sites that provide suitable habitat for one or more species of birds. They include breeding, winter, and/or migration habitat. IBAs are usually unique migratory bird habitats that stand out from the surrounding landscape and work to conserve birds on a global scale (National Audubon Society 2010).

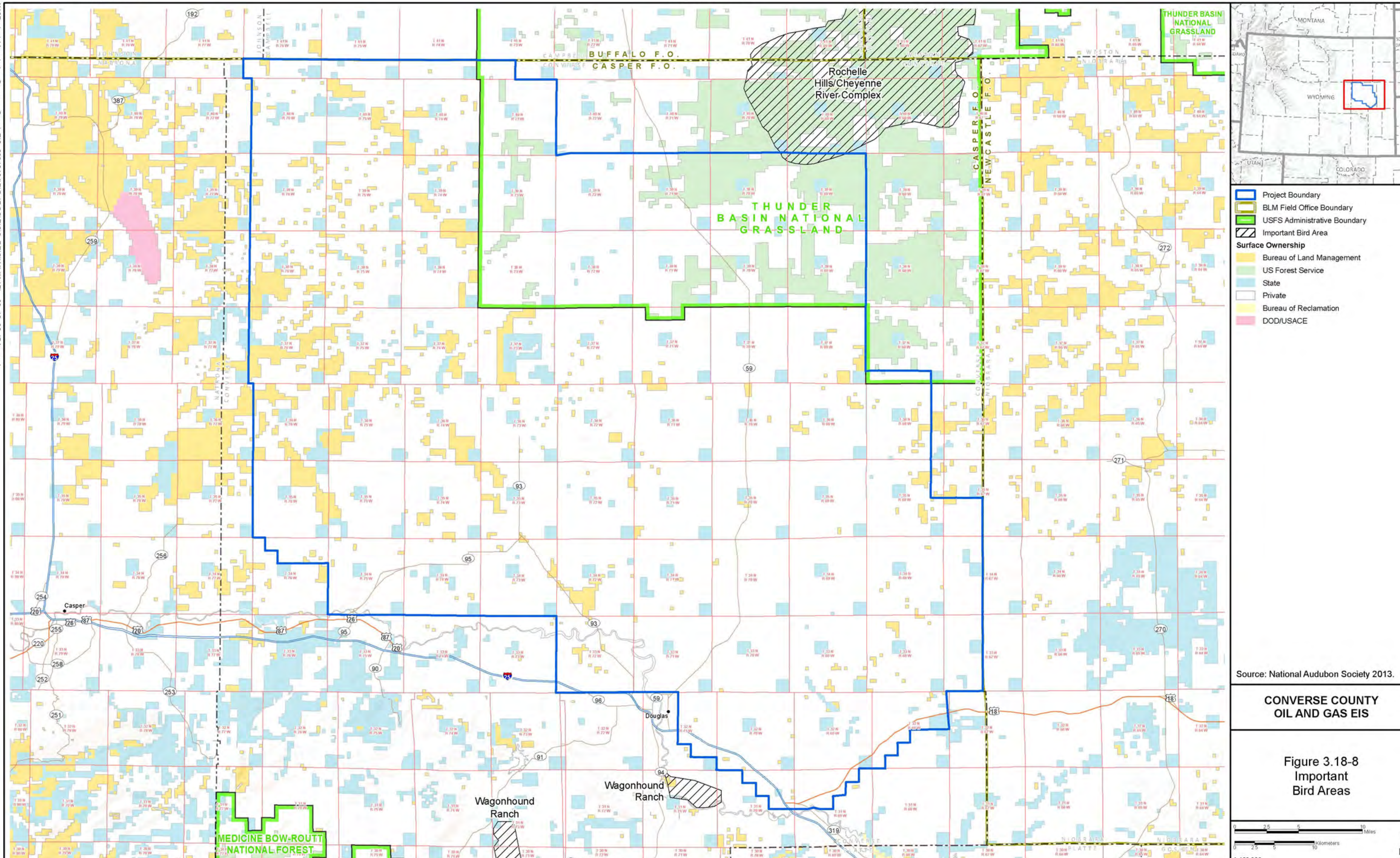
To qualify as an IBA, a site must satisfy at least one of the following criteria. The site must support:

- Species of conservation concern;
- Restricted-range species (species that are vulnerable because they are not widely distributed);
- Species that are vulnerable because their populations are concentrated in one general habitat type or biome; or
- Species or groups of similar species (such as waterfowl or shorebirds) that are vulnerable because they occur at high densities due to their behavior and habitat requirements.

The TBNG Complex of three distinct IBAs encompasses portions of Campbell, Converse, Crook, Niobrara, and Weston counties, Wyoming (**Figure 3.18-8**). The site includes approximately 572,000 acres of National Forest System lands that are interspersed with lands of other ownership, including state and private. The TBNG IBA Complex provides critically important habitat for grassland and shrubland avian species. Approximately 60 percent of the IBA complex consists of grassland habitat, 30 percent consists of sagebrush or mixed shrubland, and 10 percent consists of wetland/riparian habitat (National Audubon Society 2013). A total of 13,495 acres of the Rochelle Hills IBA and 107,087 acres of the Wagonhound IBA are within the migratory bird analysis area. These total acreages include 8,322 acres of grassland habitat in the Rochelle Hills IBA and 30,703 acres of grassland habitat in the Wagonhound IBA. However, only the Rochelle Hills IBA overlaps with the CCPA.

3.18.2.5 Migratory Bird Species

A variety of migratory bird species inhabit the vegetation communities present throughout the CCPA. Many species are present throughout the year; however, they are most abundant during migration and the breeding season. Increased species diversity generally occurs in areas exhibiting greater vegetation structure, soil moisture, and available open water, such as wetlands and riparian areas. Species that inhabit wetland and riparian habitats generally are limited to the perennial and intermittent drainages, marshes, and the margins of reservoirs, lakes, and ponds or in the immediate vicinity of these areas. A total of 437 avian species are included in the Atlas of Birds, Mammals, Amphibians, and Reptiles in Wyoming (Orabona et al. 2012). Of the 437 avian species known in Wyoming, 297 have been documented in the vicinity of the CCPA. A total of 115 have been documented breeding in the vicinity of the CCPA, and circumstantial evidence of breeding exists for an additional 35 species (Orabona et al. 2012). These documented observations can be used in conjunction with GIS shapefiles of known raptor nest locations and the (WISDOM) online application data records to provide an understanding of raptor species diversity within the CCPA.



CONVERSE COUNTY OIL AND GAS EIS

Figure 3.18-8
Important Bird Areas

Print Date: 8/1/2017

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Migratory Game Birds and Waterfowl

Migratory game bird and waterfowl species with potential to occur in the CCPA that are protected under the MBTA are presented in **Table 3.18-3**. The migratory bird analysis area is located within the Central Flyway, which is one of four administratively recognized bird migration routes in North America. The Central Flyway includes Wyoming, although much migration activity occurs along the Platte River and Missouri River valleys to the east in Nebraska. Migratory species, primarily waterfowl, using the Central Flyway depend on the Platte and Missouri rivers for food and cover during migration. Migratory bird species occurring in downstream riparian habitats of the Platte River in Nebraska could be affected by water depletions in the North Platte River systems resulting from Project-related activities. See Section 3.18.3, Special Status Wildlife Species, for Central Flyway bird species that are listed as threatened or endangered.

Table 3.18-3 Migratory Game Bird and Waterfowl Species with Potential to Occur in the CCPA

Waterfowl Species		Game Bird Species	
Common name[1]	**Scientific name**	**Common name[1]**	**Scientific name**
Canada goose	*Branta canadensis*	Virginia rail[2]	*Rallus limicola*
Wood duck	*Aix sponsa*	Sora	*Porzana carolina*
Gadwall	*Anas strepera*	Sandhill crane	*Grus canadensis*
American wigeon	*Anas americana*	Wilson's snipe	*Gallinago delicata*
Mallard	*Anas platyrhynchos*	Mourning dove	*Zenaida macroura*
Blue-winged teal	*Anas discors*	--	--
Cinnamon teal	*Anas cyanoptera*	--	--
Northern shoveler	*Anas clypeata*	--	--
Northern pintail	*Anas acuta*	--	--
Green-winged teal	*Anas crecca*	--	--
Canvasback	*Aythya valisineria*	--	--
Bufflehead	*Bucephala albeola*	--	--
Common goldeneye	*Bucephala clangula*	--	--
Barrow's goldeneye	*Bucephala islandica*	--	--
Common merganser	*Mergus merganser*	--	--
Ruddy duck	*Oxyura jamaicensis*	--	--

1 Species are presented according to the Birds of North America Taxonomic List (American Ornithologists' Union 1998).

2 Virginia rail is designated as Wyoming SGCN, Tier III (WGFD 2017d).

Source: Faulkner 2010.

The North Platte River, Cheyenne River, and other waterbodies and springs within the CCPA provide essential avian habitat. Waterfowl populations are monitored in Waterfowl Management Areas, and this information is used by WGFD to track population estimates and numbers of harvested waterfowl. WGFD supplies annual completion reports describing population and harvest trends for migratory game birds at the state level (WGFD 2012b). WGFD 1A and 1C waterfowl management areas occur within the CCPA. Habitat conditions for breeding waterfowl in North America have improved recently with increased precipitation. The majority of ducks that migrate into Wyoming come from Alberta and Montana. Duck populations in these two regions are reported to be 35 percent above the long-term average. Canada goose populations remain similar to 2014 (WGFD 2015c). According to the 2016 Migratory Game Bird Job Completion Report (WGFD 2016c), the mid-winter population estimate of ducks in the Central

Flyway portion of Wyoming was 38 percent below the long-term average in 2016 (WGFD 2016c). A total of 3,265 and 7,019 ducks were harvested in the 1A and 1C Waterfowl Management Areas, respectively, in 2015 (WGFD 2016c).

According to the WGFD (2015) report, and based on North American Breeding Bird Survey data (Sauer et al. 2014), population status and trends for other migratory game bird species in Wyoming are as follows:

- Wilson's snipe populations generally have increased in eastern portions of Wyoming.
- Virginia and Sora rail populations have increased from 1968-2013.
- Mourning dove populations have increased slightly in Wyoming over the past 10 years. Production in 2014 was generally below average, and appeared to be below average again in 2015.
- Sandhill cranes that migrate through eastern Wyoming (Crane Hunt Area 7) primarily are from the Mid-Continent Population, which has been relatively stable since the early 1980s and exceeds the established objective range of 349,000 to 472,000.

With the exception of mourning dove, migratory game birds and waterfowl are considered wetland/riparian habitat obligates. Sandhill cranes also will utilize agricultural fields to forage on waste grain. Mourning doves inhabit open areas and forage in grassland and agricultural fields. Avian species are analyzed based on potential habitat associations. The distribution of these vegetation communities across the CCPA is presented in **Table 3.18-1** and depicted in **Figure 3.14-1**.

Raptor Species

Raptors reported to occur in Converse County include the bald eagle, golden eagle, rough-legged hawk, ferruginous hawk, northern harrier, osprey, Swainson's hawk, red-tailed hawk, Cooper's hawk, merlin, northern goshawk, sharp-shinned hawk, peregrine falcon, American kestrel, and prairie falcon (Orabona et al. 2012; WISDOM 2014). Owl species reported to occur in Converse County include the great horned owl, burrowing owl, short-eared owl, and snowy owl (Orabona et al. 2012; WISDOM 2014). **Table 3.18-4** presents raptor species potentially occurring in the CCPA. General locations of raptor nests documented within the raptor analysis area are provided on **Figure 3.18-9**. ***A 0.5-mile buffer was placed around each of these nests to determine the amount of the CCPA that would be subject to a timing limit stipulation. In total 388,836 acres of the 1,502,381 total acres within the CCPA would be within a timing limit stipulation buffer, or 26 percent***. Raptor species were analyzed based on potential habitat associations (**Table 3.18-4**). The distribution of these vegetation communities across the CCPA is presented in **Table 3.18-1** and depicted in **Figure 3.14-1**.

There are many definitions for what constitutes an active, an occupied, or a used nest. Historically, the terms "active and inactive nest" has been considered to be ambiguous and should not be used unless specifically defined (Orabona and Patia 2013; Steenhoff and Newton 2007). The USFWS recently provided a narrow definition for active nests in a guidance memorandum for destruction and relocation of nest contents under MBTA (USFWS 2018). The USFWS defines an active nest as one that contains viable eggs or live chicks. While this definition is one metric to identify an active nest, it fails to capture the goals and objectives for the Casper RMP. In coordination with the WGFD, BLM used the definition based on occupied nest and annual nest use rate to be consistent with the goals and objectives of the Casper RMP.

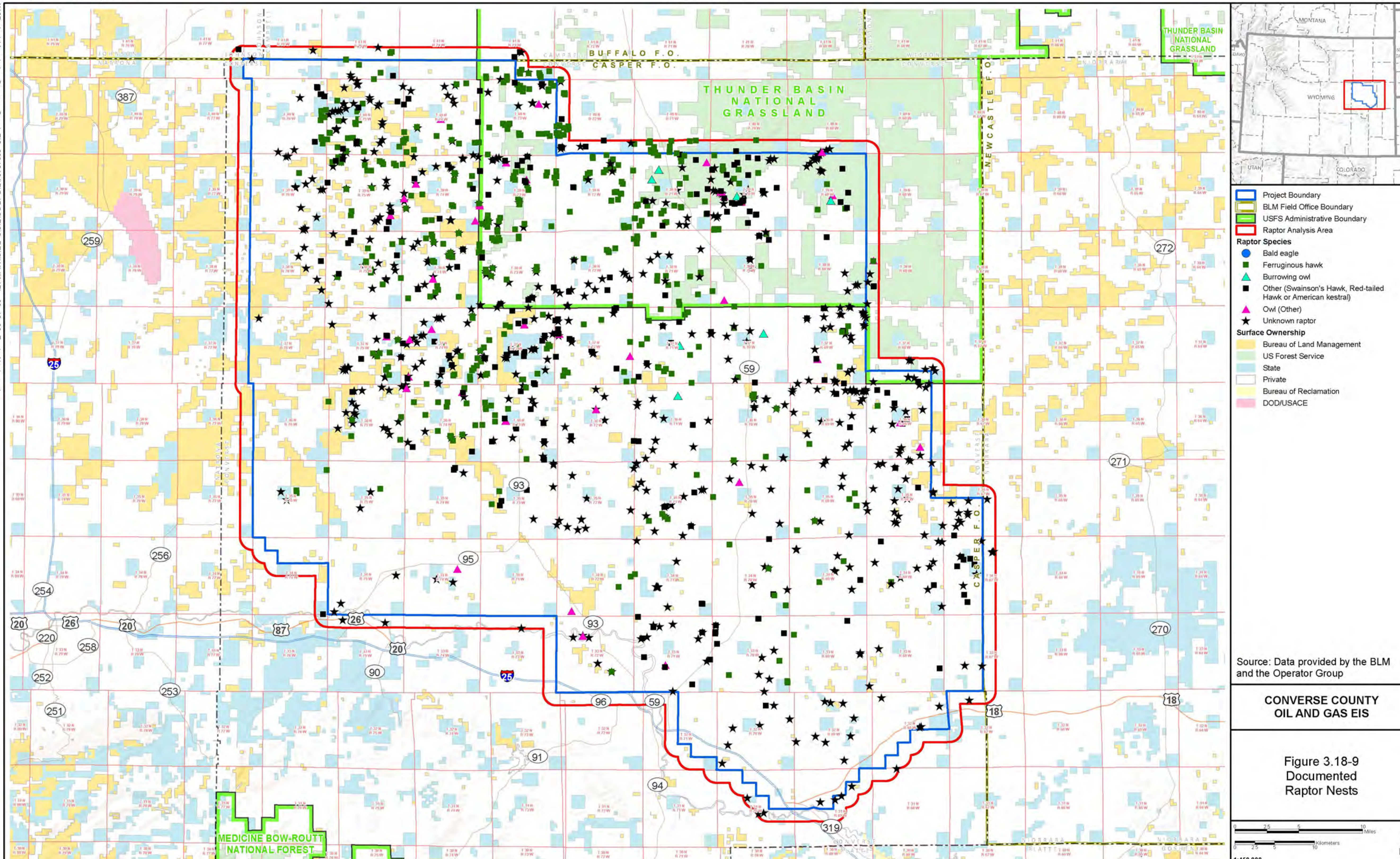

Figure 3.18-9
Documented Raptor Nests

Print Date: 12/20/2019

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Table 3.18-4 Raptor Species with Potential to Occur

Species Common Name	Number of Nests[1]	Habitat[2]
American kestrel	***2***	Agricultural land, mixed shrubland, wetland/riparian suitable trees, manmade structures or cliffs required for cavity nests.
Bald eagle	***5***	Wetland/riparian 2,498 acres of BLM-identified winter roost habitat
Burrowing owl	***7***	Agricultural land, barren/sparsely vegetated, grassland, mixed shrubland, sagebrush shrubland Prairie dog colonies and small mammal burrows required for nesting
Cooper's hawk	None documented	Agricultural land, conifer, wetland/riparian
Ferruginous hawk	***508***	Agricultural land, barren/sparsely vegetated, grassland, mixed shrubland, sagebrush shrubland Prairie dog colonies, cliff and rock outcrop habitat required for nesting
Flammulated owl	None documented	Conifer
Golden eagle	***141***	Agricultural land, barren/sparsely vegetated, grassland, mixed shrubland, sagebrush shrubland
Great gray owl	None documented	Conifer forest
Great horned owl	***38***	Agricultural land, conifer, mixed shrubland, sagebrush shrubland, wetland/riparian Mature trees required for nesting
Long-eared owl	***None documented***	Agricultural land, conifer, wetland/riparian Trees, tall shrubs, or shelterbelts required for nesting
Merlin	None documented	Agricultural land, conifer, grassland, wetland/riparian
Northern goshawk	None documented	Conifer Specific forest microhabitats required for nesting
Northern harrier	None documented	Agricultural land, grassland, mixed shrubland, sagebrush shrubland, wetland/riparian
Northern pygmy owl	None documented	Conifer forest wetland/riparian
Osprey	None documented	Wetland/riparian
Peregrine falcon	None documented	Agricultural land, barren/sparsely vegetated, mixed shrubland, sagebrush shrubland, wetland/riparian Cliff habitat required for nesting
Prairie falcon	None documented	Agricultural land, barren/sparsely vegetated, grassland, mixed shrubland, sagebrush shrubland Cliff habitat required for nesting
Red-tailed hawk	***207***	Agricultural land, grassland, mixed shrubland, sagebrush shrubland, wetland/riparian
Sharp-shinned hawk	None documented	Agricultural land, conifer, wetland/riparian
Short-eared owl	***1***	Agricultural land, grassland, wetland/riparian
Species unknown	***683***	Varies by species
Swainson's hawk	***32***	Agricultural land, grassland, mixed shrubland, sagebrush shrubland
Total	***1621***	
Non-Eagle Raptor Total	***1475***	

[1] The number of nests is not an indicator of raptor abundance.

[2] Vegetation communities as defined for the Project in Section 3.14, Vegetation.

Source: BLM 2014a, 2010a, 2007b; Schmutz and Fyfe 1987; WGFD 2017d, 2010a.

Raptor research has been hampered by inconsistent use of terms, calculations, and data interpretation (Postupalsky 1974). Until terminology is standardized nationwide, the following terms and definitions, similar to those recommended by Postupalsky (1974), will be used in Wyoming:

Breeding territory or site: An area containing 1 or more nests within the range of 1 mated pair of birds.

Occupied territory or site: Any territory or site at which one of the following activity patterns has been observed during a breeding season:

- ***i.*** ***Young were raised.***
- ***ii.*** ***Eggs were laid.***
- ***iii.*** ***One adult was observed sitting low in the nest, presumably incubating.***
- ***iv.*** ***Two adults were present on or near the nest, provided there was no reason to suspect the pair had already been counted elsewhere.***
- ***v.*** ***One adult was observed frequenting the site or maintaining a territory.***
- ***vi.*** ***Fresh sticks (unweathered breaks) or boughs indicate the nest has been recently repaired.***

Unoccupied territory or site: None of the above conditions are met.

Occupied active nest: A nest or ledge in which eggs have been laid. At least 1 of the activity patterns (i, ii, or iii) must be documented.

Inactive nest: Not an acceptable term; see occupied or unoccupied definitions. *1*

Annual nest use is the number of nests used in a year divided by the number of nests observed in a year (Carlisle et al. 2018a). A nest is considered used if it is occupied following the WGFD definition for occupied. The terms occupied and used have distinct advantages over the use of the term active. The term occupied includes the behaviors that constitute an active nest while also capturing a greater variety of reproductive behaviors. The term occupied also supports the BLM management of the habitat of nesting birds. While the number, activity status, and species using individual raptor nests vary annually, a tabulation of historic raptor nests is useful in comparing the general availability of raptor nesting habitat in the CCPA. Raptors typically produce one clutch per year and some exhibit high nest fidelity. For this reason, raptor nests are identified and monitored by a variety of agencies and organizations.

Raptor species are known to use nests for multiple years. The species using a particular nest may vary annually. For example, most owls do not construct their own nests; they use previously constructed nests or burrows. The availability of nest data is partially dependent on whether previous surveys have been conducted for other projects or for research or monitoring purposes. In areas where previous research or monitoring has been done there likely will be more raptor nest data than areas without such additional occurrence information.

When a raptor nest is identified outside of the nesting season or when no birds are present, it often is not possible to determine the species that used the nest. Such nest occurrence data is still valuable and is included in analyses as the nest of an unknown species. While the most recent raptor nest data has been included in this analysis, the presence and status of nests and nest structures (e.g., trees) can vary from year to year. The timing of the raptor breeding season can vary substantially based on species, latitude, elevation, weather, and numerous other factors.

Non-eagle raptor nest data were compiled by the BLM to provide a basis for estimating the percentage of used versus unused nests to serve as a baseline for the impact analysis. The OG provided non-eagle raptor nest survey data from 2016 to2018 for a portion of the CCPA. BLM provided all raptor nest survey data from the Casper Field Office between 1990 and 2013. The BLM, non-eagle, nesting raptor data between 2005 and 2007 were analyzed in the baseline data

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[1] *https://wgfd.wyo.gov/WGFD/media/content/PDF/Wildlife/Handbook-BioTechniques/19-NG_Birds_2013_revision.pdf*

because these were the most recent years where a consistent number of surveys had been completed.

There were limitations in the datasets received from the BLM and OG, primarily some of these datasets did not have multiple nest site visits within a year. Not having multiple nest visits limits the ability to assess detection probability and utilize multi-season occupancy modeling (Carlisle et al. 2018a). Additionally, the BLM and OG data sources varied in their consistency in how nesting definitions were applied to nest status and the data collection methods are sometimes unknown. The OG data was collected by at least three operators and appeared to vary in the type of data collected. As such, methodology from Carlisle et al. (2018a) was incorporated to assess annual nest-use rate instead.

To analyze the proportion of used and unused nests a weighted average based on the total nests surveyed and the proportional contribution of active nests from each data source was utilized. The percentages of each category (Active, Inactive, Unknown, and Did Not Located) were multiplied by the total number of non-eagle raptor nests which gave the number of surveyed nests for each category. The nests with unknown status (Unknown and Did Not Locate) were then removed from the dataset which resulted in the total number of nests surveyed with known (Used or Unused) status. In this analysis all nests that were recorded with a status of Active, Occupied, or Predated (predator killed and consumed eggs or chicks) were counted as used nests while nests with the status of Inactive were counted as Unused nests. Nests were also recategorized to Unknown status if the survey observation recorded it as Unknown, Gone, Substrate Gone, if the status category was left blank or had NA, NaN, or Did Not Locate recorded. The total number of active nests were then averaged with the total number of nests with known status. This analysis corrected for nests that could not be attributed to a raptor species and gave the annual nesting use-rate based on the number of nests contributed by each survey dataset.

Duplicate observations where nest survey areas overlapped in the OG dataset were then culled from the dataset. Duplicate nests were removed by using spatial selection queries where nest observations were located within 50 ft of another nest observation, or where tabular information stated it was a duplicated observation. A few nests outside this 50 ft buffer were also removed based on similarity of nest descriptions. Finally, eagle nesting data was also removed from BLM and OG data.

In total 2,797 non-Eagle nests were surveyed from which 290 Unknown nests and 1,572 duplicate nests were removed. This gave a total of 935 known status nests that were analyzed. The percent of Used non-eagle raptor nests within a dataset ranged from approximately 2 to 47 percent with an average of 33 percent (Table 3.18-5, Figure 3.18-10).

Table 3.18-5 *Non-Eagle Raptor Nest Activity in the Project Area*

Data Source	Year	Used Nests	Unused Nests	Total Nests of Known Status	Percent Use
BLM CFO	2005	71	115	186	38
BLM CFO	2006	99	96	195	51
BLM CFO	2007	58	87	145	40
Anadarko	2016	15	25	40	38
Anadarko	2017	24	27	51	47
Anadarko	2018	1	61	62	2
DEV Robbins Unit	2018	18	60	78	23

Table 3.18-5 Non-Eagle Raptor Nest Activity in the Project Area

Data Source	***Year***	***Used Nests***	***Unused Nests***	***Total Nests of Known Status***	***Percent Use***
Devon Crow Unit	***2018***	***8***	***55***	***63***	***13***
Devon Sheldon Draw Unit	***2018***	***11***	***19***	***30***	***37***
HWA	***2016***	***4***	***39***	***43***	***9***
HWA	***2018***	***1***	***41***	***42***	***2***
Totals		***310***	***625***	***935***	***310/935 = 33%***

Source: BLM 2018; Operator Group 2018.

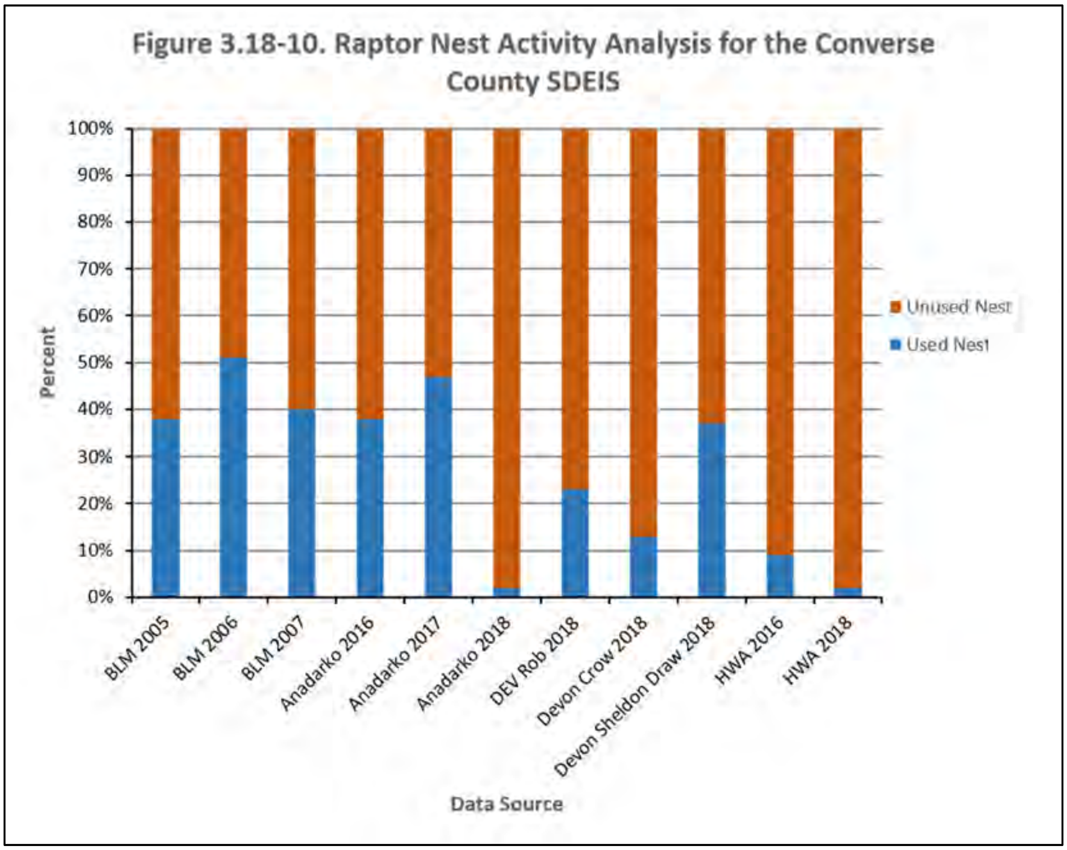

Figure 3.18-10 ***Raptor Nest Activity Analysis for theConverse County SDEIS***

The BLM and OG datasets had a variety of problems, primarily variation in protocol, how definitions were applied to nest status, and only conducting single nest-site visits within a year. These variations in protocol, definitions, and single site visits limited the type of nesting raptor definitions and statistical analysis that could be employed. In 2018, Carlisle et al. published the results of a 9-year longitudinal study of nesting raptors in the Powder River Basin. The Carlisle dataset had similar limitations with single nest visits that the BLM and OG datasets had, as such the Carlisle et al. (2018a) methodology was incorporated into the CCPA data analysis. Carlisle et al. annual use-rate calculations for the 9 years of survey data produced an annual nest use rate of 29 percent, similar to the observed CCPA nest-use rate of 33 percent. There was considerable

range in the nest-use rate between CCPA datasets, ranging from 2 percent from the OG datasets to 51 percent in the BLM dataset. The wide range in nest-use could be due to reasons such as geographic subsampling and human disturbances. The OG datasets were sampled in discrete areas where prey availability, natural population cycles, differences in local weather patterns, the number and type of nesting substrates, and natural and human disturbances could vary over time. This variation could lead to the differences in observed nest-use. Similarly, Oil and Gas development along with other disturbances may have suppressed some numbers due to the increased activity in later years. These disturbances could represent long-term impacts that limit nesting potential in the CCPA (USFWS 2019). Oil and gas development combined with other types of human disturbance could lead to population level declines in the northern Great Plains Badlands and Prairies region (USFWS 2019).

While the observed nest use rate was 33 percent, there are multiple reasons why it could be beneficial to utilize the higher nest use rate of 51 percent. The first is that this analysis focused on use rate of individual nests; whereas ferruginous and red-tailed hawks are known to visit and repair clusters of nests in their territory before the selection of one for laying eggs (Bent 1937; Olendorff 1973; Powers 1981; Smith and Murphy 1972). If any nests that were considered unused were found to be part of one of these clusters then the proportion of used nests would increase causing the nest use rate to approach 50 percent. A higher nest use rate would provide an allowance for species that are generally underrepresented in nest surveys such as kestrels and owl, whose small size and secretive nature make them hard to detect. Utilizing a higher nesting use rate would compensate for impacts to these species.

USFWS Birds of Conservation Concern

A species list for BCC was developed by the USFWS as a result of a 1988 amendment to the Fish and Wildlife Conservation Act. This Act mandated that the USFWS “identify species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the Endangered Species Act of 1973.” The goal of the BCC list is to prevent or remove the need for additional ESA bird listings by implementing proactive management and conservation actions, and that these species would be consulted on in accordance with EO 13186. The migratory bird analysis area falls within the Bird Conservation Region 17, B***a***dlands and Prairies (USFWS 2008). A total of 27 species designated as BCC have potential to occur in the analysis area (**Table 3.18-*6***).

Species of Greatest Conservation Need

In 2017, the WGFD updated the Wildlife Action Plan for the state. As part of this update, the list of SGCN was revised. A total of 65 avian species considered to be SGCN have potential to occur in the CCPA, including 3 SGCN Tier I, 52 SGCN Tier II, and 11 SGCN Tier III species (**Table 3.18-*6***).

Forest and Woodland Species

Upland forests and woodlands (identified for the Project as the conifer vegetation type) comprise approximately 11,240 acres (1 percent) of the CCPA and 20,305 acres (1 percent) of the migratory bird analysis area. As presented in **Table 3.18-*6*** and **Appendix F**, a total of 21 special status avian species are known to utilize upland forest and woodland communities for nesting, foraging, migration, or winter habitat. These species either have been documented in the analysis area or have a likelihood of occurrence based on the availability of suitable forest woodland habitat, the geographic range of the species, and the estimated abundance of the species in Wyoming (Faulkner 2010; WYNDD 2017). SGCN considered highly associated with upland forest and woodland habitats (including juniper) include: ash-throated flycatcher, black-throated gray warbler, Clark’s nutcracker, flammulated owl, great gray owl, Lewis’s woodpecker, northern goshawk, pygmy nuthatch, red crossbill, red-headed woodpecker, rufous hummingbird, Virginia’s warbler, and Williamson’s sapsucker.

Table 3.18-6 **BCC and SGCN Bird Species Potentially Occurring in the Migratory Bird Analysis Area**

Species[1] (Scientific Name)	Status[2]	Nesting Habitat	Foraging Habitat	Winter Habitat
American bittern (*Botaurus lentiginosus*)	BCC; SGCN Tier II	Wetland/riparian	Wetland/riparian	Migratory
American kestrel *(Falco sparverius)*	SGCN Tier III	Agricultural land, mixed shrubland, wetland/riparian Cavity nester	Agricultural land, mixed shrubland, wetland/riparian	Mostly migratory
American white pelican (*Pelecanus erythrorhynchos*)	SGCN Tier II	Wetland/riparian	Wetland/riparian	Migratory
Ash-throated flycatcher (*Myiarchus cinerascens*)	SGCN Tier II	Conifer (Juniper) Forest	Conifer (Juniper) Forest	Migratory
Baird's sparrow (*Ammodramus bairdii*)	BCC; SGCN Tier II	Grassland	Grassland	Migratory
Bald eagle (*Haliaeetus leucocephalus*)	BCC; SGCN Tier II	Wetland/riparian	Primarily wetland/riparian, although species will scavenge in a variety of other habitats	Wetland/riparian
Black tern (*Chlidonias niger*)	SGCN Tier II	Wetland/riparian	Wetland/riparian	Migratory
Black-billed cuckoo (*Coccyzus erythropthalmus*)	BCC; SGCN Tier II	Wetland/riparian	Wetland/riparian	Migratory
Black-crowned night-heron (*Nycticorax nycticorax*)	SGCN Tier II	Wetland/riparian	Wetland/riparian	Migratory
Black rosy-finch (*Leucosticte atrata*)	SGCN Tier II	Barren/sparsely vegetated (cliffs and rocky outcrops)	Grassland	Grassland
Black-throated gray warbler (*Setophaga nigrescens*)	SGCN Tier II	Conifer (Juniper) forest	Conifer (Juniper) forest	Migratory
Blue-gray gnatcatcher (*Polioptila caerulea*)	SGCN Tier III	Conifer (Juniper) forest; wetland/riparian	Conifer (Juniper) forest; wetland/riparian	Migratory
Blue grosbeak (*Passerina caerulea*)	SGCN Tier III	Wetland/riparian	Wetland/riparian	Migratory
Bobolink (*Dolichonyx oryzivorus*)	SGCN Tier II	Grassland	Grassland	Migratory

Table 3.18-6 BCC and SGCN Bird Species Potentially Occurring in the Migratory Bird Analysis Area

Species[1] (Scientific Name)	Status[2]	Nesting Habitat	Foraging Habitat	Winter Habitat
Brewer's sparrow (*Spizella breweri*)	BCC; SGCN Tier II	Sagebrush shrubland	Sagebrush shrubland	Migratory
Burrowing owl (*Athene cunicularia*)	BCC; SGCN Tier I	Agricultural land; barren/sparsely vegetated; grassland; mixed shrubland; sagebrush shrubland	Agricultural land; barren/sparsely vegetated; grassland; mixed shrubland; sagebrush shrubland	Migratory
Calliope hummingbird (*Selasphorus calliope*)	SGCN Tier II	Conifer forest	Wetland/riparian	Migratory
Canyon wren (*Catherpes mexicanus*)	SGCN Tier III	Barren/sparsely vegetated	Barren/sparsely vegetated	Barren/sparsely vegetated
Caspian tern (*Hydroprogne caspia*)	SGCN Tier II	Wetland/riparian	Wetland/riparian	Migratory
Cattle egret (*Bubulcus ibis*)	SGCN Tier II	Wetland/riparian	Agricultural land	Migratory
Chestnut-collared longspur (*Calcarius ornatus*)	BCC; SGCN Tier II	Grassland	Grassland	Migratory
Clark's grebe (*Aechmophorus clarkia*)	SGCN Tier II	Wetland/riparian	Wetland/riparian	Migratory
Clark's nutcracker (*Nucifraga Columbiana*)	SGCN Tier II	Conifer forest	Conifer forest	Conifer forest
Common loon (*Gavia immer*)	SGCN Tier I	Wetland/riparian	Wetland/riparian	Migratory
Common nighthawk (*Chordeiles minor*)	SGCN Tier III	Conifer forest, grassland, mixed shrubland, sagebrush shrubland	Conifer forest, grassland, mixed shrubland, sagebrush shrubland	Migratory
Common yellowthroat (*Geothlypis trichas*)	SGCN Tier III	Wetland/riparian	Wetland/riparian	Migratory
Dickcissel (*Spiza americana*)	BCC; SGCN Tier II	Agricultural land; grassland	Agricultural land; grassland	Migratory

Table 3.18-6 BCC and SGCN Bird Species Potentially Occurring in the Migratory Bird Analysis Area

Species[1] (Scientific Name)	Status[2]	Nesting Habitat	Foraging Habitat	Winter Habitat
Ferruginous hawk (*Buteo regalis*)	BCC; SGCN Tier II	Barren/sparsely vegetated (cliffs and rocky outcrops)	Agricultural land; grassland; mixed shrubland; sagebrush shrubland	Migratory
Flammulated owl (*Psiloscops flammeolus*)	SGCN Tier III	Conifer forest	Conifer forest	Migratory
Forster's tern (*Sterna forsteri*)	SGCN Tier II	Wetland/riparian	Wetland/riparian	Migratory
Franklin's gull (*Leucophaeus pipixcan*)	SGCN Tier II	Wetland/riparian	Agricultural land, wetland/riparian	Migratory
Golden eagle (*Aquila chrysaetos*)	BGEPA; BCC; SGCN Tier II	Barren/sparsely vegetated (cliffs and rocky outcrops)	Agricultural land; grassland; mixed shrubland; sagebrush shrubland	Agricultural land; grassland; mixed shrubland; sagebrush shrubland
Grasshopper sparrow (*Ammodramus savannarum*)	BCC; SGCN Tier II	Grassland	Grassland	Migratory
Great blue heron (*Ardea Herodias*)	SGCN Tier II	Wetland/riparian	Wetland/riparian	Migratory
Great gray owl (*Strix nebulosi*)	SGCN Tier II	Conifer forest	Conifer forest	Conifer forest
Greater sage-grouse (*Centrocercus urophasianus*)	SGCN Tier II	Sagebrush shrubland	Sagebrush shrubland	Sagebrush shrubland
Harlequin duck (*Histrionicus histrionicus*)	SGCN Tier II	Wetland/riparian	Wetland/riparian	Migratory
Horned grebe (*Podiceps auritus*)	BCC	Wetland/riparian	Wetland/riparian	Migratory
Lewis's woodpecker (*Melanerpes lewis*)	BCC; SGCN Tier II	Conifer forest; wetland/riparian	Conifer forest; wetland/riparian	Conifer forest; wetland/riparian areas
Loggerhead shrike (*Lanius ludovicianus*)	BCC; SGCN Tier II	Agricultural land, mixed shrubland, sagebrush shrubland, wetland/riparian	Agricultural land, mixed shrubland, sagebrush shrubland, wetland/riparian	Migratory

Table 3.18-6 BCC and SGCN Bird Species Potentially Occurring in the Migratory Bird Analysis Area

Species[1] (Scientific Name)	Status[2]	Nesting Habitat	Foraging Habitat	Winter Habitat
Long-billed curlew (*Numenius americanus*)	BCC; SGCN Tier II	Grassland	Agricultural land; grassland; wetland/riparian	Migratory
MacGillivray's warbler (*Geothlypis tolmiei*)	SGCN Tier II	Wetland/riparian	Wetland/riparian	Migratory
Marbled godwit (*Limosa fedoa*)	BCC	Migratory	Wetland/riparian	Migratory
McCown's longspur (*Calcarius mccownii*)	BCC; SGCN Tier II	Grassland	Grassland	Migratory
Merlin (*Falco columbarius*)	SGCN Tier III	Agricultural land; conifer; grassland; wetland/riparian	Agricultural land; conifer; grassland; wetland/riparian	Migratory
Mountain plover (*Charadrius montanus*)	BCC; SGCN Tier I	Barren/sparsely vegetated; grassland	Barren/sparsely vegetated; grassland	Migratory
Northern goshawk (*Accipiter gentilis*)	SGCN Tier I	Conifer forest Specific microhabitats required for nesting	Conifer forest	Conifer forest
Peregrine falcon (*Falco peregrinus*)	BCC; SGCN Tier II	Barren/sparsely vegetated (cliffs and rocky outcrops)	Agricultural land, grassland; mixed shrubland; sagebrush shrubland; wetland/riparian	Migratory
Pinyon jay (*Gymnorhinus cyanocephalus*)	BCC	Conifer forest (Juniper)	Conifer forest (Juniper)	Conifer forest (juniper)
Prairie falcon (*Falco mexicanus*)	BCC	Barren/sparsely vegetated (cliffs and rocky outcrops)	Agricultural land, grassland; mixed shrubland; sagebrush shrubland	Agricultural land, grassland; mixed shrubland; sagebrush shrubland
Pygmy nuthatch (*Sitta pygmaea*)	SGCN Tier II	Conifer forest	Conifer forest	Conifer forest
Red crossbill (*Loxia curvirostra*)	SGCN Tier II	Conifer forest	Conifer forest	Conifer forest
Red-eyed vireo (*Vireo olivaceus*)	SGCN Tier II	Wetland/riparian	Wetland/riparian	Migratory

Table 3.18-6 BCC and SGCN Bird Species Potentially Occurring in the Migratory Bird Analysis Area

Species[1] (Scientific Name)	Status[2]	Nesting Habitat	Foraging Habitat	Winter Habitat
Red-headed woodpecker (*Melanerpes erythrocephalus*)	BCC; SGCN Tier II	Conifer forest, wetland/riparian	Conifer forest, wetland/riparian	Migratory
Rufous hummingbird (*Selasphorus rufus*)	SGCN Tier II	Conifer forest, grassland, mixed shrubland, wetland/riparian	Conifer forest, grassland, mixed shrubland, wetland/riparian	Migratory
Sagebrush sparrow (*Amphispiza nevadensis*)	BCC; SGCN Tier II	Sagebrush shrubland	Sagebrush shrubland	Migratory
Sage thrasher (*Oreoscoptes montanus*)	BCC; SGCN Tier II	Mixed shrubland; sagebrush shrubland	Mixed shrubland; sagebrush shrubland	Migratory
Short-eared owl (*Asio flammeus*)	BCC; SGCN Tier II	Grassland	Agricultural land; grassland; wetland/riparian	Agricultural land; grassland; wetland/riparian
Snowy egret (*Egretta thula*)	SGCN Tier II	Wetland/riparian	Wetland/riparian	Migratory
Swainson's hawk (*Buteo swainsoni*)	BCC; SGCN Tier II	Agricultural land; grassland; mixed shrubland; sagebrush shrubland	Agricultural land; grassland; mixed shrubland; sagebrush shrubland	Migratory
Trumpeter swan (*Cygnas buccinator*)	SGCN Tier II	Wetland/riparian areas	Wetland/riparian areas	Migratory
Upland sandpiper (*Bartramia longicauda*)	BCC; SGCN Tier II	Grassland	Grassland	Migratory
Virginia rail (*Rallus limicola*)	SGCN Tier III	Wetland/riparian	Wetland/riparian	Migratory
Virginia's warbler (*Oreothlypis virginiae*)	SGCN Tier II	Conifer forest, mixed shrubland	Conifer forest, mixed shrubland	Migratory
Western grebe (*Aechmophorus occidentalis*)	SGCN Tier II	Wetland/riparian	Wetland/riparian	Migratory
White-faced ibis (*Plegadis chihi*)	SGCN Tier II	Wetland/riparian	Wetland/riparian	Migratory
Williamson's sapsucker (*Sphyrapicus thyroideus*)	SGCN Tier II	Conifer forest	Conifer forest	Migratory

Table 3.18-6 BCC and SGCN Bird Species Potentially Occurring in the Migratory Bird Analysis Area

Species[1] (Scientific Name)	Status[2]	Nesting Habitat	Foraging Habitat	Winter Habitat
Willow flycatcher (*Empidonax traillii*)	SGCN Tier III	Wetland/riparian	Wetland/riparian	Migratory
Yellow-billed cuckoo (eastern) (*Coccyzus americanus*)	SGCN Tier II	Mixed shrubland; wetland/riparian	Mixed shrubland; wetland/riparian	Migratory

[1] These species also may be considered ESA listed, BLM sensitive, and/or USFS sensitive species, which are discussed in Section 3.18.3, Special Status Wildlife Species.

[2] Status: BCC = USFWS Bird of Conservation Concern; SGCN Tier I, II, III = Species of Greatest Conservation Need, Wyoming State Wildlife Action Plan.

Source: Baicich and Harrison 2005; BLM 2010a; Cornell Lab of Ornithology 2015; Faulkner 2010; Orabona et al. 2012; Sauer et al. 2014; USFS 2013a, no date; USFWS 2014c, 2008; WGFD 2017d, 2010; WISDOM 2012; WYNDD 2017.

Grassland Species

Approximately 995,706 acres (66 percent) of the CCPA and 1,370,493 acres (62 percent) of the migratory bird analysis area is comprised of grassland habitat. A variety of avian species utilize grassland communities for nesting, foraging, or winter habitat including 22 special status avian species (**Table 3.18-*6*** and **Appendix F**). These species either have been documented in the analysis area or have a likelihood of occurrence based on the availability of suitable grassland habitat, the geographic range of the species, and estimated abundance of the species in Wyoming (Faulkner 2010; WYNDD 2017). SGCN considered highly associated with grassland habitat include: Baird's sparrow, black rosy-finch, bobolink, burrowing owl, chestnut-collard longspur, dickcissel, grasshopper sparrow, long-billed curlew, McCown's longspur, mountain plover, short-eared owl, Swainson's hawk, and upland sandpiper.

The black rosy-finch has specific alpine tundra habitat requirements that do not correspond entirely with the grassland vegetation community identified for the Project.

Sagebrush Shrubland Species

Sagebrush shrublands comprise 330,463 acres (22 percent) of the CCPA and 531,791 acres (24 percent) of the migratory bird analysis area. As presented in **Table 3.18-*6*** and **Appendix F**, a total of 12 special status avian species are known to utilize sagebrush communities for nesting, foraging, migration, or winter habitat. These species either have been documented in the analysis area or have a likelihood of occurrence based on the availability of suitable sagebrush shrubland habitat, the geographic range of the species, and estimated abundance of the species in Wyoming (Faulkner 2010; WYNDD 2017). A total of four SGCN would be considered highly associated with sagebrush shrubland habitat: Brewer's sparrow, greater sage-grouse, sagebrush sparrow, and sage thrasher. Greater sage-grouse is analyzed in Section 3.18.3, Special Status Species.

Wetland and Riparian Species

The CCPA includes both herbaceous and forested wetlands/riparian communities that flank intermittent streams, reservoirs, stock water ponds, and some perennial waterways. The North Platte River is partially within the CCPA and provides important avian habitat. These vegetation communities comprise approximately 9,108 acres (1 percent) of the overall CCPA and 21,593 acres (1 percent) of the migratory bird analysis area. As presented in **Table 3.18-*6*** and **Appendix F**, a total of 42 special status avian species are known to utilize riparian and wetland habitats for nesting, foraging, or winter habitat. These species either have been documented in the analysis area or have a likelihood of occurrence based on the availability of suitable wetland and riparian habitat, the geographic range of the species, and estimated abundance of the species in Wyoming (Faulkner 2010; WYNDD 2017). SGCN considered highly associated with wetland and riparian habitats include: American bittern, American white pelican, bald eagle, black tern, black-billed cuckoo, black-crowned night-heron, blue-gray gnatcatcher, glue grosbeak, Caspian tern, cattle egret, Clark's grebe, common loon, common yellowthroat, Forster's tern, Franklin's gull, great blue heron, Harlequin duck, long-billed curlew, red-eyed vireo, red-headed woodpecker, snowy egret, trumpeter swan, Virginia rail, western grebe, white-faced ibis, willow flycatcher, and yellow-billed cuckoo.

Species Associated with Prairie Dog Colonies

Several migratory bird species including mountain plover, burrowing owl, ferruginous hawk, and golden eagle utilize prairie dog colonies. Mountain plovers prefer the bare ground habitat associated with prairie dog colonies. The burrowing owl inhabits prairie dog burrows for nesting and shelter. Prairie dogs colonies provide concentrated areas of primary prey species for species such as ferruginous hawks and golden eagles. There are 15,825 acres of black-tailed prairie dog colony habitat in the CCPA and 48,672 within the analysis area (BLM 2014a).

Migratory Bird Breeding Seasons

Many migratory bird species are sensitive to disturbance during the breeding season. During the breeding season, the integrity of the nest and foraging habitat used by adult birds is crucial to survival of young. In addition, young birds are at greater risk of predation during the nestling period and immediately post-fledging, when their motor skills and foraging behaviors are developing. Consequently, the majority of measures to protect birds involve avoidance of construction activities in the immediate vicinity of nests to reduce potential impacts during the breeding season.

Although most bird species have relatively well-defined breeding seasons, information for some species-specific breeding periods remains unavailable. Typically, the breeding season has evolved to coincide with the abundance of critical resources, such as food or nesting material, that allow the young sufficient time to reach independence before winter. For example, great horned owls breed very early in the year so that the critical period of greatest food need by the nestlings coincides with the period when small mammal populations are high (Johnsgard 2002). Conversely, cedar waxwings breed late in the summer when berries, a dietary staple, are abundant (Witmer et al. 2014).

The timing and duration of the breeding season is species-specific and may vary according to latitude, elevation, and climatic conditions. Weather and day lengths are major determinants of the nesting season; therefore, breeding generally occurs later in higher latitudes of a species' range (Baicich and Harrison 2005).This trend also applies to higher elevations, where snow and cold temperatures remain longer than at lower elevations. In areas with substantial elevation gradients, the breeding season for a given species may be prolonged. In addition, many species have extended breeding periods because they may produce two or even three clutches each year.

In general, large avian species (e.g., raptors) have prolonged periods of development when the young remain in the nest and are dependent upon the parents. Other species, such as upland game birds, may leave the nest within hours of hatching and forage with their parents long before they can fly. Small songbirds remain in the nest until they can fly; however, their development often is so rapid that the adults may complete the entire nesting cycle in 1 month or less. The duration of incubation and nestling periods is well established and can be predicted within a few days for most avian species.

Raptors typically produce one clutch per year and many exhibit high fidelity to nest sites and nesting territories (Romin and Muck 2002). For this reason, raptor nests are identified and monitored by a variety of agencies and organizations.

3.18.3 Special Status Wildlife Species

This subsection presents a description of special status terrestrial wildlife species resources within the analysis area, including special status migratory bird species. Special status aquatic species are addressed in Section 3.18.5. Special status terrestrial species include the following:

- Federally listed species, which are those taxa listed as endangered, threatened, proposed, or candidate by the USFWS, pursuant to the Federal ESA of 1973 (50 CFR 17.11).
- BLM sensitive species, which are species requiring special management consideration to promote their conservation and reduce the likelihood and need for future listing under the ESA, are designated as BLM sensitive by the Wyoming State Director, and are listed and tracked within each field office (BLM Manual 6840).
- USFS Region 2 sensitive species, which the Regional Forester for the Rocky Mountain Region has designated for development and implementation of conservation strategies for sensitive species and their habitats in coordination with other USFS units, managing agencies, and landowners.

3.18.3.1 Regulatory Background

Special status species are those species for which state or federal agencies afford an additional level of protection by law, regulation, or policy. Included in this category are federally listed species that are protected under the ESA and species designated as sensitive by the BLM and USFS. In addition, there are state wildlife species of greatest conservation need lists for Wyoming found within the State Wildlife Action Plan (WGFD 2017d, 2010a) and Wyoming Game and Fish Commission's Chapter 52 that includes nongame wildlife regulation for the state declared within Wyoming State Statutes, Title 23, and include many of the BLM and USFS sensitive species as well as ESA listed species.

Laws, regulations, policies, and IMs that directly influence special status wildlife management decisions for the Project primarily are implemented by the BLM, USFWS, USFS, and the WGFD. BLM IMs are directives that supplement the BLM Manual sections and handbooks and contain new policies or procedures that must reach employees quickly, interpret existing policies, or provide instruction. In addition to those discussed for terrestrial wildlife (Section 3.18.1.1), the following regulations, legal requirements, and policies provide protection for terrestrial wildlife occurring in the CCPA.

- Endangered Species Act of 1973;
- BLM Special Status Species Management Policy 6840 (6840 Policy) (Rel. 6-125);
- USFS Manual (FSM) 2670;
- Record of Decision and Approved Resource Management Plan Amendment for Greater Sage-Grouse (BLM 2015b);
- USFS 2015 Greater Sage-grouse Record of Decision for Northwest Colorado and Wyoming and Land Management Plan Amendments for the Routt National Forest, Thunder Basin National Grassland, Bridger-Teton National Forest, and Medicine Bow National Forest;
- BLM IMs 2012–044, 2010-027, WO IM-2010-156, and WY-2013-005;
- BLM Memorandum of Understanding WO-230-2010-04;
- Wyoming Game and Fish Commission Chapter 52 Nongame Wildlife Regulations; and
- State of Wyoming EO ***2019-3***.

<u>Federal Regulations</u>

Endangered Species Act

Federal regulations regarding the protection of special status species and their critical habitats are overseen by USFWS, which maintains a list of all threatened, endangered, proposed, or candidate species pursuant to the ESA of 1973. In accordance with the ESA, as amended, the lead agency (BLM) in coordination with the USFWS must ensure that any action they authorize, fund, or carry out would not adversely affect a federally listed threatened or endangered species. Take of species protected under the ESA, which are incidental to a lawful activity may be exempted through formal consultation under section 7(a)(2) of the ESA whenever a federal agency, federal funding, or a federal permit is involved. It is a violation of Federal law to take listed species or their habitat without appropriate permits even if the take is accidental. An incidental take permit may be obtained under section 10(a)(1)(B) of the ESA upon completion of a satisfactory Habitat Conservation Plan (HCP) for a listed species. There is no mechanism for exempting or authorizing incidental take after it has already occurred.

BLM and USFS Sensitive Species

The Wyoming BLM and USFS Region 2 maintain sensitive species lists that include species of conservation interest for these agencies. These lists are monitored and protected to ensure that federal actions do not result in an ESA listing of those species. Each BLM field office coordinates with the State

Office, which maintins the BLM Wyoming Sensitive Species List (IM WY 2010-027). USFS sensitive species lists are maintained at the regional level.

The BLM Special Status Species Management Policy 6840 (6840 Policy) (Rel. 6-125) "provides policy and guidance, consistent with appropriate laws, for the conservation of special status species of plants and animals, and the ecosystems upon which they depend. These are species which are proposed for listing, officially listed as threatened or endangered, or are candidates for listing as threatened or endangered under the provisions of the ESA; those listed by a State in a category such as threatened or endangered implying potential endangerment or extinction; and those designated by each State Director as sensitive. Conservation in this section and pursuant to the ESA means the use of all methods and procedures which are necessary to improve the status of federally listed species and their habitats to a point where the provisions of the ESA are no longer necessary. Conservation of special status species means the use of all methods and procedures which are necessary to improve the condition of special status species and their habitats to a point where their special status recognition is no longer warranted."

The FSM 2670 requires analysis of potential impacts to sensitive species; those species for which the Regional Forester has identified population viability is a concern. FSM 2670 states: "Sensitive species of native plant and animal species must receive special management emphasis to ensure their viability and to preclude trends toward endangerment that would result in the need for Federal listing."

State Regulations

In addition to the ***WGFD Strategic Habitat Plan (WGFD 2009) and the*** State Wildlife Action Plan (WGFD 2017d, 2010a) ***that*** includes the list of SGCN, the Wyoming Game and Fish Commission established regulations that govern the take of nongame wildlife species in Wyoming (Chapter 52). These regulations ***and policies*** serve to protect ***game and*** nongame amphibians, reptiles, birds, crustaceans, fish, mammals, and mollusks***, and essential habitats. The WGFD is directed by the Wyoming Game and Fish Commission to recommend the following mitigation measures for these wildlife and habitat resources that fall into categories of vital, high, and moderate values (WGFC 2016):***

- ***No significant declines in species distribution or abundance or loss of habitat function within vital habitats (e.g., greater sage-grouse PHMA, wetlands, and habitats essential for Tier 1 SGCN).***
- ***No net long-term loss of habitat function or species distribution or abundance within high value habitats (e.g., big game winter-yearlong range, and riparian habitat, and habitats associated with Tier II SGCN).***
- ***No large-scale loss, or cumulative loss, of landscape habitat function within moderate value habitats (e.g., other big game seasonal ranges and habitats associated with Tier II SGCN).***

In addition, the foundation for greater sage-grouse management in Wyoming was established by the Governor's EO 2011-05, Greater Sage-Grouse Core Area Protection (Core Area Strategy). On July 29, 2015, the State of Wyoming issued EO ***2019-3***, which replaced EO 2011-5***,*** EO 2013-3***, and EO 2015-4***. The WGFD assists in implementing EO ***2019-3*** along with other state agencies as well as local and federal partners.

3.18.3.2 Information Sources

In addition to the information sources listed in Section 3.18.1.2, a list of species for the Project and their potential for occurring within the CCPA (as identified in **Appendix F**) and information regarding special status terrestrial species and habitats was obtained from a review of existing published sources including:

- USFWS IPaC system;
- WYNDD spatial data and Species Assessments;
- USFS Region 2 Technical Conservation Assessments for Forest Sensitive Species;
- WGFD greater sage-grouse lek data and habitat delineations;
- Wyoming Wildlife Action Plan (WGFD 2017d, 2010a); and
- Wyoming Interagency Spatial Database (WISDOM).

Special status species were considered as having potential to occur within the analysis area if occurrence has been documented for the species, the species geographic range currently exists within the analysis area, and/or suitable habitat is present.

3.18.3.3 Special Status Wildlife Analysis Area

The analysis area for the majority of the special status wildlife is the same as described for general wildlife in Section 3.18.1 and is based upon suitable habitat within the HUC-12 units crossed by the CCPA. In addition, the Preble's meadow jumping mouse analysis area includes WYNDD modeled habitat within the CCPA plus a 1-mile buffer, and the greater sage-grouse analysis area includes the CCPA plus a 4-mile buffer. Existing disturbance to greater sage-grouse leks and breeding habitats are analyzed within the DDCT assessment areas developed for the Project that includes a 4-mile buffer around all occupied leks within 4 miles of the CCPA and within PHMA.

3.18.3.4 Federally Listed, Proposed, and Candidate Wildlife Species

Five federally listed, proposed, and candidate species potentially occurring within or downstream of the CCPA (**Appendix F**) and carried forward for detailed analysis are discussed in detail in the following sections. Two terrestrial wildlife species within the CCPA are on the ESA species list issued by USFWS for Converse County. These included Preble's meadow jumping mouse (threatened) and black-footed ferret (endangered). Additionally, three wildlife species that are not known to occur in the CCPA, but do occur in the downstream riparian habitats of the North Platte River in Nebraska and could be adversely affected by North Platte River water depletions resulting from project-related activities. These include the piping plover (*Charadrius melodus*), which is threatened, and two endangered species, the interior least tern (*Sterna antillarum*) and the whooping crane (*Grus americana*).

<u>Preble's Meadow Jumping Mouse (Threatened)</u>

The Preble's meadow jumping mouse is federally listed as a threatened species under the ESA. The species was proposed for delisting; however, USFWS determined that current scientific evidence indicated that removing the Preble's meadow jumping mouse from the Federal Endangered and Threatened Wildlife List was not warranted (78 FR 31679).

Preble's meadow jumping mouse is a small rodent that inhabits well-developed riparian habitat with adjacent, relatively undisturbed grassland communities near water and seems to prefer streamside habitats with structural diversity, including a dense herbaceous understory, shrubs, and trees (68 FR 37276). This species occurs in southeast Wyoming, and previous designation of critical habitat for the mouse in Wyoming was not reinstated in August 2011 (76 FR 47490). Major threats to this species include intensive grazing, human development, and the associated increase in predators that benefit directly or indirectly from human habitation and conversion of native riparian habitat to agricultural land (Smith et al. 2004).

As described above, the analysis area for WYNDDs suitable habitat predictive model for this species includes a 1-mile buffer around the CCPA. There are approximately 8,403 acres of potentially suitable habitat in the analysis area, present along the North Platte River and La Prele Creek located at the far southern extent of the CCPA, near the Town of Douglas (**Figure 3.18-*11***).

A recent WGFD survey did not detect any individuals at five locations that were conducted in suitable habitat along the North Platte River in Converse County (WGFD 2013a). However, individuals have been confirmed in the analysis area south of I-25 near the Town of Douglas and one individual was documented within the CCPA in 1999 (WISDOM 2014). Long-term trapping studies for Preble's meadow jumping mouse have been difficult to implement. Population estimate studies have occurred at a few sites in Colorado; however, no long-term trapping studies have been conducted in Wyoming, which limits the understanding of population densities in this state (78 FR 31680).

Black-footed Ferret (Nonessential Experimental)

Historical observations of black-footed ferrets were recorded within the analysis area prior to 1985, but there have been no documented occurrences since (WISDOM 2012). The black-footed ferret is the only ferret species native to North America, with a distribution and persistence intricately linked to the distribution and presence of prairie dog (*Cynomys* spp.) colonies. The black-footed ferret preys almost exclusively on prairie dogs and relies on their colonies for shelter, hunting sites, and parturition sites. Historically, the black-footed ferret range included much of the Western Great Plains, extending north into Canada and as far south as Texas and Arizona. In Wyoming, the black-footed ferret was found in black-tailed (*C. ludovicianus*) and white-tailed (*C. leucurus*) prairie dog colonies, which are commonly found in semi-desert and short- to mid-grass prairies (Esch et al. 2005). USFWS suggests that 225 acres of black-tailed prairie dog habitat is required to support one female black-footed ferret (USFWS 2013b).

In March 2013, USFWS (USFWS 2004a) block-cleared both black- and white-tailed prairie dog towns throughout the State of Wyoming, thereby ceasing to recommend surveys for black-footed ferret and relaxing the requirements of consultation with USFWS under Section 7 of the ESA (USFWS 2004a). USFWS determined that wild endangered black-footed ferret populations do not exist outside of the experimental reintroduced population of ferrets in the Shirley Basin/Medicine Bow Management Area (i.e., outside of the CCPA). Therefore, ferrets in Wyoming are considered part of a nonessential experimental population, which are treated similarly as a proposed species for regulatory purposes.

There are 15,825 acres of black-tailed prairie dog colony habitat in the CCPA and 48,672 in the analysis area (BLM 2014a). The USFWS recommends that project proponents and federal action agencies protect all prairie dog towns or complexes for their value to the prairie ecosystem and the many species that rely on them. USFWS also recommends that potentially disturbed prairie dog towns be evaluated for their value to future black-footed ferret reintroduction (USFWS 2004a).

A prairie dog complex of approximately 3,000 acres exists in the 5,980-acre Cheyenne River Zoological Special Interest Area in the TBNG (approximately 10 miles from the CCPA boundary), which provides potential black-footed ferret habitat. Any development in the vicinity of this special interest area must be evaluated for adverse effects on black-footed ferret reintroduction objectives at the area (USFS 2006d). Additionally, the TBNG has a 45,469-acre Black-Footed Ferret Reintroduction Habitat Management Area (MA 3.63) set aside for reintroduction that contains a 15,508-acre prairie dog complex located outside the CCPA but within the HUC-12 analysis area. Approximately 63 acres of MA 3.63 overlaps with the analysis area on the TBNG.

3.18.3.5 BLM and USFS Sensitive Species

The USFS Region 2 has identified 15 sensitive mammals, 1 sensitive non-migratory bird, and 4 sensitive terrestrial invertebrate species for the Project. Two of the USFS sensitive species, the greater sage-grouse and the black-tailed prairie dog, also are considered MIS for the TBNG. Five of the USFS sensitive mammals also are designated as BLM sensitive. **Appendix F** lists the BLM and USFS sensitive species that were considered for analysis. The BLM has identified seven sensitive mammals and one sensitive non-migratory bird for the Project. The Wyoming BLM has undertaken specific management efforts toward maintaining satisfactory habitats for these species (BLM 2010a). No BLM sensitive terrestrial invertebrate species were identified for the Project.

Seven mammals, one non-migratory bird, and four terrestrial invertebrate species on the BLM Wyoming State Office and USFS Region 2 sensitive species lists have been documented within the analysis area at least once or have potential to occur based on overlapping suitable habitat.

Bats

Four special status bat species have been documented within the CCPA: fringed myotis (BLM and USFS sensitive), long-eared myotis (BLM sensitive), hoary bat (USFS sensitive), and Townsend's big-eared bat (BLM and USFS sensitive).

The fringed myotis and long-eared myotis both inhabit desert, grassland, and woodland habitats, with the latter preferring forested areas. They roost in caves, mines, rock crevices, or buildings. Long- eared myotis also roost in hollow trees. Both species hibernate in winter. Caves and mines are included in documented hibernation sites used by these species (WGFD 2010a); however, there is no potential for caves and karst in the CCPA (Epstein 2005). WYNDD (2014) has documented three fringed myotis in the CCPA and an additional 134 throughout the state. The long-eared myotis has been documented as recently as 2012 in the far southern extent of the CCPA near La Prele Reservoir (WISDOM 2012). A 2011 mist-net survey conducted by WGFD captured 26 individuals of long-eared myotis throughout the state, including captures in the southern portion of the CCPA (WGFD 2012a). The distribution of long-eared myotis is restricted in Wyoming, but it is considered common in a variety of suitable habitats (WGFD 2010). Habitat degradation and human activity around caves and abandoned mines are the major threats to both fringed myotis and long-eared myotis (WGFD 2010a).

The Townsend's big-eared bat is listed as sensitive for both USFS Region 2 and Wyoming BLM. This species' range extends throughout most of North America, including the western U.S., British Columbia, central Mexico, and the Baja Peninsula; however, it appears to be relatively uncommon throughout its range. This bat relies on cave-like structures for shelter during all portions of its life cycle. There are reports of this species occasionally using hollows in large trees or abandoned buildings, but caves and mines remain essential landscape features for this species. Reliable data on the abundance of Townsend's big-eared bat are lacking; however, there is general concurrence that there has been a downward trend in abundance of the species over the past 50 years (Gruver and Keinath 2003). The Townsend's big-eared bat forages along edge habitats (e.g., forested edges and intermittent streams), in forested habitat, along heavily vegetated stream corridors, and in open areas near wooded habitat. This species is vulnerable to mine closures, and populations are susceptible to decline due to recreational activities that impact roosting habitat. Townsend's big-eared bat populations are further affected by broad-scale insect control programs (WGFD 2017d, 2010a). Population densities and trends in the state are not well known. There has been one verified occurrence of Townsend's big-eared bat in southern Converse County since 1980. There were an additional five potential occurrences of this species prior to 1990 (Gruver and Keinath 2003). A 2011 mist-net survey of bats in eastern Wyoming did not capture any Townsend's big-eared bats within the CCPA; however, Townsend's big-eared bats are adept at avoiding capture in nets (WGFD 2012a).

The hoary bat is listed as sensitive for the USFS Region 2 and has been documented in the Medicine Bow-Routt National Forests and TBNG. The hoary bat is a long-distance migrant that is considered widespread in Wyoming during spring, summer, and fall (Griscom et al. 2012). They are solitary and roost in the foliage of deciduous and coniferous trees. Preferred habitat consists of a mixture of trees and open areas (Griscom et al. 2012). They tend to forage along forest edges. Individuals have not been documented in the wildlife analysis area; however, suitable woodland habitat exists in limited areas.

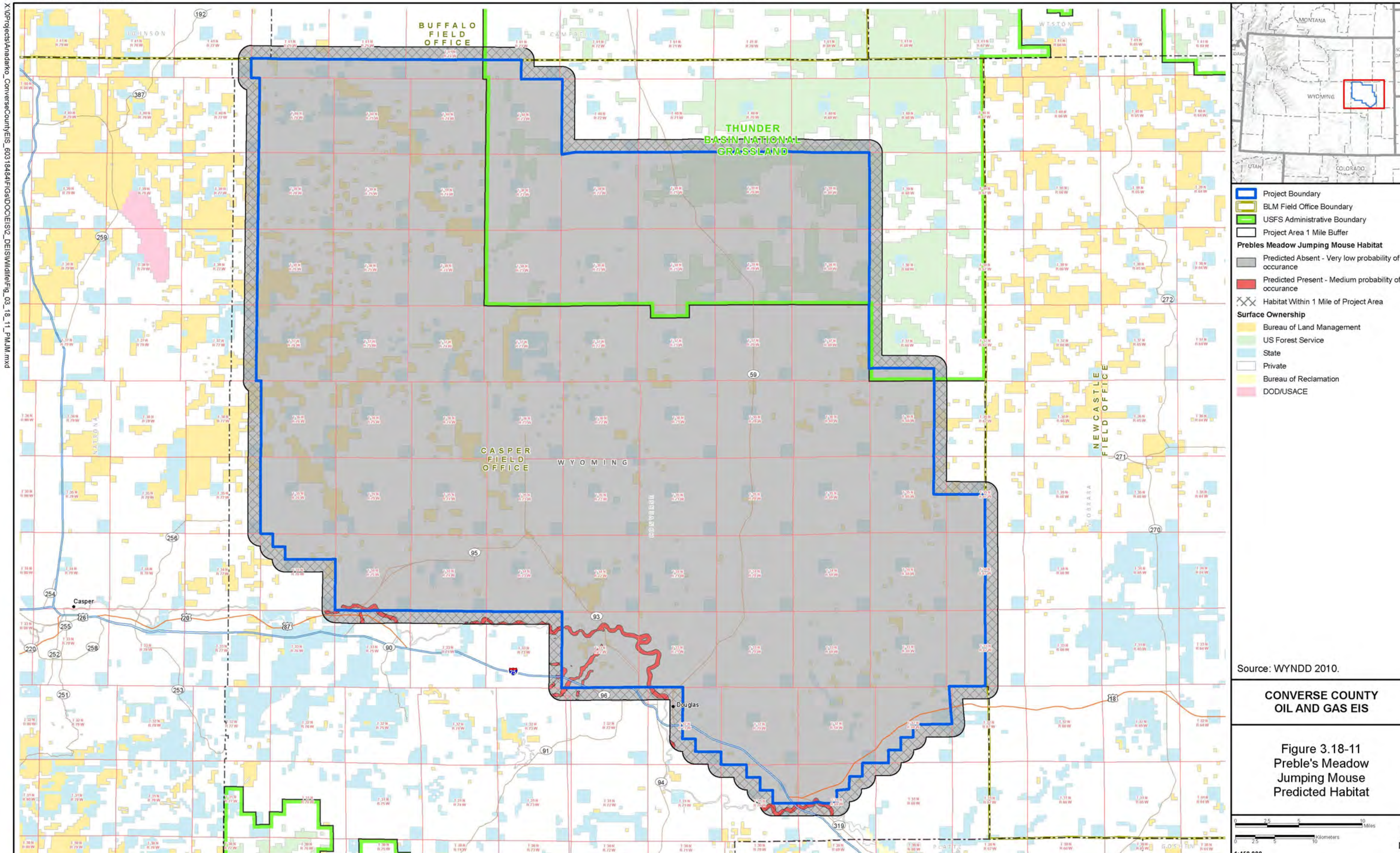

Figure 3.18-11
Preble's Meadow Jumping Mouse Predicted Habitat

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Small Mammals

In addition to the Preble's meadow jumping mouse, other small mammal special status species documented or with the potential to occur within the CCPA include: black-tailed prairie dog (BLM and USFS sensitive), Northern river otter (USFS sensitive), and swift fox (BLM and USFS sensitive).

There are 15,825 acres of black-tailed prairie dog colony habitat in the CCPA and 48,672 within the analysis area (BLM 2014a). Less than 1 percent of the black-tailed prairie dog colonies within the CCPA (less than 2 percent within the analysis area) are not active. Therefore, nearly all of the colonies are either active or of unknown status. **Figure 3.18-*12*** shows general locations for habitat and occurrences of other special status species, including the black-tailed prairie dog. In 2009, USFWS completed a status review of the black-tailed prairie dog throughout its range and determined that it does not warrant protection as a threatened or endangered species under the ESA (FR 74 63343). However, USFWS recommends that project proponents and federal action agencies protect all prairie dog colonies or complexes for their value to the prairie ecosystem and the many species that rely on them. USFWS also recommends that potentially disturbed prairie dog colonies be evaluated for their value to future black-footed ferret reintroduction (USFWS 2004b).

The USFS selected the black-tailed prairie dog as a MIS in the TBNG for low structure grasslands and the biological community of additional wildlife species that typically benefit from the expansion of prairie dog colonies (USFS 2006d). In addition, the TBNG created a Prairie Dog Management Strategy as an amendment to the TBNG LRMP in 2009 to provide for the conservation of black-tailed prairie dogs and their habitat (USFS 2009).

The range of the black-tailed prairie dog once spanned the short- and mixed-grass prairie of North American east of the Rocky Mountains from southern Canada to northern Mexico. This species still occurs over much of its historic range, although in more widely scattered colonies. Black-tailed prairie dogs occur within the eastern third of Wyoming, including Converse County and the CCPA (USFWS 2014a). The black-tailed prairie dog faces other threats such as rodent control programs, recreational shooting, and habitat alteration. This species also is vulnerable because of its habitat specificity and fidelity, territoriality and area requirements, and susceptibility to diseases such as sylvatic plague (Buseck et al. 2005).

The northern river otter has a low likelihood of occurrence within the analysis area; however, according to recent research, its range is expanding rapidly (Boyle 2006). The northern river otter historically occupied all major drainages and national forests in Wyoming, but its population decreased greatly due to unregulated trapping in the early 1900s. The northern river otter received protection from trapping in 1953, and the species has reoccupied some of its former range in the northwestern part of the state. Today, northern river otters have the potential to occur in most drainages within Wyoming, including in the southern portion of Converse County and in Medicine Bow National Forest (Boyle 2006); however, they have not been directly observed in the CCPA (WISDOM 2012). Principal threats to the northern river otter include habitat destruction and degradation and human-caused mortality (Boyle 2006).

Swift fox are most abundant in the southeastern corner of Wyoming where their population is stable. WYNDD has documented 57 swift foxes in Converse County; 969 individuals have been documented throughout the state (WYNDD 2014). The swift fox is the smallest of all canids and is adapted to living in prairie regions. At one time, the swift fox was common throughout short-grass and mid-grass prairies in North America; however, conversion of the prairie to farmland, overgrazing by livestock, and poisoning campaigns aimed at wolves reduced the population. Swift fox populations began to recover in the mid-1950s. The swift fox is extremely vulnerable to human activities such as trapping, hunting, automobiles, agricultural conversion of habitat, and prey reduction due to rodent control programs. The greatest source of mortality is predation by coyotes and raptors (Dark-Smiley and Keinath 2003). **Figure 3.18-*12*** shows general locations for habitat and occurrences of other special status species, including the swift fox.

Greater Sage-grouse

Greater sage-grouse is a BLM sensitive species and USFS Region 2 sensitive species. The greater sage-grouse was previously a candidate for listing under the ESA based on findings by USFWS in March 2010 (77 FR 70103). However, on September 22, 2015, the USFWS determined that the species does not warrant protection under the ESA and was removed from the list of candidate species. Therefore, greater sage-grouse in Wyoming continue to be managed by the WGFD. Conservation efforts for this species in Wyoming currently are coordinated by the WGFD in cooperation with the USFWS, BLM, USFS, and regional greater sage-grouse working groups in an attempt to increase population levels and avoid federal listing under the ESA. The BLM and USFS control surface use around occupied greater sage-grouse leks during sensitive time periods and manage for greater sage-grouse habitats.

In addition to its other special status designations, the greater sage-grouse is classified by the USFS as a MIS in the TBNG (USFS 2006d). The greater sage-grouse was selected as a MIS for sagebrush habitats that have tall, dense, and diverse herbaceous understories, which occur within areas with a history of lighter livestock grazing intensity. Species such as sage thrasher, Brewer's sparrow, pronghorn, and sage vole are supported by similar upland habitats.

The USFWS Greater Sage-grouse Conservation Objectives Team report (USFWS 2013) identified conservation objectives that are targeted at maintaining redundant, representative, and resilient greater sage-grouse habitats and populations. Across the greater sage-grouse range, BLM and USFS land use plans have been amended to incorporate conservation measures for the species in an effort to prevent its listing under the ESA. In June 2015, the BLM Wyoming State Office and USFS Medicine Bow and Bridger-Teton National Forests and the TBNG submitted the Wyoming Greater Sage-grouse Land Use Plan Amendments and Final EIS, which includes the lands administered by the BLM CFO and USFS TBNG. The BLM and USFS RODs were finalized in September 2015. The Wyoming Greater Sage-grouse Land Use Plan Amendments are built upon the foundation for greater sage-grouse management established by and complementary to Wyoming Governor's EO ***2019-3*** (which replaced Wyoming EO 2011-5), Greater Sage-grouse Core Area Protection Strategy, by establishing similar conservation measures and focusing restoration efforts in the same key areas most valuable to the greater sage-grouse. The State of Wyoming has coordinated with Sage-Grouse Local Working Groups and the Sage-grouse Implementation Team to identify greater sage-grouse core population areas (Core Areas) that are designed to identify habitats necessary to promote greater sage-grouse population viability and ensure stable populations persist in the face of human development (State of Wyoming EO 2011-5, Greater Sage-grouse Core Area Protection). Connectivity corridors also have been delineated to help identify habitats that are important in promoting gene flow between greater sage-grouse populations in Wyoming Core Areas and those of adjacent states.

The BLM and USFS also have updated greater sage-grouse habitat maps to include the following habitat designations:

- Priority Habitat Management Areas: BLM-managed and National Forest System lands identified as having the highest value to maintaining sustainable greater sage-grouse populations. PHMAs largely coincide with areas identified as Priority Areas for Conservation in the USFWS Conservation Objectives Team report (USFWS 2013a) and contain designated core population areas (Core Areas) and connectivity areas designated under EO ***2019-3***. In addition, EO ***2019-3*** modified the Core Area boundaries. The boundary changes are inconsistent with the maps and acreages presented in the Approved Resource Management Plan Amendment for Greater Sage-grouse; therefore, EO 2011-5 remains the reference for the Core Area boundaries. The CCPA contains 199,281 acres of PHMA, and 284,375 acres of PHMA are found within the greater sage-grouse analysis area.

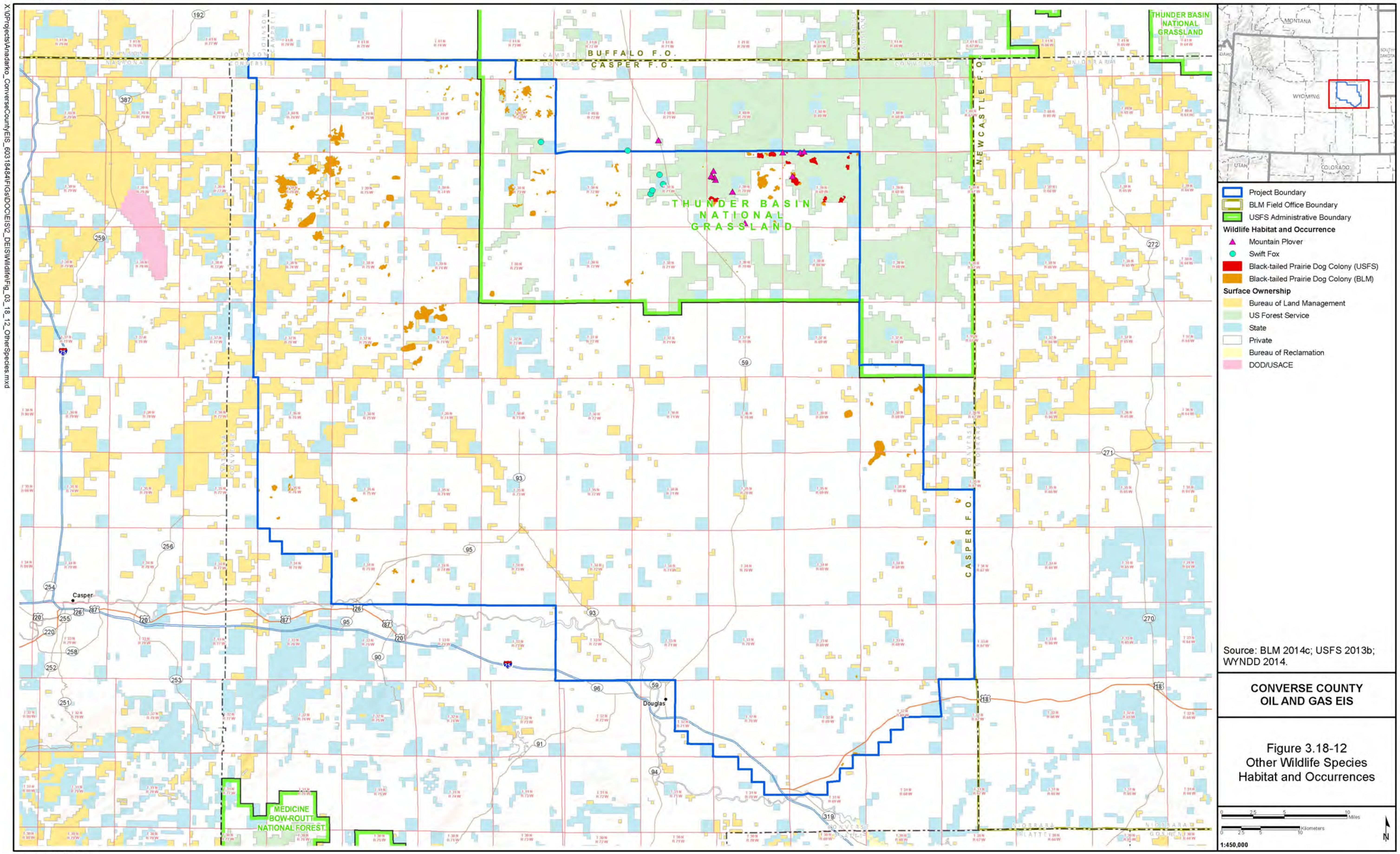

Figure 3.18-12
Other Wildlife Species Habitat and Occurrences

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- General Habitat Management Areas: BLM-managed and National Forest System lands where some special management would apply to sustain greater sage-grouse populations. GHMAs are areas of occupied seasonal or year-round habitat outside of PHMAs. There are 1,287,429 acres of GHMA within the CCPA, and 1,752,212 acres of GHMA within the greater sage-grouse analysis area.

The Wyoming Greater Sage-grouse Land Use Plan Amendments also identify Sagebrush Focal Areas, which are a subset of PHMA. However, no Sagebrush Focal Areas are located within the greater sage-grouse analysis area.

Greater Sage-grouse PHMAs and GHMA

Figure 3.18-*13* provides the sage-grouse PHMA, GHMA, and lek sites in the greater sage-grouse analysis area. Based on the BLM, USFS, and WGFD management direction, six greater sage-grouse PHMAs overlap with the greater sage-grouse analysis area including the Douglas, Natrona, North Glenrock, and Thunder Basin BLM PHMAs as well as the Bill and M Creek USFS PHMAs. The BLM PHMAs contain designated WGFD Core Areas. Greater sage-grouse Core Areas include habitat with the highest densities of breeding greater sage-grouse in the state, as well as areas important for connectivity between populations. In an effort to prevent federal listing of greater sage-grouse, the WGFD completed revised maps (Core Area Versions 3 and 4 Maps) of greater sage-grouse Core Areas in Wyoming. The Core Areas include roughly 25 percent of the state, but they comprise 83 percent of the greater sage-grouse population in the state. Under the direction of the BLM Approved Resource Management Plan Amendment, which is Attachment 4 to BLM (2015b), impacts are to be assessed using Core Area Version 3 Maps found within Wyoming EO 2011-5. Based on direction from the draft BLM (IM WY-2016-024), Core Area Version 4 Maps were considered and analyzed under one Alternative of this EIS.

The Natrona PHMA does not overlap with the CCPA and no leks in this PHMA occur within 4 miles of the CCPA. Within the CCPA, the remaining five PHMAs comprises 318,848 acres (21.2 percent) under the Core Area Version 3 Maps and 293,458 acres (19.5 percent) under Core Area Version 4 Maps.

The Douglas PHMA is entirely within the CCPA and is approximately 88,195 acres in size under the Core Area Version 3 Maps and 66,841 acres in size under the Core Area Version 4 Maps. This PHMA is located in the southeastern corner of the CCPA with land cover comprised of a mosaic of grassland and sagebrush shrubland habitats with mixed grass prairie and sand prairie comprising the greatest acreage. The Douglas PHMA is characterized by a low population of sage-grouse and a total of ***4*** occupied leks. Average peak male attendance at leks in the CCPA has declined by approximately 38 percent since 2006 (**Table 3.18-6**). Additionally, approximately 2,500 acres of this PHMA was affected by a wildfire in 2012. In an effort to protect and restore habitat in this PHMA, an operator-led, multi-stakeholder working group known as the Douglas Core Area Restoration Team initiated the *Plan for the Development of Oil and Gas Resources within a Sage-Grouse Core Population Area, Douglas Core Area, Converse County, Wyoming* (Chesapeake 2013).

Within the greater sage-grouse analysis area, the North Glenrock PHMA comprises approximately 118,201 acres under the Core Area Version 3 Maps and 114,202 acres under the Core Area Version 4 Maps. Approximately 53,152 acres overlapping with the CCPA under the Core Area Version 3 Map and 52,945 acres overlapping with the CCPA under the Core Area Version 4 Map. This PHMA is located along the western boundary of the CCPA and is the most productive of the PHMAs in the CCPA with ***8*** occupied leks in the CCPA. Habitat in this PHMA predominantly is grassland and sparsely vegetated lands with a smaller component of big sagebrush shrubland and steppe. Average peak male attendance at leks in the CCPA has increased by 322 percent since 2006 with the average number of peak male attendance at 15.7 in 2016 (**Table 3.18-*7***).

The Thunder Basin PHMA comprises approximately 81,953 acres of land in the greater sage-grouse analysis area under the Core Area Version 3 Maps and approximately 81,916 acres under the Core Area

Version 4 Maps. Much of this PHMA is located within the TBNG to the northeast of the CCPA, with approximately 46,901 acres overlapping with the CCPA under the Core Area Version 3 Maps and 46,863 acres overlapping with the CCPA under the Core Area Version 4 Maps. There are a total of ***4*** occupied leks in the Thunder Basin PHMA within the bounds of the CPPA. Average peak male attendance at PHMA leks in the CCPA has declined by 75 percent since 2006 (**Table 3.18-7**). Habitat in this PHMA is characterized by a mosaic of grassland and sagebrush shrubland and steppe habitats.

Table 3.18-7 **Greater Sage-grouse Lek Attendance in PHMAs within the CCPA**

	Peak Male Attendance at Leks and Percent Change from Previous Year							
	North Glenrock		Douglas		Thunder Basin		M Creek	
Year	Average Number	Percent Change	Average Number	Percent Change	Average Number	Percent Change	Average Number	Percent Change
2006	3.7	--	12.0	--	22.9	--	12.3	--
2007	13.6	265.9	12.7	5.6	21.0	-8.1	11.7	-5.4
2008	10.5	-22.7	8.8	-30.3	17.1	-18.4	7.0	-40.0
2009	11.9	12.9	6.0	-32.1	8.4	-50.8	2.7	-61.9
2010	16.5	38.2	2.0	-66.7	7.6	-10.2	0.7	-75.0
2011	7.7	-53.0	1.2	-41.7	8.3	9.4	1.0	50.0
2012	9.4	21.2	2.5	114.3	5.7	-31.0	0.0	-100.0
2013	3.3	-65.0	1.8	-26.7	2.9	-50.0	0.0	0.0
2014	6.6	102.8	5.2	181.8	2.6	-10.0	1.0	0.0
2015	9.1	37.0	8.3	61.3	4.3	66.7	0.0	-100.0
2016	15.7	73.0	7.5	-10.0	5.7	33.3	0.0	0.0
Total Percent Change 2006-2016		**322.0**		**-37.5**		**-75.0**		**-100.0**

Source: WGFD 2016d.

The M Creek PHMA comprises approximately 26,445 acres of land in the greater sage-grouse analysis area. The entirety of this PHMA is on the TBNG and is not considered a Core Area by the WGFD. This PHMA has 6,980 acres that overlap with the CCPA. There are ***2*** occupied leks and ***1 undetermined lek. A***ll 3 are within the 4-mile greater sage-grouse analysis area but outside of the CCPA. Average peak male attendance at PHMA leks in the CCPA has declined by 100 percent since 2006, with no males counted by WGFD in 2013 (**Table 3.18-6**). Habitat in this PHMA comprises primarily grassland communities including mixed-grass prairie and short grass prairie, and to a less degree, big sagebrush shrubland and steppe.

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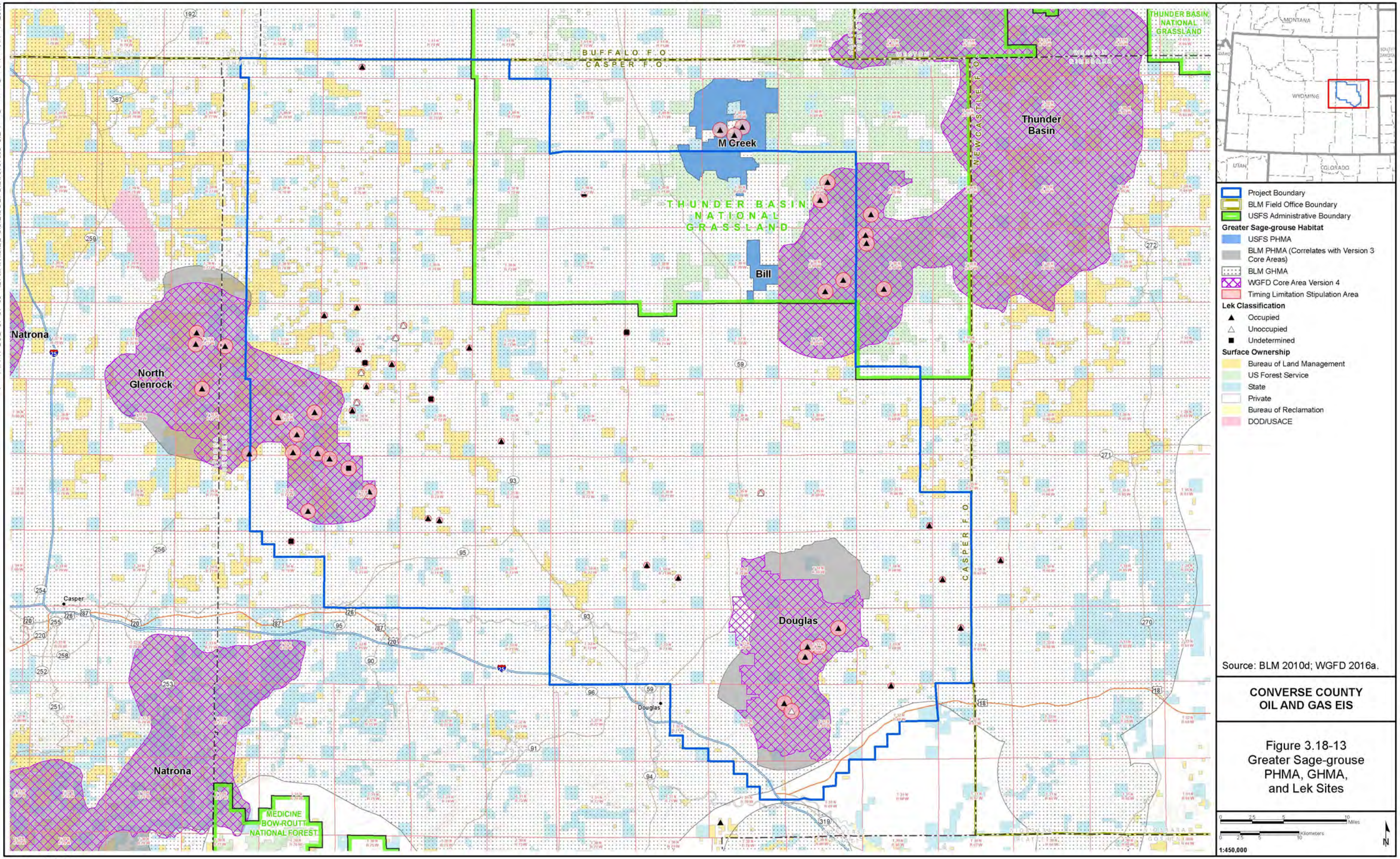

Figure 3.18-13
Greater Sage-grouse PHMA, GHMA, and Lek Sites

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The Bill PHMA is the smallest area of PHMA in the analysis area and is approximately 4,054 acres in size. This PHMA is adjacent to the western-most extent of the Thunder Basin PHMA. The entirety of the Bill PHMA is within the TBNG and is not considered a Core Area by the WGFD. The entire PHMA also is within the CPPA and no leks occur within it. Habitat in the Bill PHMA comprises primarily big sagebrush shrubland and steppe and mixed-grass prairie.

The BLM, USFS, and State of Wyoming require that, prior to the start of a project, applicants must demonstrate that a project's surface disturbance will not cause any declines in greater sage-grouse populations. To address such impacts, the agencies require that project applicants assess the project sites for existing and proposed disturbances by utilizing a DDCT to sufficiently demonstrate that proposed activities will not exceed the allowable density of one well pad per an average of 640 acres (1.0 square mile) or will not exceed greater than 5 percent of suitable habitat disturbance within the DDCT assessment area for the project. Preliminary DDCT assessment areas were created for this Project to identify existing and potential disturbance in these areas for impacts analysis; however, the formal DDCT policy review process would not be conducted until site-specific disturbance is identified prior to project permitting. The DDCT is a spatially based tool that is designed to calculate the average density of disruptive activities and total surface disturbance within the area affected by the project, or DDCT assessment area. Five DDCT assessment areas were created for the project; one for each of the PHMAs in the CCPA including Douglas, North Glenrock, Thunder Basin, M Creek, and Bill (**Figure 2.5-2**). Each DDCT assessment area was created by buffering the CCPA by 4 miles and identifying all with occupied leks within the PHMAs. Each of the occupied greater sage-grouse leks within PHMAs was then buffered by 4 miles and clipped to the boundary of the PHMA. Existing disturbance acreage in each of the five DDCT assessment areas are summarized on **Tables 3.18-*8*** and **Table 3.18-*9***. Four of the five DDCT assessment areas have existing disturbance totaling greater than 5 percent. The total percentage of existing disturbance in all of the DDCT assessment areas combined is 18.9 percent.

Table 3.18-8 **Existing Surface Disturbance in BLM Greater Sage-grouse DDCT Assessment Areas**

DDCT Assessment Area	Acres of PHMA Habitat in DDCT Assessment Area		Existing Disturbance in the DDCT Assessment Area			
	Core Area Version 3[1]	Core Area Version 4[2]	Core Area Version 3[1]		Core Area Version 4[2]	
			Acres	Percent	Acres	Percent
Douglas	88,195	66,841	23,328	26.5	15,713	23.5
North Glenrock	118,201	114,202	12,129	10.3	11,741	10.3
Thunder Basin	81,953	81,916	7,967	9.7	7,940	9.7
Total	**288,349**	**262,959**	**43,425**	**15.1**	**35,700**	**13.6**

[1] Under the BLM Approved Resource Management Plan Amendment, PHMA is delineated based on the Core Area Version 3 Maps under the EO ***2011-5***.

[2] Based on direction from the draft BLM IM WY-2016-024, the Core Area Version 4 Map under EO ***2019-3*** was considered and analyzed under one of the action alternatives.

Source: BLM 2015b; WyGISC 2017; EO ***2019-3***.

Table 3.18-9 **Existing Surface Disturbance in USFS Greater Sage-grouse DDCT Assessment Areas**

DDCT Assessment Area	Acres of PHMA Habitat in DDCT Assessment Area	Existing Disturbance in the DDCT Assessment Area	
		Acres	Percent
Bill	4,054	67	1.7
M Creek	26,445	239	0.9
Total	**30,499**	**306**	**1.0**

Source: USFS 2015b; WyGISC 2017.

Tables 3.18-*10* and **3.18-*11*** summarize the acres and percentage of existing surface disturbance within the DDCT assessment areas by disturbance type. The greatest amount of existing surface disturbance for the combined DDCT assessment areas is from fire and vegetation treatments. Oil and gas, which accounts for 0.6 percent of the existing disturbance, is fifth behind fire and vegetation treatment, rangleland, roads, transportation, and other structures and developments.

Table 3.18-10 **Existing Surface Disturbance by Type within the BLM Greater Sage-grouse DDCT Assessment Areas**

Core Area Version / Disturbance Type	Surface Disturbance							
	Douglas		North Glenrock		Thunder Basin		Total	
	acres	percent	acres	percent	acres	percent	acres	percent
Version 3								
Fire or Vegetation Treatment	11,138	12.6	9,904	8.4	2,371	2.9	23,412	7.3
Mining	38	0.0	183	0.2	1	0.0	221	0.1
Oil and Gas	597	0.7	1,026	0.9	426	0.5	2,050	0.6
Rangeland	2,036	2.3	115	0.1	3,474	4.2	5,624	1.8
Roads and Transportation	1,189	1.3	571	0.5	724	0.9	2,484	0.8
Structure or Development	7,543	8.6	89	0.1	702	0.9	8,334	2.6
Utilities	788	0.9	242	0.2	270	0.3	1,299	0.4
Total Version 3	**23,328**	**26.5**	**12,129**	**10.3**	**7,967**	**9.7**	**43,425**	**13.6**
Version 4								
Fire or Vegetation Treatment	6,831	10.2	9,931	8.7	2,385	2.9	19,146	6.5
Mining	34	0.1	183	0.2	1	0.0	217	0.1
Oil and Gas	466	0.7	794	0.7	468	0.6	1,729	0.6
Range Land	1,520	2.3	90	0.1	3,436	4.2	5,046	1.7
Roads and Transportation	968	1.4	549	0.5	725	0.9	2,242	0.8
Structure or Development	5,332	8.0	87	0.1	702	0.9	6,121	2.1
Utilities	562	0.8	108	0.1	223	0.3	893	0.3
Total Version 4	**15,713**	**23.5**	**11,741**	**10.3**	**7,940**	**9.7**	**35,394**	**12.1**

Source: WYGISC 2017.

Table 3.18-11 **Existing Surface Disturbance by Type within the USFS Greater Sage-grouse DDCT Assessment Areas**

	Surface Disturbance					
	Bill		M Creek		Total	
Disturbance Type	**Acres**	**Percent**	**Acres**	**Percent**	**Acres**	**Percent**
Fire or Vegetation Treatment	0	0.0	37.65	0.1	37.65	0.1
Mining	0	0.0	2.6	0.0	2.6	0.0
Oil and Gas	0	0.0	26.5	0.1	26.5	0.1
Range Land	61.05	1.5	0	0.0	61.05	0.2
Roads and Transportation	5.44	0.1	82.3	0.3	87.74	0.3
Utilities	0.04	0.0	90.11	0.3	90.15	0.3
Total	**67**	**1.7**	**239**	0.9	**306**	**1.0**

Source: WYGISC 2017.

Greater Sage-grouse Habitats

The greater sage-grouse ranges throughout sagebrush habitats in 11 western states and in southern Canada and has suffered population declines throughout its range due to habitat fragmentation and loss and alteration from natural (e.g., fire, drought) and man-made causes (77 FR 70103). Greater sage-grouse generally is found throughout the BLM CFO, with the exception of the more heavily forested, agriculturally developed, and urbanized areas (BLM 2007b).

Lekking/Nesting Habitat

The center of breeding activity for greater sage-grouse is referred to as a lek. Leks are characterized as flat, sparsely vegetated areas within large tracts of sagebrush (Connelly et al. 2004). Males typically begin to appear on leks in March, with peak attendance of Wyoming leks occurring in April (WGFD 2010a). Greater sage-grouse nesting habitat typically is located near active leks and consists of medium to tall sagebrush with a perennial grass understory (Connelly et al. 2000). Studies have shown that taller sagebrush with larger canopies and more residual understory cover usually lead to higher nesting success (Connelly et al. 2004, 2000).

WGFD classifies the annual status of a lek based on the following definitions (WGFD 2011):

- Active: A lek that is attended by at least two males during the breeding season or males showing signs of strutting activity.
- Inactive: A lek where one or no males were documented during the breeding season and it shows no signs of activity (i.e., droppings, feathers) based on at least two ground surveys separated by at least 7 days.
- Unknown: A designation given when no data are available for a lek during a given breeding season.

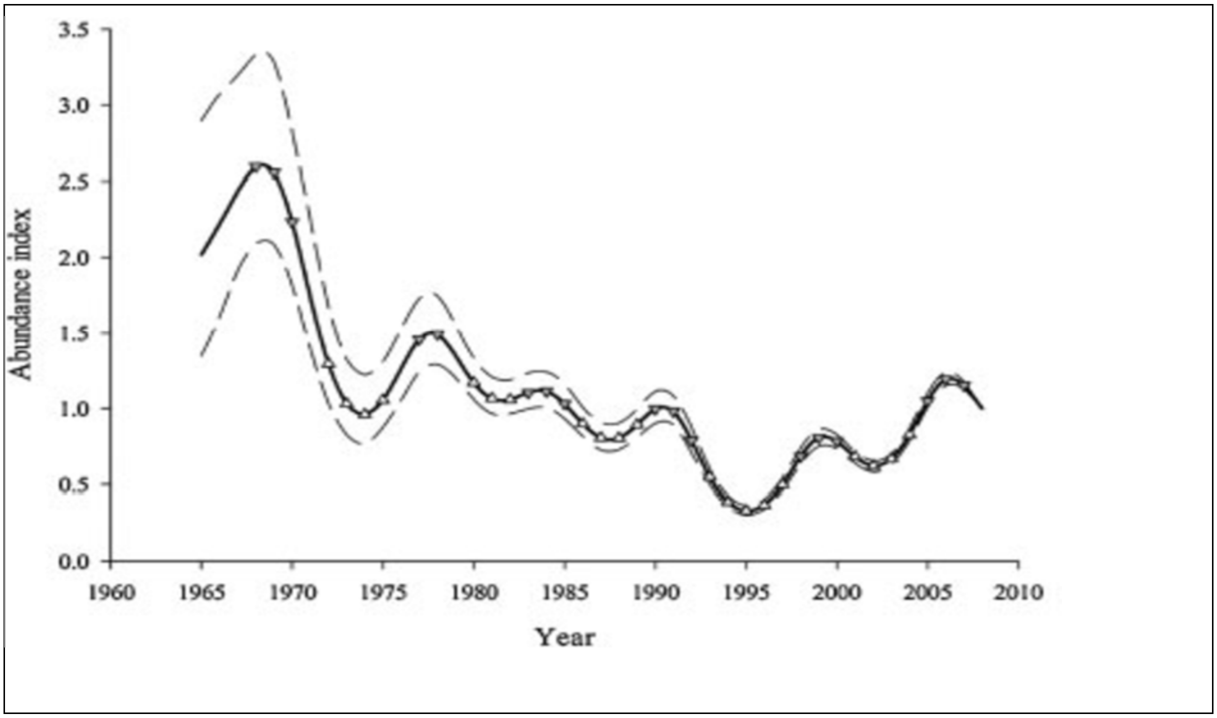
WGFD management status of a lek is based on the following categories (WGFD 2011):

- Occupied: A lek that has been active in at least 1 year during the prior 10 years.
- Unoccupied-destroyed: A lek that is a formerly active lek in which the surrounding sagebrush habitat has been destroyed and is no longer suitable for greater sage-grouse breeding.

- Unoccupied-abandoned: A lek that is in suitable habitat that has not been active for the most recent 10 consecutive years.
- Undetermined: A lek that has insufficient data in the last 10 years to designate it otherwise.

State, federal, and private entities are actively involved in monitoring greater sage-grouse leks during the breeding season throughout the State of Wyoming. Lek data, or the numbers of males attending a given lek, provide managers the needed information to gauge population trends and to effectively promote the conservation of the species. Lek counts have been used widely for monitoring populations of greater sage-grouse; however, this method has limitations. Problems in using lek data arise because of incomplete knowledge of lek sites and their spatial definitions, behavior of the birds, and difficulties in counting greater sage-grouse (Johnson and Rowland 2007).

Greater sage-grouse populations are cyclic, meaning they experience alternating periods of increases and decreases. Statewide population models based on lek data collected since the 1960s suggest that overall populations within Wyoming have declined since counts first began (**Figure 3.18-*14***) (Connelly and Braun 1997; Connelly et al. 2004; Fedy and Aldridge 2011). These models show a downward trend between the late 1960s and early 1990s. Although an increasing trend appears in more recent years, the recurring peaks remain well below historical levels. As noted, these population models are based on estimates of actual greater sage-grouse numbers, and are useful in assessing how different variables (e.g., climate change or habitat disturbance) may have impacted populations over time.

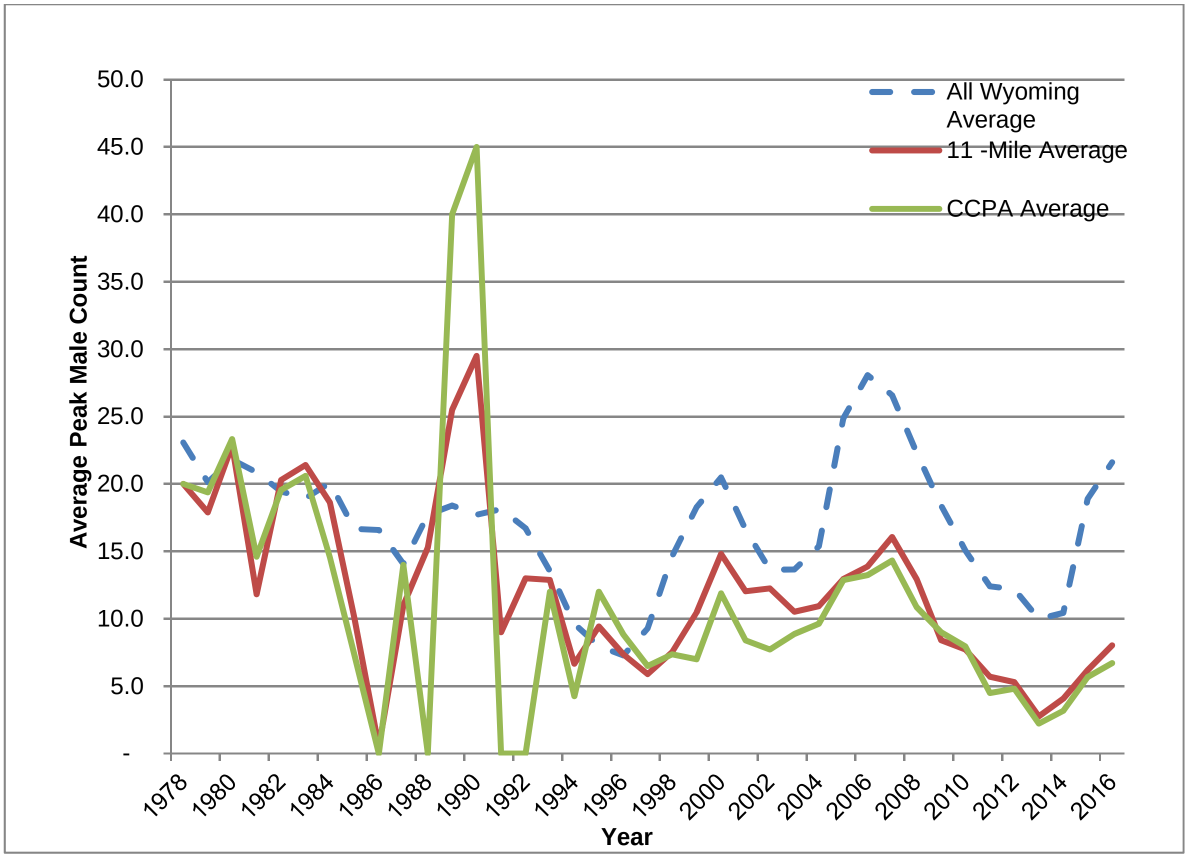


Notes: Overall Wyoming greater sage-grouse lek trend model, estimating abundance index using generalized additive modeling approach. The thicker black line represents the model built using all surveyed greater sage-grouse leks in Wyoming from 1965 to 2008. The abundance index is the ratio of the number of birds in a particular year to year 2008. Dashed lines represent the 95 percent confidence intervals. Downward gray triangles are major downturns and upward triangles indicate major upturns.

Source: Fedy and Aldridge 2011.

Figure 3.18-14 **Greater Sage-grouse Lek Trend Model**

Based on average peak male counts, leks within the CCPA follow statewide averages in periodicity as well as population fluctuations (**Figure 3.18-*15***). These data also mimic population models showing an overall slight increase in population numbers over the last 17 years; however, numbers have been steadily decreasing in the last 7 years.



Note: CCPA averages represent data collected from 34 occupied, 6 undetermined, and 6 unoccupied leks. Statewide averages represent data collected from 2,453 leks throughout the state. Data summarized in both averages were not available for all leks in all given years.

Source: WGFD 2016d.

***Figure 3.18-15* Average Peak Male Attendance at Leks between 1978 and 2016**

In total, there are 46 greater sage-grouse leks in the CCPA; ***33*** are considered by WGFD to be occupied, ***5*** are undetermined, and ***8*** are unoccupied. An additional 8 leks, all of which are considered occupied by WGFD, are located outside but within 2 miles of the CCPA. ***Nineteen*** of the ***46*** leks are located in PHMAs. The remaining ***27*** leks are located in GHMA. All leks, lek status, designated habitat, and male peak attendance between 2006 and 2016 in the CCPA are presented in **Table 3.18-*10***. Greater sage-grouse leks in the analysis area are displayed in **Figure 3.18-*13***.

The data presented in **Table 3.18-*12*** and **Figure 3.18-*15*** provide a metric for understanding observed trends in the sage-grouse attendance at leks in the CCPA. Overall, the 54 leks within 2 miles of the CCPA 2016 have experienced a reduction in peak male attendance of approximately 6 percent between 2006 and 2016. Attendance at all leks in the CCPA had slightly declined since 2006; however, peak male attendance is on an upward trend since a low in 2013. In 2013, no male sage-grouse were observed on at least 13, and possibly as high as 39 (some leks were not counted in 2013 or data is missing) of the 54 leks. Despite the recent upward trend in peak male attendance, all greater sage-grouse leks in the analysis area are at risk of being abandoned as development continues to increase.

Brooding Habitat

The late spring and summer periods are when hens and broods are typically found in more lush habitats consisting of a high diversity of grasses and forbs that attract insects (Blomberg et al. 2012). These habitats include wet meadows, riparian areas, and irrigated farmland within or near sagebrush (Schroeder et al. 1999). Hens with broods utilize these habitats until forbs desiccate and insect abundance decreases. Unsuccessful hens and cocks also utilize these same habitats; however, due to their nutritional flexibility, they are able to occupy a wider variety of habitats during the spring and summer months (Connelly et al. 2004). In many greater sage-grouse populations, high quality brooding habitat often is the limiting factor for population growth. Brooding habitat often can be adversely affected by drought, invasive weeds, and overgrazing associated with improper range management. Suitable brooding habitat is located within the analysis area along wet areas found near adjacent nesting habitat.

Wintering Habitat

Depending on the severity of the winter, greater sage-grouse move to south and east-facing slopes that maintain exposed sagebrush. Studies have shown that south-facing slopes with sagebrush at least 10 to 12 inches above the snow level are required for both food and cover. Windswept ridges, draws, and swales also may be used, especially if these areas are in close proximity to exposed sagebrush (Connelly et al. 2004). In years with harsh winter conditions (i.e., deep snow), greater sage grouse would often gather in large flocks in areas with the highest quality winter habitat. It is suggested that high quality winter habitat is limited in portions of the greater sage-grouse's range (Connelly et al. 2000). Suitable sagebrush habitat for wintering greater sage-grouse is present within the analysis area, but has not been delineated.

Table 3.18-12 **Greater Sage-grouse Leks and Peak Male Attendance within 2 miles of the CCPA**

Lek Name	WGFD Status	Peak Male Attendance 2006-2016[1]											PHMA / GHMA
		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	
55 Ranch 1	Occupied	0	0	0	0	0	2	0	0	0	0	0	GHMA
55 Ranch 2	Unoccupied	0	0	0	0	0	0	0	0	0	0	-	GHMA
55 Ranch 3	Occupied	--	0	48	18	22	18	12	-	9	8	13	GHMA
55 Ranch 4	Occupied	27	26	20	15	6	4	0	0	0	0	0	GHMA
55 Ranch 5	Undetermined	0	0	2	0	0	0	0	0	0	0	0	GHMA
55 Ranch 7	Unoccupied	0	-	0	0	0	0	0	0	0	0	0	GHMA
55 Ranch 8	Occupied	0	5	4	8	2	0	1	0	0	0	1	GHMA
Bill Hall	Occupied	13	19	11	5	3	1	2	3	1	8	8	Douglas
Bill Hall #2	***Uno***ccupied	9	1	--	0	0	0	0	0	0	0	0	Douglas
Bill Hall South	Occupied	--	--	--		--	--	--	--	8	12	8	Douglas
Blue Hill 1	Occupied	--	--	0	23	40	25	15	5	16	24	31	North Glenrock
Blue Hill 2	Occupied	--	59	7	25	18	6	5	6	2	8	4	North Glenrock
Blue Hill 3	Occupied	--	--	--	--	2	0	0	0	0	0	0	North Glenrock
Blue Hill 4	Occupied	--	--	--	5	26	15	40	0	2	24	58	North Glenrock
Cheyenne Divide 1	Occupied	--	--	0	0	0	0	0	--	0	0	0	GHMA
Cheyenne Divide 2	Occupied	--	--	0	0	0	0	1	--	0	0	8	GHMA
Clausen Ranch	Occupied	--	--	--		--	--	--	11	19	40	40	GHMA
Clausen Ranch 2	Occupied	--								6	17	16	GHMA
Cole Creek	Occupied	--	--	--	10	25	0	3	3	0	0	0	North Glenrock
Cow Creek Road	Occupied	36	18	29	17	19	12	5	1	0	0	5	Thunder Basin

Table 3.18-12 **Greater Sage-grouse Leks and Peak Male Attendance within 2 miles of the CCPA**

Lek Name	WGFD Status	Peak Male Attendance 2006-2016[1]											PHMA / GHMA
		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	
Downs	Occupied	--	8	0	0	0	--	0	2	0	0	0	Thunder Basin
Dry Fork 1	Unoccupied	--	0	0	--	0	--	0	--	0	0	0	GHMA
Dry Fork 2	Unoccupied	--	0	0	--	0	0	0	--	0	0	0	GHMA
Dull Center	Occupied	0	0	9	0	4	0	4	2	3	1	0	Thunder Basin
East Antelope #1	Occupied	50	45	26	14	5	3	12	8	22	30	29	Douglas
East Antelope #2	Unoccupied	0	0	--	0	0	0	0	0	0	0	0	Douglas
East Steckley Road	Occupied	34	31	20	8	2	2	--	0	0	0	0	M Creek
Flat-Top	Occupied	--	11	16	17	4	3	1	0	0	0	0	Douglas
Highland	Occupied	--	--	--	--	--	--	12	4	1	4	0	GHMA
Iberlin	Occupied	62	65	44	30	18	21	13	6	13	20	25	Thunder Basin
Lone Tree Gulch 1	***Occupied***	--	--	0	0	0	0	0	2	0	0	0	GHMA
Lone Tree Gulch 2	Occupied	--	--	0	17	16	9	0	0	0	0	0	North Glenrock
Mai Tai	Occupied	12	18	13	6	0	0	0	0	0	--	0	GHMA
Manning Road	***Uno***ccupied	1	2	1	0	0	0	0	0	0	0	0	GHMA
North 95	Occupied	--	--	11	38	45	17	13	4	0	0	0	GHMA
North 95 East	Occupied	--	--	9	3	2	0	0	0	0	0	0	GHMA
North Bobcat Road	Occupied	21	20	16	3	0	7	--	0	1	1	0	Thunder Basin
North Owens	Occupied	--			--	--	4	4	2	0	0	0	Thunder Basin
North Shawnee	Occupied	10	8	7	4	3	0	0	0	0	0	0	GHMA
Ormsby Draw	Occupied	-- --	--						4	38	10	43	North Glenrock

-- -- -- -- -- --

Table 3.18-12 **Greater Sage-grouse Leks and Peak Male Attendance within 2 miles of the CCPA**

Lek Name	WGFD Status	Peak Male Attendance 2006-2016[1]											PHMA / GHMA
		2006	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	
Red Hills	***Undetermined***	--	4	1	0	0	0	0	--	0	0	0	M Creek
Rocky Top	Occupied	--								10	17	1	GHMA
Sand Creek 1	Undetermined	--	2	0	0	--	--	0	0	0	0	0	North Glenrock
Sand Creek 2	Occupied	--	52	88	28	13	7	10	7	5	2	0	North Glenrock
South Jenny Trail	Undetermined	--					0	--		0	0	--	GHMA
South Poison Draw	Undetermined	--					0	--		0	0	0	GHMA
Steckley Road	Occupied	3	0	0	0	0	1	--	0	3	0	0	M Creek
Suicide Hill	Occupied	--	--	--	--	--	8	8	5	3	1	0	GHMA
Tillards 1	Occupied	0	0	0	0	0	0	0	0	10	0	0	North Glenrock
Tillards 2	Occupied	41	37	21	23	41	23	30	11	0	32	37	North Glenrock
Turner Divide	Undetermined	--	--	0	--	--	0	0	0	0	0	--	GHMA
UL Oil Field	Unoccupied	--	0	--	--		0	--		0	--	--	GHMA
Upper Lake Creek	Occupied	41	36	22	9	12	14	14	7	1	8	10	Thunder Basin
W. Harney Creek	Occupied	--			0			0		16	2	3	GHMA
Average Male Attendance		6.7	8.6	7.9	6.0	6.1	3.7	3.8	1.7	3.5	5.0	6.3	
Percent Change from Previous Year		--	23	-10	-30	1	-62	1	-120	51	30	21	
Percent Change from 2006 to 2016		-6.0											

[1] No lek count data is represented with "--".

Migratory Birds

A total of 36 special status migratory bird species have been identified as having potential to occur in the migratory bird analysis area. Of these, 32 species were carried forward for analysis in this EIS. **Appendix F** lists BLM and USFS sensitive wildlife species, ESA listed species, and their potential to occur within the CCPA. Rationale for species excluded from further analysis also are provided in **Appendix F**. Three migratory bird species, the interior least tern (*Sterna antillarum*), piping plover (*Charadrius melodus*), and whooping crane (*Grus americana*), are not documented as occurring in the CCPA but occur in downstream habitats of the North Platte River in Nebraska.

The CFO has identified Sensitive Species for the BLM-administered lands in the CCPA. A total of 16 BLM Sensitive migratory bird species have been identified for the Project and are carried forward for analysis in this EIS (**Appendix F**). The USFS, Region 2 has designated Forest Sensitive Species for the TBNG. A total of 28 USFS sensitive migratory bird species on the TBNG have been identified for the Project (**Appendix F**). Four of these species were eliminated from further analysis (**Appendix F**). No migratory bird species have been designated as MIS for the TBNG. The greater sage-grouse is not a migratory species and is not protected under the MBTA. The greater sage-grouse is no longer a federal candidate species; however, it is a BLM Sensitive and a USFS Sensitive species.

Terrestrial Invertebrates

Two USFS Region 2 sensitive butterfly species, the Ottoe skipper (*Hesperia ottoe*) and the regal fritillary (*Speyeria idalia*), have been documented in the analysis area. In addition the monarch butterfly (*Danaus plexippus plexippus*) and the western bumble bee (*Bombus occidentalis*) are suspected to occur in the TBNG and have potential to occur in the analysis area.

The Ottoe skipper has been documented twice in Converse County, as well as in Platte County, to the southeast of the CCPA (Selby 2005; WYNDD 2014). This species occurs in mixed-grass prairie dominated by grasses such as little bluestem and sideoats grama. The CCPA consists of approximately 995,706 acres (66.3 percent) of grassland habitats and the entire wildlife analysis area consists of 1,370,493 acres (62.1 percent) of this habitat type. Primary threats to this species include historic loss, degradation, and fragmentation of the prairie landscape, row crop agriculture, urban development, housing construction, road construction and maintenance, gravel mining, and wind-energy development (Selby 2005).

The regal fritillary has been documented twice in Converse County and has been observed five times throughout the state of Wyoming (WYNDD 2014). This species was confirmed to the southeast of the CCPA; in Platte, Goshen, and Laramie counties; and to the northeast of the CCPA in Crook County. The regal fritillary is associated with mixed-grass and tall-grass prairie, wet meadows, and marshy areas. The CCPA consists of approximately 1,004,814 acres (66.88 percent) of grassland and wetland or riparian habitats and the entire wildlife analysis area consists of 1,392,086 acres (63.10 percent) of these habitat types. Western populations generally are associated with more xeric, or dry, habitats. In recent years, regal fritillaries have experienced dramatic large-scale population declines. Habitat loss and fragmentation are the greatest historical factors contributing to the decline of the species. Conversion of prairie habitat to agricultural and urban development and shrub and tree encroachment also may negatively affect this species (Selby 2007).

The monarch butterfly and the western bumble bee are listed as sensitive for the USFS Region 2 and are suspected to occur in the Medicine Bow-Routt National Forests and TBNG. Both species have wide distributions across much of the western U.S. and may occur in any habitat with the exception of open water habitats.

Monarch butterflies are known for their long-distance seasonal migrations they extend from southern Canada to Oyamel fir forests in central Mexico (USFS 2015c). Along their migration routes and on their summer ranges, monarch butterflies require milkweeds, upon which adult monarchs lay eggs. They also require nectar-producing flowering plants of many other species that provide food for adult butterflies. Thus, monarch butterflies potentially could occur throughout the wildlife analysis area where these requirements are met, though the most likely habitats for milkweed host plants are in mesic riparian and marshy habitats.

Western bumble bees have a wide range across the western U.S. from Alaska south to central California and east of the Rocky Mountains including the western plains. However, this species has undergone a drastic decline though some areas of its former range and are now rare along the west coast of central California to British Columbia (Evans et al. No Date). The range of the western bumble bee overlaps with the entire state of Wyoming and due to the wide range of habitats this species may utilize it has potential to occur in the wildlife analysis area.

Aquatic Species

Special status aquatic species are discussed in Section 3.18.5.

3.18.3.6 Species of Greatest Conservation Need

Under the WGFD State Wildlife Action Plan, a list of SGCN was identified. A total of 65 migratory bird and 21 mammalian species considered SGCN by WGFD have the potential to occur within the analysis area (**Appendix F**). Migratory bird species designated as SGCN are listed in **Table 3.18-*6***. Of the 21 mammal species considered SGCN, seven also are designated as special status species under the ESA or as BLM/USFS Sensitive Species and are discussed above under the appropriate designation including: black-footed ferret, Preble's meadow jumping mouse, swift fox, black-tailed prairie dog, northern river otter, long-eared myotis, and Townsend's big-eared bat. The remaining 14 species and their associated habitat are listed in **Table 3.18-*13***.

Table 3.18-13 **Mammalian Species of Greatest Conservation Need**

Common Name (*Scientific Name*)	**Habitat**	**SGCN Status**
Dwarf shrew (*Sorex nanus*)	Barren/sparsely vegetated.	Tier II
Eastern red bat (*Lasiurus borealis*)	Wetland/riparian.	Tier III
Eastern spotted skunk (*Spilogale putorius*)	Mixed shrubland, wetland/riparian.	Tier II
Hayden's shrew (*Sorex haydeni*)	Grassland, wetland/riparian.	Tier III
Little brown myotis (*Myotis lucifugus*)	Conifer forest, wetland/riparian.	Tier II
Long-legged myotis (*Myotis Volans*)	Conifer forest, wetland/riparian.	Tier III
Olive-backed pocket mouse (*Perognathus fasciatus*)	Agricultural land, grassland, mixed shrubland.	Tier III
Pallid bat (*Antrozous pallidus*)	Barren/sparsely vegetated, conifer forest, grassland, mixed shrubland, sagebrush shrubland.	Tier II
Plains harvest mouse (*Reithrodontomys montanus*)	Grassland, sagebrush shrubland.	Tier II
Sagebrush vole (*Lemmiscus curtatus*)	Sagebrush shrubland.	Tier II

Table 3.18-13 **Mammalian Species of Greatest Conservation Need**

Common Name (*Scientific Name*)	**Habitat**	**SGCN Status**
Sand Hills pocket gopher (*Geomys lutescens*)	Grassland.	Tier II
Silky pocket mouse (*Perognathus flavus*)	Barren/sparsely vegetated, grassland.	Tier III
Spotted ground squirrel (*Xerospermophilus spilosoma*)	Agricultural land, grassland, mixed shrubland, sagebrush shrubland.	Tier III
Western small-footed myotis (*Myotis ciliolabrum*)	Barren/sparsely vegetated, conifer forest, grassland, mixed shrubland.	Tier II

Source: WGFD 2017d, 2010a.

3.18.4 Aquatic Biological Resources

3.18.4.1 Regulatory Background

In addition to laws and regulations discussed for terrestrial wildlife (Section 3.18.1.1), additional regulations and legal requirements for aquatic species and habitat within the analysis area are implemented by agencies with management responsibilities for aquatic resources or the lands associated with aquatic resources. These include the WGFD, BLM, USFS, and the USFWS. The following regulations and legal requirements provide protection for aquatic resources. Regulations related to special status aquatic species are discussed in Section 3.18.5.

- Jurisdiction for Protecting Fish Resources – Wyoming Statute 23-1-103;
- Fish Resource Protection – Wyoming Game and Fish Commission, Chapter 52, Section 9; and
- Prevention of Invasive Species Infestation – Wyoming Game and Fish Commission, Chapter 62.

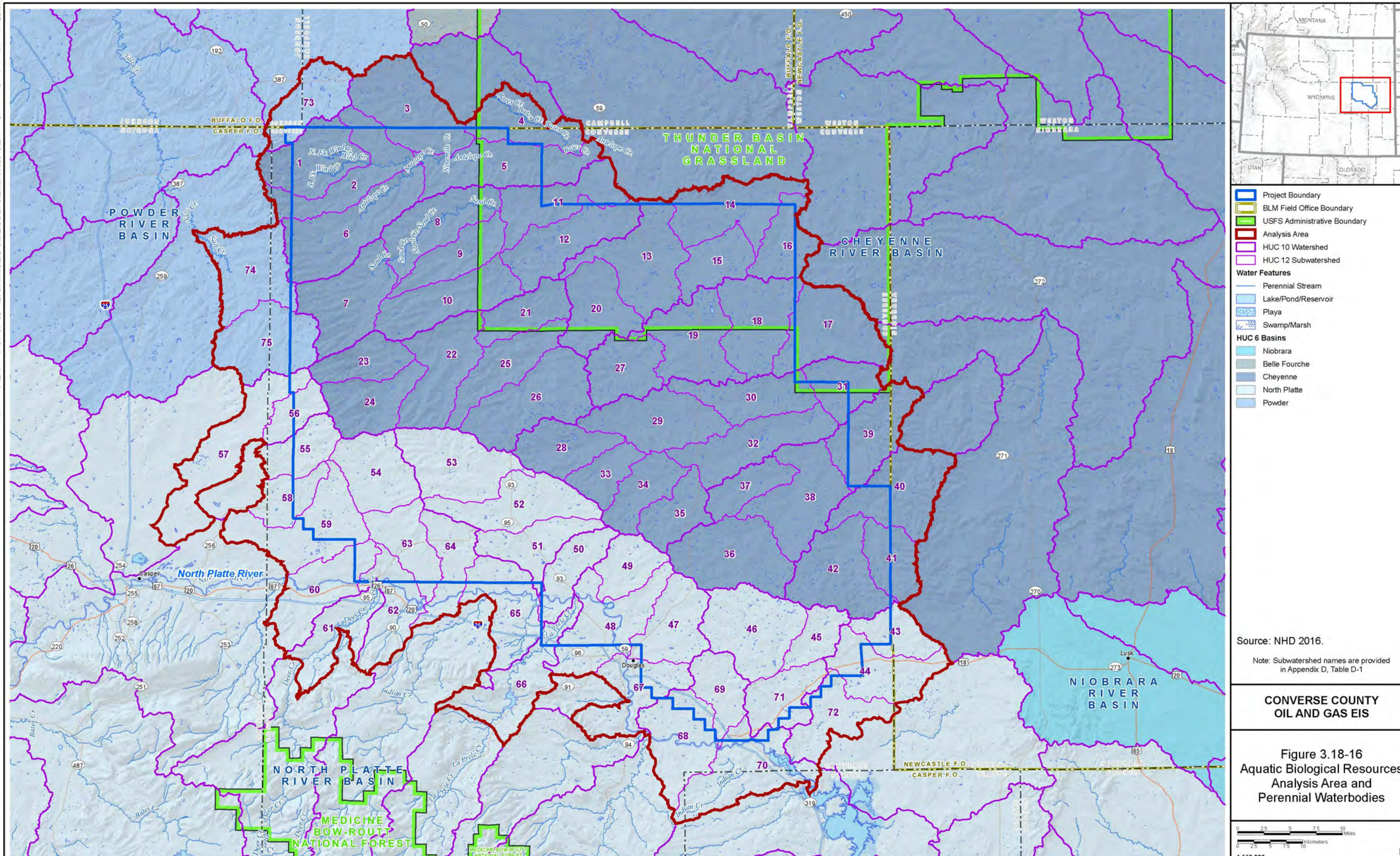
Federal land management statutes also address the management of fish and wildlife as a resource. FLPMA states that public lands will be managed to “provide food and habitat for fish and wildlife” (Sec. 101. [43 USC 1701]) and fish and wildlife are a resource value to which the principles of multiple use and sustained yield, as defined under FLPMA, apply (Sec. 103. [43 USC 1702]).

The National Forest Management Act of 1976 amends the Forest and Rangelands Renewable Resources Planning Act of 1974 to ensure that USFS plans provide for multiple use and sustained yield of wildlife and fish (Sec. 2 [16 USC 1600]).

Aquatic species discussed in this section include fish due to their recreational value as game species. Fish species with importance as special status species are discussed in Section 3.18.5. Amphibians also are included because these species utilize aquatic habitats for breeding purposes and development of young. Some amphibian species such as frogs use aquatic habitats throughout the year.

3.18.4.2 Aquatic Biological Resources Analysis Area

The geographical extent of the analysis area for aquatic biological resources includes perennial streams, and lakes/reservoirs/ponds within the HUC-12 subwatersheds that overlap with the CCPA (**Figure 3.18-*16***). In most cases, the subwatersheds extend varying distances beyond the CCPA.



CONVERSE COUNTY OIL AND GAS EIS

Figure 3.18-16
Aquatic Biological Resources Analysis Area and Perennial Waterbodies

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3.18.4.3 Habitat

Aquatic habitat within the analysis area is located in portions of three basins: Cheyenne, North Platte, and Powder River. Based on priority habitat designated by WGFD (2015), the CCPA contains crucial aquatic habitat referred to as the North Platte, Middle Platte, and Prairie Stream and Riparian corridors, with approximately 3, 7, and 74 square miles, respectively. Perennial streams in the areas include the North Platte River in the North Platte and Middle Platte corridors and Antelope Creek in the Prairie Stream and Riparian corridors. The CCPA also contains approximately 17 square miles of aquatic enhancement habitat in the Middle North Platte Area. The following information describes perennial streams and lakes/reservoirs for subwatersheds associated with these three basins. Additional subwatersheds are located in the analysis area, but they do not contain perennial streams. Subwatershed names associated with the reference numbers shown in **Figure 3.18-*16*** are provided on **Table D-1** in **Appendix D**.

<u>Cheyenne River Basin</u>

Fourteen subwatersheds in the Cheyenne River basin contain perennial stream segments, nine of which contain named perennial streams (**Figure 3.18-*16*** and **Table D-2** in **Appendix D**). In total, approximately 86 miles of named perennial streams are located within the Cheyenne River basin portion of the analysis area, including Antelope, Bates, Ninemile, Sand, West Fork Walker, Wind, North Fork Wind, and South Fork Wind creeks. Perennial streams with the largest lengths in miles within this portion of the analysis area are Antelope Creek (20 miles), Sand Creek (20 miles), Bates Creek (19 miles), and Wind Creek (10 miles). Two perennial streams, Antelope and Sand creeks, occur within the TBNG. One additional stream in the TBNG, Dry Fork Cheyenne Creek, contains some reaches with water being present on a consistent basis (Baer and Byer 2015). Moderate to large reservoirs or lakes that exceed 10 acres are limited in the Cheyenne River basin portion of the analysis area, with Goochy and Reed reservoirs being the only named waterbodies.

<u>North Platte River Basin</u>

Eighteen subwatersheds with perennial stream segments occur within the North Platte basin portion of the analysis area (**Table D-2** in **Appendix D**). Approximately 165 miles of 23 named perennial streams that overlap with the North Platte River portion of the analysis area. The largest extent of perennial stream lengths in this portion of the analysis area consist of the North Platte River (82 miles), La Prele Creek (25 miles), Deer Creek (15 miles), Indian Creek (9 miles), and Dry Creek (8 miles). The other perennial stream lengths are individually less than 5 miles in length. Lakes and reservoirs that exceed 10 acres in this portion of the analysis include Baaken Esmay, East Side, Warner, Glendo, and Wintermote.

<u>Powder River Basin</u>

A small portion of the Powder River Basin overlaps with the CCPA (**Table D-2** in **Appendix D**). Three subwatersheds in this basin form a portion of the northwestern corner of the analysis area. Approximately 8 miles of 1 perennial stream, Salt Creek, overlaps with this portion of the Powder River basin that is part of the analysis area. One perennial waterbody, Pinedale Reservoir, is located in the Headwaters Dry Fork Powder River subwatershed, which overlaps with the analysis area.

3.18.4.4 Fisheries

WGFD classifies game fisheries using a combination of scores for productivity, accessibility, and aesthetics (WGFD 2006). The top four stream rankings include blue, red, yellow, and green, with blue being the highest quality. Orange ribbon streams are those containing populations of cold/warm sport fish species (WGFD 2006). Within the CCPA, 4 miles of the North Platte River is a blue river stream, and La Prele Creek is a red ribbon stream. Both blue and red ribbon streams are recognized as “special resources” (i.e., receiving relatively high weighting when mitigating adverse effects) (USACE 2013; WGFD 2006).

Cheyenne River Basin

The Cheyenne River basin overlaps with the middle and northern portions of the CCPA. Many of the tributary streams in this basin are intermittent or ephemeral within the CCPA (Barrineau et al. 2007). The Cheyenne River basin is one of four basins located in WGFDs Northeastern Missouri River region (WGFD 2010a). This group of basins contains 3 native game, 20 native nongame, 14 non-native game, and 8 non-native nongame fish (**Table 3.18-*14***). The native game fish community is composed of three bullhead and catfish species (black bullhead, channel catfish, and stonecat). Game fish species known to occur in analysis area streams in the Cheyenne River basin include green sunfish in Lightning Creek and black bullhead and green sunfish in Antelope Creek (Barrineau et al. 2007). Smallmouth bass also occurs in Antelope, Dry Fork Cheyenne, and Sand creeks at scattered locations, as a result of introductions from local stock ponds (Baer and Byer 2015).

Nongame fish species in the Cheyenne River basin include a mixture of native and nonnative species (**Table 3.18-*14***). Most of the species are represented by the minnow and sucker families.

Table 3.18-14 **Fish Species in the Northeastern Missouri River Basins**

Native Game	Native Nongame	Non-Native Game	Non-Native Nongame
Black bullhead (*Ameiurus melas*)	Creek chub (*Semotilus atromaculatus*)	Black crappie (*Pomoxis nigromaculatus*)	Common carp (*Cyprinus carpio*)
Channel catfish (*Ictalurus punctatus*)	Brassy minnow (*Hybognathus hankinsoni*)	Bluegill (*Lepomis macrochirus*)	Emerald shiner (*Notropis atherinoides*)
Stonecat (*Noturus flavus*)	Central stoneroller (*Campostoma anomalum*)	Brook trout (*Salvelinus fontinalis*)	–
–	Fathead minnow (*Pimephales promelas*)	Brown trout (*Salmo trutta*)	Gizzard shad (*Dorosoma cepedianum*)
–	–	Freshwater drum (*Aplodinotus grunniens*)	–
–	Finescale dace (*Chrosomus neogaeus*)	Green sunfish (*Lepomis cyanellus*)	Golden shiner (*Notemigonus crysoleucas*)
–	Flathead chub (*Platygobio gracilis*)	Largemouth bass (*Micropterus salmoides*)	Grass carp (*Ctenopharyngodon idella*)
–	Goldeye (*Hiodon alosoides*)	Northern pike (*Esox lucius*)	Spottail shiner (*Notropis hudsonius*)
–	Iowa darter (*Etheostoma exile*)	Rainbow trout (*Oncorhynchus mykiss*)	Longnose sucker (*Catostomus catostomus*)
–	Lake chub (*Couesius plumbeus*)	Smallmouth bass (*Micropterus dolomieu*)	Northern plains killfish (*Fundulus ransae*)
–	Longnose dace (*Rhinichthys cataractae*)	Walleye (*Sander vitreus*)	–
–	Mountain sucker (*Catostomus platyrhynchus*)	White crappie (*Pomoxis annularis*)	–
–	Pearl dace (*Margariscus margarita*)	Yellow perch (*Perca flavescens*)	–
–	Plains minnow (*Hybognathus placitus*)	Snake River cutthroat trout (*Oncorhynchus clarki behnkei*)	–

Table 3.18-14 **Fish Species in the Northeastern Missouri River Basins**

Native Game	Native Nongame	Non-Native Game	Non-Native Nongame
–	Plains topminnow (*Fundulus sciadicus*)	–	–
–	Red shiner (*Cyprinella lutrensis*)	–	–
–	River carpsucker (*Carpiodes carpio*)	–	–
–	Sand shiner (*Notropis stramineus*)	–	–
–	Shorthead redhorse (*Moxostoma macrolepidotum*)	–	–
–	Western silvery Minnow (*Hybognathus argyritis*)	–	–
–	White sucker (*Catostomus commersonii*)	–	–

NOTE: Basins include the Little Missouri River, Belle Fourche River, Cheyenne River, and Niobrara River.

Source: WGFD 2017d, 2016, 2013d, 2010a.

North Platte River Basin

The North Platte River basin contains first- or second-order streams with perennial flows that support a mixture of cold water and warmwater fish species. WGFD (WGFD 2010) lists 4 native game, 25 native nongame, 16 non-native game, and 8 non-native nongame fish species in the North Platte River basin (**Table 3.18-*15***). Trout are not native to the North Platte River drainages in Wyoming, but are largely sought after by game fishermen. Brown and rainbow trout are present in two streams within the CCPA: North Platte River and La Prele Creek. Other warmwater game species include largemouth bass, green sunfish, bluegill, walleye, yellow perch, black bullhead, and channel catfish (WGFD 2014b). Game fish species occurrence in the North Platte River and La Prele Creek include the following species:

- North Platte River – brown trout, rainbow trout, rainbow trout, black bullhead, channel catfish, largemouth bass, green sunfish, walleye, yellow perch;
- La Prele Creek – brown trout, rainbow trout, green sunfish.

Table 3.18-15 **Fish Species in the Platte River Basins**

Native Game	Native Nongame	Non-Native Game	Non-Native Nongame
–	–	–	Brook stickleback (*Culaea inconstans*)
Black bullhead (*Ameiurus melas*)	Bigmouth shiner (*Hybopsis dorsalis*)	Black crappie (*Pomoxis nigromaculatus*)	Common carp (*Cyprinus carpio*)
Channel catfish (*Ictalurus punctatus*)	Brassy minnow (*Hybognathus hankinsoni*)	Bluegill (*Lepomis macrochirus*)	Emerald shiner (*Notropis atherinoides*)
Sauger (*Sander canadensis*)	Central stoneroller (*Campostoma anomalum*)	Brook trout (*Salvelinus fontinalis*)	Gizzard shad (*Dorosoma cepedianum*)
Stonecat (*Noturus flavus*)	Common shiner (*Luxilus cornutus*)	Brown trout (*Salmo trutta*)	Golden shiner (*Notemigonus crysoleucas*)

Table 3.18-15 **Fish Species in the Platte River Basins**

Native Game	Native Nongame	Non-Native Game	Non-Native Nongame
–	Creek chub (*Semotilus atromaculatus*)	Freshwater drum (*Aplodinotus grunniens*)	Goldfish (*Carassius auratus*)
–	Goldeye (*Hiodon alosoides*)	Golden trout (*Oncorhynchus aguabonita*)	Grass carp (*Ctenopharyngodon idella*)
–	Hornyhead chub (*Nocomis biguttatus*)	Green sunfish (*Lepomis cyanellus*)	Spottail shiner (*Notropis hudsonius*)
–	Iowa darter (*Etheostoma exile*)	Kokanee salmon (*Oncorhynchus nerka*)	–
–	Johnny darter (*Etheostoma nigrum*)	Lake trout (*Salvelinus namaycush*)	–
–	Lake chub (*Couesius plumbeus*)	Largemouth bass (*Micropterus salmoides*)	–
–	Longnose dace (*Rhinichthys cataractae*)	Pumpkinseed (*Lepomis gibbosus*)	–
–	Longnose sucker (*Catostomus catostomus*)	Rainbow trout (*Oncorhynchus mykiss*)	–
–	Mountain sucker (*Catostomus platyrhynchus*)	Smallmouth bass (*Micropterus dolomieu*)	–
–	Orangethroat darter (*Etheostoma spectabile*)	Walleye (*Sander vitreus*)	–
–	Northern plains killifish (*Fundulus kansae*)	White crappie (*Pomoxis annularis*)	–
–	Plains minnow (*Hybognathus placitus*)	Yellow perch (*Perca flavescens*)	–
–	Plains topminnow (*Fundulus sciadicus*)	–	–
–	Quillback (*Carpiodes cyprinus*)	–	–
–	Red shiner (*Cyprinella lutrensis*)	–	–
–	River carpsucker (*Carpiodes carpio*)	–	–
–	Sand shiner (*Notropis stramineus*)	–	–
–	Shorthead redhorse (*Moxostoma macrolepidotum*)	–	–
–	Sturgeon chub (*Macrhybopsis gelida*)	–	–
–	Suckermouth minnow (*Phenacobius mirabilis*)	–	–
–	White sucker (*Catostomus commersonii*)	–	–

NOTE: Basins include the North Platte River and South Platte River.
Source: WGFD 2017d, 2016, 2013d, 2010a.

According to WGFD, warmwater stream assessments were conducted in 2004 and 2005 to assess the status of fish assemblages and habitat in the North Platte River (WGFD 2013a). These assessments identified several priority conservation areas, including La Prele Creek (WGFD 2010a), which WGFD manages to provide a trout fishery. The 2004-2005 steam assessments identified nine native fish species in the stream. WGFD also identified the Antelope Creek drainage as an aquatic wildlife conservation area. Antelope Creek drains into the North Platte River near Douglas, Wyoming.

Powder River Basin

A small portion of the CCPA overlaps with three subwatersheds in the Powder River basin. One of the subwatersheds, Big Bull Cedar Creek-Salt Creek, contains a perennial stream, Salt Creek. This stream contains two game fish species: black bullhead and channel catfish.

3.18.4.5 Amphibians and Reptiles

Amphibians potentially occurring in the analysis area include tiger salamanders (*Ambystoma mavortium*), toads, and frogs. Species that likely are present in the analysis area include the plains spadefoot toad (*Spea bombifrons*), Woodhouse's toad (*Bufo woodhousii*), and boreal chorus frog (*Pseudacris maculata*) (WGFD 2014b). Amphibians generally occupy aquatic habitats, including springs, wetlands, riparian corridors, or open water, which they depend on for the first phase of their life-cycles and for breeding, prey, thermoregulation, and cover throughout their lives. Riparian and wetland habitats comprise approximately 1 percent of the CCPA including herbaceous and forested wetland/riparian communities adjacent to intermittent streams, reservoirs, stock water ponds, and perennial waterways. Wetlands/riparian areas are discussed in detail in Section 4.14, Vegetation, and Section 4.17, Wetland and Riparian Areas.

Reptiles that utilize aquatic habitats in the CCPA include turtles, which occur in upland and riparian and wetland habitats. Turtle species likely to occur in the CCPA include the western painted turtle (*Chrysemys picta bellii*) and eastern snapping turtle (*Chelydra serpintina*) (WGFD 2014b, 2010a).

3.18.4.6 Aquatic Invasive Species

Aquatic invasive species are nonnative aquatic species that can adversely affect aquatic species and their habitat. In Wyoming, aquatic invasive species or diseases of concern include zebra and quagga mussels, New Zealand mudsnail, rusty crayfish, Asian carp, and aquatic plants such as Hydrilla (*Hydrilla verticillata*), Eurasian watermilfoil (*Myriopyllum spicatum*), and curly pondweed (*Potamogeton crispus*) (WGFD 2017b). Other invasive species include Asian clam (*Corbicula fluminea*), brook stickleback (*Culaea inconstans*), and whirling disease. Species or diseases that have been detected in the North Platte River basin include Rusty crayfish, Asian clam, brook stickleback, aquatic plants, and whirling disease (WGFD 2017b). WGFD has a Wyoming Aquatic Invasive Species program that focuses on the prevention of the introduction and spread of invasive species through watercraft inspections and monitoring in waterbodies (WGFD 2016b).

3.18.5 Special Status Aquatic Species

Protection for special status aquatic species within the analysis area is regulated by the USFWS, USFS, BLM, and WGFD. The BLM and USFS manage special status species on their public lands in coordination with the WGFD. The USFWS has regulatory oversight for the management of federally listed species and their critical habitat. Management direction and guidance for special status aquatic species are provided through existing laws and regulations, agency policies, implementation management plans, recovery plans, and state wildlife action plans. In addition to laws and regulations discussed in previous sections, the following regulations and management direction are applicable to special status aquatic species in the analysis area.

- ESA mandates the protection of federally listed and proposed species for listing;
- BLM Special Status Species Management Policy 6840;
- USFS Manual 2670; and
- Wyoming Action Plan (WGFD 2017d, 2010a).

USFS Region 2 identified special status species, which the Regional Forester for the Rocky Mountain Region designated for development and implementation of conservation strategies for sensitive species and their habitats in coordination with other USFS units, managing agencies, and landowners.

The following information identifies special status aquatic species that potentially occur in the analysis area. Other species that were considered but eliminated from further analysis are listed in **Appendix F**.

3.18.5.1 Federal Species

No federally listed or candidate fish or amphibian species occur within the CCPA. However, one fish species, pallid sturgeon (*Scaphirhynchus antillarum*), is included in the analysis due to consideration of water depletions in the North Platte River basin and Platte River system. Pallid sturgeon was listed as endangered in 1990 (55 FR 36641) and a recovery plan was published in 1993 and revised in 2014 (USFWS 2014d). The species occurs in the Lower Platte River, defined as downstream of the mouth of the Elk River confluence. No critical habitat has been designated for this species. Pallid sturgeon is a bottom-dweller that prefers areas with strong current and firm sandy bottoms in the main channel of large turbid rivers (USFWS 2014b).

3.18.5.2 BLM Sensitive and USFS Sensitive Species

The CCPA was evaluated as potential habitat for BLM sensitive and USFS Sensitive species. No aquatic BLM Sensitive fish species occur within the CCPA. Potential habitat was evaluated for 13 aquatic USFS Sensitive fish species in the TBNG. Based on known occurrences or potential habitat that overlaps with the TBGN and the CCPA, three fish species were carried forward into the EIS analysis. In addition, one amphibian species, the northern leopard frog, was carried forward for analysis. Northern leopard frog is considered a BLM Sensitive and USFS Sensitive species. No USFS aquatic MIS occur in the TBNG streams within the CCPA. Terrestrial and avian BLM and USFS Sensitive species are discussed in Section 3.18.3, Special Status Wildlife Species.

<u>Fish</u>

Plains minnow (*Hybognathus placitus*) is present in Wyoming and the TBNG. The species is known to occur in Salt Creek in the Powder River basin (WGFD 2014b), and there is potential for occurrence within the Cheyenne River basin (Barrineau et al. 2007). The plains minnow typically inhabits channels of shallow, fluctuating streams with shifting sand substrates (Rees et al. 2005). Preferred habitats include backwaters and gentle eddies and areas with aquatic vegetation. The plains minnow spawns from April through August.

Plains topminnow (*Fundulus sciadicus*) primarily inhabits tributary streams to the Cheyenne River Basin in Wyoming where it is considered an introduced species (Pasbrig et al. 2012). Plains topminnows are most often found in heavily vegetated, shallow, slow water habitats in small, clear streams. This species has been collected in Antelope Creek where its habitat consists of runs and backwater areas with sand-dominated substrates (Barrineau et al. 2007). The spawning period for plains topminnow is May through early July (Rahel and Thel 2004a).

Flathead chub (*Platygobio gracilis*) is rare in Wyoming and has only been documented in the North Platte River within the CCPA (WGFD 2017a, 2010; WISDOM 2012). Streams within the CCPA that contain this species include the North Platte River and Lightning Creek. Flathead chub typically occurs in turbid rivers and their larger tributaries. In rivers, flathead chub ismost commonly associated with moderate to high flows and small substrates such as sand and gravel (Baxter and Stone 1995; Woodling 1985). Observations in streams within the northern plains reported a range in habitat types including the main channel, side channels, and backwaters, although adult fish were mainly found in the main channel (Rahel and Thel 2004b). Smith (1988), as cited in Rahel and Thel (2004b), reported that flathead chub likely spawn over riffle areas in the summer at water temps that exceed 21°C (69.8°F). Although the spawning habitat of flathead chub remains unknown, the timing of the spawning season appears to coincide with lower flows, reduced turbidity levels, and warmer water temperatures in summer (Olund and Cross 1961, as cited in Rahel and Thel 2004a).

Amphibians

The northern leopard frog (*Lithobates pipiens*) is documented within the CCPA. There are scattered documented occurrences of the species throughout the CCPA (WISDOM 2012), and it is known to occur in Antelope Creek in the Cheyenne River basin (WDFG 2014). This species was once common and widespread, but populations are known to be declining throughout its range (76 FR 61931). Habitat consists of marshes, beaver ponds, streams, rivers, lakes, and wet meadows at elevation up to approximately 9,000 feet amsl (Smith and Keinath 2007). This species uses underwater areas as overwinter habitat.

3.18.5.3 Native Fish – Species of Greatest Conservation Need

In addition to the species discussed above, seven native fish species are considered SGCN by WGFD: bigmouth shiner (*Notropis dorsalis*), brassy minnow (*Hybognathus hankinsoni*), central stoneroller (*Campostoma anomalum*), common shiner (*Luxilus cornutus*), Iowa darter (*Etheostoma exile*), plains killifish (*Fundulus zebrinus*), and plains topminnow (WGFD 2016, 2010). These fish species are documented or highly likely to occur in the CCPA.

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4.0 Environmental Consequences

This chapter presents the analysis of environmental impacts associated with the Proposed Action and the alternatives presented in Chapter 2.0. ***Option 1 (Existing Raptor Stipulations from the Casper RMP, Decision 4047) and five proposed raptor amendments (Options 2 through 6) are analyzed under Alternative B.***

Disturbance and impact comparisons for the alternatives are presented in **Tables 2.7-1** and **2.7-2**, respectively, thus providing the reviewers and the decision maker a side-by-side comparison of the impacts for each key resource topic. Analysis of environmental impacts in this chapter is confined to that associated with new disturbances for each alternative.

The BLM is conducting a programmatic analysis of proposed oil and gas development in the CCPA from which subsequent site-specific NEPA documents for specific permitting actions can be tiered. This tiered approach to NEPA is described in the CEQ's Regulations (40 CFR 1500-1508). Tiering is appropriate when it allows the lead agency to focus on those issues ready for decision; deferring detailed consideration of those issues not yet ready for analysis due to uncertainty or lack of detailed knowledge of the proposed development. Due to the size of the area of potential effects and inability to perform analyses at the appropriate level to determine specific impacts, a programmatic analysis followed by subsequent tiered NEPA is appropriate for the proposed development in the CCPA.

Exact locations of impacts have not been defined (i.e., no site-specific disturbance could be determined); therefore, proportional estimates of disturbance impacts were calculated by multiplying the acres of surface present in the CCPA for the resource/parameter of interest (typically identified in Chapter 3.0) by the percent disturbance during construction for each alternative/parameter being analyzed. For example, to calculate the estimated disturbance impact to sagebrush shrubland under Alternative A, the total amount of sagebrush shrubland in the CCPA (330,463 acres; see **Table 3.14-1**) was multiplied by the percent of the CCPA to be disturbed during construction under Alternative A (0.7 percent; see **Table 2.3-3**).

It should be noted that final well siting and associated site-specific effects would be determined in detail during the APD phase of the permitting process. Under this process, each well or group of wells and related facilities would undergo site-specific environmental review prior to construction, as directed by the BLM (Section 2.***2***, Management Common to All Alternatives). Additional site-specific mitigation requirements also may be added at that time. ***Note that the BLM's authority to require mitigation of impacts is limited by the land and mineral estate ownership pattern in the CCPA (see Section 1.4.3).*** The environmental impacts identified in this EIS are based on general well locations as discussed in Chapter 2.0 of this document.

Planned natural gas developments in the CCPA under Alternative A are described in previously approved NEPA documents identified in Section 2.3.2***, New Development Under No Action***. As of January 9, 2015, an estimated 1,663 wells remained to be drilled on 361 new well pads in addition to the 1,520 existing wells in the CCPA.

To estimate the total oil and gas-related impacts for each action alternative, the impacts for the No Action Alternative (Alternative A) must be added to the impacts for each action alternative (Alternative B and Alternative C). Many of the effects identified as a result of oil and gas development occurring under Alternative A also would occur under expanded oil and gas activities associated with implementation of Alternative B or Alternative C. Differences between the action alternatives generally would be in the degree or level of effects. Expansion of the existing oil and gas field would create effects that overlap or combine with those occurring under Alternative A (No Action). These total effects and impacts from energy-related industries (e.g., mining, wind power) are analyzed in Chapter 5.0, Cumulative Effects.

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4.1 Air Quality and Climate

This section presents an assessment of the effects on air quality, air quality related values (AQRVs), and climate due to the Project. An emissions inventory was developed to quantify criteria pollutant and greenhouse gas (GHG) emissions from Alternative B. This inventory was utilized in two different models to predict potential effects on air quality (i.e., criteria pollutants, including ozone, and HAPs), visibility, atmospheric deposition, and acid neutralizing capacity.

For the purposes of assessing air quality impacts, Alternative B was modeled using two models: a near-field model evaluated local effects on criteria pollutants and HAPs in the immediate vicinity of activities that would be authorized under the alternatives, and a regional model evaluated regional effects on criteria pollutants, including ozone, and AQRVs. Alternative B was selected for modeling because it is anticipated to have the highest air quality effects. Alternative A and Alternative C consist of fewer new well pads and less total acres disturbed relative to Alternative B.

4.1.1 Emission Inventories and Modeling

4.1.1.1 Emissions Inventory

Emission inventories for the Project development and production activities were compiled for the air quality impact assessment for all sources associated with Alternative B. The Project emissions include NO_X, CO, SO_2, PM_{10}, $PM_{2.5}$, VOCs, 6 HAPs, and GHG emissions. The 6 HAPs include benzene, toluene, ethylbenzene, and xylenes (BTEX), formaldehyde, and n-hexane. Of the 187 HAPs regulated under Section 112 of the CAA, these 6 HAPs are the primary ones emitted in the oil and gas industry. While GHG emissions estimates were developed for CO_2, CH_4, and nitrous oxide (N_2O) as well as the global warming potential (GWP) in CO_2e, GHG emissions were not modeled for this analysis. The GHG emissions were calculated using an emission model, as discussed in **Appendix A**. The impacts of the GHG emissions were not modeled as it is common practice to not model the GHG emission impacts due to the complexity of the climate models needed to conduct the analysis. Therefore, information related to GHG emissions are provided for informational purposes only.

There are two different types of activities (field development and production) associated with the Project for which emission inventories were compiled. Emission-generating activities during field development included well pad, disposal pad, production pad, and access road construction along with reclamation, drilling, hydraulic fracturing/completion, workovers, and vehicle travel during the construction, drilling and completion phase. Activities also included construction and vehicle travel during installation of gathering and sales pipeline systems, and well flaring emissions until the gathering and sales pipelines receive oil/condensate. Additionally, construction emissions and emissions from road traffic related to development of nine types of facilities were compiled, including the combined processing facility, gas plants, compressor stations, oil/condensate storage, water management, the storage yard, electrical substations, fresh water ponds, and a work force facility.

Production sources included dehydration units, separators, blowdown tanks, generators, pumping engines, amine units, compressor engines, heater treaters, and produced liquids storage tanks. The inventory also included emissions-generating activities from oil/condensate loading onto railcars, process flaring, pneumatic venting and production-related vehicle travel. The specific components of field development and production emissions and total field-wide emissions are discussed in the Air Quality Technical Support Document (**Appendix A**).

The Project emission inventory was developed using data provided by the OG as the primary source of information. The inventory accounted for all applicable emissions controls such as New Source Performance Standards and new Tier standards for non-road engines. The most important of these emissions controls are those specifically targeted at Wyoming oil and gas sources. The WDEQ Air Quality Division (AQD) regulates emissions from oil and gas sources through the Oil and Gas Permitting

Guidance (WDEQ–AQD Chapter 6 Section 2, 2016). Different regulations apply in different regions of the state, with the most stringent level of controls applied to the areas outside the CCPA.

A complete list of control measures applied to the Project emission inventories by source is found on **Table 4.1-1**.

Table 4.1-1 Emissions Control Measures

Emissions Source Category	Type(s) of Controls Applied
Construction equipment heavy equipment (diesel internal combustion engines [ICE])	***Ultra-low sulfur diesel (ULSD)***
Construction traffic – tailpipe	---
Construction traffic – fugitive dust	Watering; restricted speed limit
Construction wind erosion – fugitive dust	Watering
Reclamation equipment heavy equipment (diesel ICE)	***ULSD***
Reclamation traffic – tailpipe	---
Reclamation traffic – fugitive dust	Watering; restricted speed limit
Reclamation wind erosion – fugitive dust	Watering
Drilling equipment (diesel ICE)	ULSD; Tier 2 engine technology
Drilling equipment (diesel boiler)	ULSD
Drilling/rig move traffic – tailpipe	---
Drilling/rig move traffic – fugitive dust	Watering; restricted speed limit
Hydraulic fracturing equipment (diesel ICE)	ULSD; Tier 2 engine technology
Hydraulic fracturing traffic – tailpipe	---
Hydraulic fracturing traffic – fugitive dust	Watering; restricted speed limit
Workover equipment (diesel ICE)	ULSD; Tier 2 engine technology
Workover traffic – tailpipe	---
Workover traffic – fugitive dust	Watering; restricted speed limit
Well completion venting	80% of wells capture flowback gas, 20% of wells flare flowback gas
Well completion flaring	98% destruction efficiency
Wildcat flaring	10% of wells flare produced gas for first 6 months. Flare has 98% destruction efficiency
Production/tanker traffic	Watering; restricted speed limit
Production wind erosion – fugitive dust	Watering; use of gravel
Compressor engines (natural gas ICE)	Wyoming Best Available Control Technology (BACT)
Generators (diesel ICE)	ULSD; Tier 4 engine technology
Pumping units (natural gas ICE)	Wyoming BACT
Separators/line heaters (natural gas boilers)	None
Dehydrator – reboiler	None
Dehydrator – flashing	98% destruction efficiency (combustor)

Table 4.1-1 Emissions Control Measures

Emissions Source Category	Type(s) of Controls Applied
Heater treaters	None
Fugitive piping component emissions	None
Gas Plant Amine unit	98% destruction efficiency (combustor)
Gas Plant Amine reboiler	None
Produced liquids storage tanks – flashing/working/breathing	98% destruction efficiency (combustor)
Produced liquids storage tanks – truck loading	98% destruction efficiency (combustor)
Produced liquids – railcar loading	Submerged loading
Pneumatic ***device*** venting	98% destruction efficiency (combustor)
Gas Plant Process flare	98% destruction efficiency

--- = No controls applied.

4.1.1.2 Greenhouse Gases

As part of the Project, GHG emissions are produced and emitted by various sources during oil and gas exploration, well development, and production. The primary components of GHG emissions associated with oil and gas exploration and production are CO_2, N_2O, and CH_4.

The GHG emissions are quantified in terms of CO_2e. Unifying emissions in terms of CO_2e allows for the comparison of different greenhouse gases based on their Global Warming Potential (GWP). GWP is a measure of the amount of energy a ton of gas absorbs over a given period of time, relative to one ton of CO_2. The CO_2e is derived by multiplying the emissions of the gas by its GWP. Methane is estimated to have a GWP of 28 to 36, while N_2O has a GWP of 265 to 298 times that of CO_2 for a 100-year timescale (USEPA 2016b). For calculating the CO_2e for the Project, the GWP for methane was assumed to be 28, while the GWP for N_2O was assumed to be 298. See **Appendix A** for more detail regarding the greenhouse gas emissions calculations.

4.1.1.3 Near-field Modeling

A near-field ambient air quality impact assessment was performed to quantify pollutant effects of both criteria air pollutants (excluding ozone) and HAPs within and near the CCPA that could result from Alternative B. The purpose of the near-field modeling analysis was to assess potential future air impacts in the near-field (i.e., just downwind) of activities that could occur under Alternative B. The USEPA regulatory model AERMOD was used to predict impacts within 50 km of planned activities. Near-field impacts of criteria pollutants (SO_2, NO_2, CO, PM_{10}, and $PM_{2.5}$), and selected HAPs (benzene, toluene, ethyl-benzene, xylene, n-hexane, and formaldehyde) were evaluated. Impacts were compared to applicable state and federal AAQS for criteria pollutants and USEPA reference exposure levels (RELs), reference concentrations (RfCs) for non-carcinogens, and unit risk factors (URFs) for carcinogens.

Model Approach and Limitations

In accordance with the USEPA's Guideline on Air Quality Models (Appendix W of 40 CFR Part 51; USEPA 2005), the near-field ambient air quality effect assessment was carried out using the latest version of AERMOD available at the time the modeling was conducted. AERMOD is a Gaussian plume model and is USEPA's guideline model for assessing local effects from industrial sources (USEPA 2005). AERMOD addresses dispersion and transport of pollutants and is approved for assessing the maximum pollutant concentrations within the near-field of an emissions source.

The AERMOD modeling system includes AERMET, AERMAP, and AERMOD. The AERMAP terrain processor was not used for this application so that the results would be representative of the full CCPA rather than a specific location within the CCPA. This approach is justifiable because the specific development locations are not yet known. The version numbers of the AERMOD modeling system that were used include AERMET version 16216r and AERMOD version 16216r.

AERMOD model options were set to their regulatory default values, unless otherwise noted in the Air Quality Technical Support Document (**Appendix A**). Model results were processed to calculate effects in a manner consistent with the form of the AAQS (for criteria pollutants) or applicable significance threshold (for HAPs). A more detailed description of the AERMOD model and modeling analysis can be found in **Appendix A**.

Five years (2011-2015) of hourly surface meteorological data from Converse County Airport, near Douglas, Wyoming, and concurrent upper air data from Rapid City, South Dakota, was processed with AERMET (USEPA 2004a), the meteorological preprocessor for AERMOD. USEPA recommends including 1-minute Automated Surface Observing System data when preparing a model-ready meteorological data set for use in AERMOD, which was available from the Converse County Airport and utilized for analysis.

It is important to note that the near-field modeling analysis was conducted to address NEPA requirements, not state or federal permit requirements. While a near-field modeling analysis can be a required component of the WDEQ permit application process, the requirements under NEPA are different than permit requirements. For the purposes of this EIS, the near-field analyses were conducted to assess and disclose whether potential adverse air quality impacts may occur. Adherence to all state and federal requirements for new or modified sources would be required prior to construction activities, which may include additional, site-specific, near-field modeling.

Criteria Air Pollutants

Background concentrations of criteria pollutants were added to model-predicted concentrations to calculate the total concentrations of a pollutant and then compared to applicable AAQS. The ambient concentrations of criteria pollutants monitored within or near the CCPA were used to define background air quality. The BLM conducted air quality monitoring in Converse County at the Blizzard Heights monitor from May 2013 to June 2016. In addition to ozone, the Blizzard Heights monitor measures concentrations of NO_2, CO, and $PM_{2.5}$. Three years of monitoring data from mid-May 2013 through the end of March 2016 was obtained and processed to calculate existing ambient background concentrations. For those pollutants not monitored at the Blizzard Heights monitor, which includes SO_2 and PM_{10}, ambient background concentrations were obtained from other nearby representative WDEQ monitors. Monitoring data were processed to calculate concentrations in a manner consistent with the form of the AAQS. Background values were added to modeled near-field effects to calculate total criteria air pollutant effects for comparison to AAQS. See **Appendix A** for more detail regarding the ambient air background data.

HAPs

Three different assessments were conducted to analyze exposure to potential HAP emissions. First, the modeled short-term (1-hour) HAP concentrations were compared to acute RELs, which are defined as concentrations at or below which no adverse health effects would be expected. No RELs are available for ethylbenzene and n-hexane; instead, short-term thresholds for these HAPs were developed by dividing the thresholds that indicate an immediate danger to life or health by 10 (IDLH/10). These IDLH values are determined by the National Institute for Occupational Safety and Health and were obtained from the USEPA Air Toxics Database (USEPA 2007b). These values are approximately comparable to mild effects levels for 1-hour exposures.

The second assessment looked at long-term exposures to HAPs. For this assessment, modeled maximum annual concentrations were compared to RfCs. An RfC is defined by USEPA as the daily inhalation concentration at which no long-term adverse health effects would be expected. RfCs exist for both non-carcinogenic and carcinogenic effects on human health (USEPA 2007b).

The third assessment looked at long-term exposures to suspected carcinogens (benzene, ethyl-benzene, and formaldehyde). This assessment was based on estimates of the increased latent cancer risk over a 70-year lifetime. This analysis presents the potential incremental risk from these pollutants and does not represent a total risk analysis. The cancer risks were calculated using the maximum predicted annual concentrations and the USEPA chronic inhalation unit risk factors for carcinogenic constituents. Estimated cancer risks were evaluated based on the Superfund National Oil and Hazardous Substances Pollution Contingency Plan (USEPA 1993a), where a cancer risk range of $1x10^{-4}$ (1 in 10,000) to $1x10^{-6}$ (1 in 1,000,000) generally would be acceptable. Two estimates of cancer risk are presented: a most likely exposure (MLE) scenario, and a maximally exposed individual (MEI) scenario. The estimated cancer risks were adjusted to account for duration of exposure and whether the time was spent at home or elsewhere.

For estimation of long-term exposure, maximum annual modeled concentrations were multiplied by the USEPA unit risk factors (based on 70 years of exposure) for each pollutant, and then the product was multiplied by an adjustment factor that represents the ratio of estimated exposure time to 70 years. The MLE duration was assumed to be 9 years, which corresponds to the mean duration that a family remains at a residence (USEPA 1993a). This duration corresponds to an adjustment factor of 9/70, or 0.13. The duration of exposure for the MEI was assumed to be 60 years (i.e., the LOP), corresponding to an adjustment factor of 60/70, or 0.86.

An additional adjustment was made for time spent at home versus time spent elsewhere. For the MLE scenario, the at-home time fraction was 0.64 (USEPA 1993a), and it was assumed that during the rest of the day, the individual would remain in an area where annual HAP concentrations would be one quarter as large as the maximum annual average concentration. Therefore, the MLE adjustment factor was further adjusted to (0.13) x [(0.64 x 1.0) + (0.36 x 0.25)], or 0.0949. For the MEI scenario, it was assumed that the individual would be at home 100 percent of the time; therefore, the final adjustment factor remained at 0.86 (i.e., 0.86 x 1.0).

4.1.1.4 Regional Modeling

The purpose of the regional modeling analysis was to quantify potential air quality impacts to both ambient air concentrations and AQRVs from the Project and other current and future reasonably foreseeable development in the region. Cumulative impacts were evaluated for ozone, NO_2, SO_2, PM_{10}, $PM_{2.5}$, and CO and AQRVs at Class I and sensitive Class II areas. The analyses were performed using the Comprehensive Air Quality Model with Extensions (CAMx) to predict both project-only as well as cumulative air quality impacts.

The CAMx photochemical modeling system was used to assess ozone effects as photochemical models are able to simulate the formation, transport, and removal of ozone, its precursors, and other reactive pollutants in the atmosphere. Ozone is not emitted directly into the atmosphere, but is formed from photochemical reactions of precursor species (primarily NO_X and VOCs) in the presence of sunlight. In addition, photochemical models can be used to estimate the concentrations of particulate matter. Therefore, the same photochemical model used to assess ozone effects also was used to assess AQRV effects to visibility and atmospheric deposition.

Photochemical models differ from near-field models in many ways, but most importantly photochemical models require all emissions sources to be explicitly included in the modeling analysis. As a result, photochemical modeling provides a cumulative assessment of effects without the addition of ambient background concentrations; therefore, care needs to be taken in estimating the fraction of the cumulative concentrations that would be due to the Project.

Regional Inventory

A comprehensive regional emissions inventory also was developed in order to assess potential future cumulative impacts on air quality and air quality related values. Year 2028 was selected as the future year, which corresponds with the maximum emissions year from the Project. To simulate cumulative conditions in year 2028 two future year cumulative emission inventories were developed to analyze impacts from Alternative A and Alternative B. The details of the emissions inventories for the two alternatives are found in **Appendix A** and are summarized below:

- Alternative A – The emissions inventory for Alternative A is developed to assess potential future cumulative air quality conditions based on reasonably foreseeable development activities within the 4-km domain. Available emissions information for specific Reasonably Foreseeable Future Actions (RFFAs) is explicitly modeled as part of the cumulative reasonably foreseeable development. Alternative A emissions were developed for year 2028. As explained in Attachment A to **Appendix A**, year 2028 was selected for analysis as it is the year with the maximum project emissions.
- Alternative B – A project-specific emissions inventory was developed for the Proposed Action. To assess potential future cumulative conditions, the project emissions inventory was modeled in conjunction with Alternative A emissions inventory. The potential air quality impacts due to the Proposed Action are assessed by comparing the modeled cumulative impacts for Alternative A to Alternative B. More details also are found in Attachment C to **Appendix A**.

The regional cumulative emissions inventory included point sources, area sources, non-road and on-road mobile sources, as well as ammonia emissions, windblown dust, biogenic emissions, sea salt and fire emissions.

Model Approach and Limitations

The use of the CAMx model for analysis of potential cumulative air quality impacts has been well established; this model has been used for many previous visibility modeling studies throughout the western U.S., including State Implementation Plans (SIPs) and other EISs. The Three-State Air Quality Modeling Study (ENVIRON 2014) was used as the basis for assessing regional air quality and AQRVs for this analysis. The 2008 Base Year modeling also was used because it was the only one available at the time the Project was initiated.

The CAMx modeling system was run for Alternative A and Alternative B. The Alternative A modeling scenario was required to estimate potential future cumulative air quality impacts under a No Action scenario, and to facilitate isolating the project-only impacts from the cumulative impacts predicted from the Alternative B scenario. The regional emissions inventory for Alternative A was based on estimated reasonably foreseeable development emissions without the Project. For the Alternative B modeling scenario, the Project-specific emissions inventory was used as part of the total regional emissions. To assess future cumulative impacts for Alternative B, the Project-specific emissions inventory was modeled in conjunction with the Alternative A emissions inventory. The potential air quality impacts due to Alternative B were assessed by subtracting the cumulative modeled impacts for Alternative A from the cumulative Alternative B impacts. See **Appendix A** for a more detailed description of the emissions inventories for both modeling scenarios.

All models are tools developed to provide an estimate or prediction. Therefore, there are inherent uncertainties and biases that are helpful to understand when interpreting model results. In the case of photochemical models there are uncertainties in the model inputs and model formulation (chemical reactions, transport, removal rates, etc.). For example, model inputs such as emissions, boundary conditions, or meteorological conditions, often are based on estimates or averages. The model uncertainty further increases when modeling future conditions, which requires estimates for all emission sources (e.g., industrial, electric generation, motor vehicle, biogenic, etc.). The assumptions used to estimate future emissions affect the modeled environment and can likewise affect the model's prediction of the Project effects.

To estimate the model bias, the model values are compared to monitored values. This analysis provides information regarding whether the model values are biased high or low relative to observations. Knowing the direction of the model biases can be helpful when interpreting the results. In general, the model platform under-predicted concentrations of all gas-phase pollutants and over-predicted concentrations of total $PM_{2.5}$ and PM_{10} in areas with monitoring data. The tendency to under-predict gas-phase pollutant concentrations (and over-predict PM concentrations) indicates that the future concentrations could be higher than predicted by the model for gas-phase pollutants and lower than predicted by the model for total PM concentrations. To minimize model bias and help bound model uncertainty, Project effects for ozone and $PM_{2.5}$ are presented for both model-predicted absolute concentrations and model-adjusted concentrations. Model-adjusted concentrations were derived by adjusting raw model results based on known biases.

Photochemical models are not formulated to assess effects of NO_2, CO, and SO_2 in close proximity to model sources; therefore, it is more appropriate to use the near-field modeling results to assess potential effects of these pollutants for comparison to applicable AAQS.

Air Quality

To quantify the effect of the Project on ambient air quality, the modeling results were compared with applicable standards and thresholds. Model-predicted concentrations of NO_2, CO, SO_2, ozone, $PM_{2.5}$, and PM_{10} are summarized and reported. The CAMx results were post-processed to conduct the following analyses.

- Comparison of modeled cumulative air quality effects to the applicable AAQS. For ozone and $PM_{2.5}$, this analysis was conducted using two techniques: the model-predicted, absolute effects and the model-adjustment method for both monitored and unmonitored areas. These two techniques provide a range of potential effects, which helps to bound model uncertainty. For all other criteria pollutants, only the model-predicted absolute effects method was used. See **Appendix A** for more detail regarding these analysis techniques.
- Isolation of the contribution of Alternative B to cumulative air quality effects. For ozone, this analysis was conducted using two techniques: the brute force method and the APCA. These two techniques are discussed in the Regional Modeling Results section of Section 4.1.3 and provide a range of potential effects, which helps to bound model uncertainty. For all other criteria pollutants, only the brute force method was used. See **Appendix A** for more detail regarding these analysis techniques.
- Comparison of cumulative air quality effects to the applicable PSD increments. While the effects have been numerically compared to PSD increments, there was no formal assessment of increment consuming sources. These demonstrations are provided for informational purposes only and are not regulatory PSD Increment consumption analyses, which would be completed as necessary during the permitting process.
- Alternative B impacts to visibility at Class I and sensitive Class II areas.
- Contributions of sulfur and nitrogen deposition from Alternative B to deposition analysis thresholds and ANC for sensitive waterbodies.

The AAQS for each criteria pollutant analyzed and the method used to process modeling results for direct comparison to the form of the standard are provided in **Table 3.1-1**. Air quality and visibility effects have been reported for the Class I areas and sensitive Class II areas as stated in Section 3.1.4. Deposition and acidification have been reported at the sensitive lakes listed in Section 3.1.4. A more detailed description of the CAMx model, the model-adjustment method, and modeling effect analysis can be found in **Appendix A**.

<u>Visibility</u>

Visibility effects were calculated using the methodology documented in the FLAG Phase 1 Report – Revised (FLAG 2010), hereby referred to as the FLAG Report. The FLAG Report was developed by a collaborative effort among Federal Land Managers to create consistent approaches to evaluate air pollution effects on resources. To determine changes in natural conditions, the FLAG Report utilizes the IMPROVE equation, which calculates light extinction as a function of relative humidity for large particles, small particles and sea salt particles. To remain consistent with that methodology, the changes in light extinction associated with Alternative B were calculated using the IMPROVE equation and compared to the FLAG Report recommended values of 0.5 and 1.0 delta dv thresholds, where 1.0 delta dv is the change in visibility just perceivable to the human eye.

In general, the model slightly under-predicted total light extinction for areas with monitoring data. The under-prediction primarily was attributed to compensating biases. While the model substantially over-predicted fine soil, it substantially under-predicted organic carbon. With the model's tendency to under-predict total light extinction, the future visibility impacts could be slightly larger than predicted by the model.

<u>Deposition</u>

Potential nitrification and acidification effects to terrestrial and aquatic ecosystems were assessed as a result of model-predicted nitrogen and sulfur deposition. Nitrification and acidification effects to terrestrial and aquatic ecosystems were analyzed at Class I areas, sensitive Class II areas, and sensitive lakes for both model simulations. Deposition impacts were assessed using two measures: deposition analysis thresholds (DATs) and the change in the ANC of sensitive waterbodies. DATs are thresholds of nitrogen and sulfur deposition rates per hectare per year (0.005 kg N/ha/yr or kg S/ha/yr). The accepted thresholds for changes to ANC are 10 percent change in ANC for lakes with background ANC values greater than 25 microequivalents (µeq/L) per liter and no more than a 1 µeq/L change in ANC for lakes with background ANC values equal to or less than 25 µeq/L. The only lake analyzed that has a background ANC less than 25 µeq/L was Upper Frozen Lake in the Bridger Wilderness Area.

In general, the model under-predicted both nitrogen and sulfur wet deposition for areas with monitoring data. With this tendency to under-predict wet deposition, it is possible the future nitrogen and sulfur deposition could be moderately larger than predicted by the model.

4.1.2 Impacts to Air Quality and Climate from Alternative A – No Action

Under Alternative A, new development would continue within the CCPA as disclosed under previous NEPA documents (Section 2.3.2). Air quality effects would include oil and gas activities from these previous projects and other reasonably foreseeable future actions. An estimated 10,253 acres of disturbance would result from new development under Alternative A (**Table 2.3-3**).

4.1.2.1 Alternative A Emissions Inventory Summary

Total emissions within the CCPA for Alternative A were not isolated and analyzed directly. The Alternative A emission inventory would consist of all existing emissions within the CCPA as well as future emissions associated with predicted levels of new development as shown in **Table 4.1-2**. Emissions from existing activities likely would be consistent with current levels and decrease in the future as current levels of oil and gas production in the area decline.

Table 4.1-2 Annual Emission Inventory for Criteria and Hazardous Pollutants for Alternative A

Year	Criteria Pollutants (tpy)						HAP (tpy)[1]						
	NOx	CO	SO_2	VOC	PM_{10}	$PM_{2.5}$	Bz	EtBz	Form	H_2S	n-Hx	Ti	Xy
1	1,158	1,314	2.8	830	1,399	207	3.6	0.6	24.6	0.0	7	4	3
2	1,357	1,671	3.6	1,178	1,523	215	5.0	0.9	36.5	0.0	11	6	4
3	1,561	2,031	4.4	1,527	1,760	251	6.3	1.1	48.4	0.0	14	8	6
4	1,763	2,390	5.2	1,876	1,983	284	7.7	1.3	60.3	0.0	18	10	8
5	1,966	2,749	6.0	2,194	2,184	316	9.0	1.5	72.2	0.0	22	12	9
6	2,168	3,109	6.8	2,512	2,393	349	10.4	1.8	84.1	0.0	25	14	11
7	2,369	3,467	7.6	2,829	2,585	380	11.7	2.0	96.0	0.0	29	16	13
8	2,571	3,826	8.5	3,147	2,785	411	13.1	2.2	107.9	0.0	32	17	14
9	2,989	4,408	10.0	3,757	3,121	485	16.3	2.7	133.8	0.0	39	22	18
10	3,186	4,764	10.8	4,061	3,200	489	17.6	3.0	145.7	0.0	43	24	19
11	3,384	5,122	11.6	4,177	3,386	520	19.0	3.2	157.6	0.0	46	26	21
12	3,585	5,481	12.4	4,404	3,577	551	20.3	3.4	169.5	0.0	50	28	22
13	3,785	5,839	13.2	4,632	3,757	580	21.6	3.7	181.4	0.0	54	30	24
14	3,978	6,191	14.0	4,857	3,935	609	22.9	3.9	193.3	0.0	57	31	26
15	4,179	6,548	14.8	5,115	4,127	640	24.3	4.1	205.1	0.0	61	33	27
16	3,471	6,162	13.9	4,966	3,046	507	23.9	3.9	204.6	0.0	60	33	27
17	3,345	5,718	13.3	4,872	2,998	495	23.1	3.9	198.0	0.0	60	33	27
18	3,344	5,717	13.3	4,859	2,955	491	23.1	3.9	198.0	0.0	60	33	27
19	3,343	5,717	13.3	4,846	2,914	487	23.1	3.9	198.0	0.0	60	33	27
20	3,342	5,717	13.3	4,837	2,894	485	23.1	3.9	198.0	0.0	60	33	27
21	3,342	5,717	13.3	4,828	2,874	483	23.1	3.9	198.0	0.0	60	33	27
22	3,341	5,716	13.3	4,820	2,853	481	23.1	3.9	198.0	0.0	60	33	27
23	3,341	5,716	13.3	4,811	2,833	479	23.1	3.9	198.0	0.0	60	33	27
24	3,340	5,716	13.3	4,802	2,812	477	23.1	3.9	197.9	0.0	60	33	27
25	3,340	5,716	13.3	4,794	2,804	477	23.1	3.9	197.9	0.0	60	33	27
26	3,339	5,716	13.3	4,785	2,796	476	23.1	3.9	197.9	0.0	60	33	27
27	3,339	5,716	13.3	4,776	2,788	475	23.1	3.9	197.9	0.0	60	33	27
28	3,339	5,715	13.3	4,768	2,779	474	23.1	3.9	197.9	0.0	60	33	27
29	3,338	5,715	13.3	4,759	2,772	474	23.1	3.9	197.9	0.0	60	33	27
30	3,338	5,715	13.3	4,755	2,760	472	23.1	3.9	197.9	0.0	60	33	27
31	2,635	4,837	11.1	3,760	2,579	413	18.1	3.1	143.3	0.0	52	26	23
32	2,223	4,258	9.6	3,177	2,416	371	14.8	2.6	117.4	0.0	45	22	20
33	2,023	3,899	8.8	2,885	2,271	345	13.5	2.4	105.5	0.0	41	20	18
34	1,822	3,541	8.0	2,593	2,125	318	12.1	2.2	93.6	0.0	38	18	16
35	1,622	3,183	7.2	2,301	1,988	293	10.8	2.0	81.7	0.0	34	16	15
36	1,422	2,824	6.4	2,010	1,851	267	9.5	1.7	69.8	0.0	30	14	13
37	1,222	2,466	5.6	1,718	1,713	242	8.1	1.5	58.0	0.0	27	12	11
38	1,022	2,107	4.8	1,426	1,575	216	6.8	1.3	46.1	0.0	23	10	10
39	821	1,749	4.0	1,135	1,439	190	5.5	1.0	34.2	0.0	20	8	8
40	488	1,255	2.6	647	1,285	154	2.5	0.1	16.8	0.0	9	2	1

[1] Bz = benzene; EtBz = ethyl-benzene; Form = formaldehyde; n-Hx = x-hexane; Ti = toluene; Xy = xylene.

4.1.2.2 Impacts to Criteria Pollutants

Criteria pollutant concentrations under Alternative A would be consistent with current measured background levels. Representative potential near-field criteria pollutant effects from anticipated new wells and other ancillary activities are shown in **Table 4.1-3**. Impacts in this table were developed utilizing a subset of near-field criteria pollutant assessments modeled for the Alternative B near-field assessment as it is expected that available wells will be developed for Alternative A in a manner similar to Alternative B, with the exception of larger 16 well pads. Therefore, only impacts from 8 well pads and ancillary facilities were included for the assessment of impacts from Alternative A. Additionally, the Alternative B emissions inventory was developed based on evaluation of current practices in the CCPA, and these would be expected to continue under Alternative A. Finally, Alternative A development likely would have similar emission sources as Alternative B due to use of the most current drilling technologies, equipment, and processes.

Modeled Alternative B activities that would be applicable to Alternative A include:

- A single well per pad during production;
- An 8-well construction pad;
- An 8-well drilling pad;
- ***An 8-well completion pad;***
- An 8-well production pad;
- A gas plant; and
- A compressor station.

It is assumed that under Alternative A, the largest well pads would be 8-wells. See **Appendix A** for additional details regarding the near-field modeling configuration, emissions, and assessment cases.

In the long-term, regional criteria pollutant effects under Alternative A would be lower than the NAAQS/WAAQS. ***For the near field assessment, Table 4.1-3 provides a summary of the highest near-field modeling criteria pollutant impacts including the model-predicted impact in accordance with the form of the NAAQS/WAAQS, the ambient background, total impact, and percent of standard for each pollutant. The table provides a summary of the activities that would be predicted to cause the highest impacts for each criteria pollutant. With the exception of 24-hour PM_{10}, 1-hour-NO_2, and 24-hour $PM_{2.5}$, all criteria pollutants and averaging periods were below the NAAQS/WAAQS for all modeling assessment cases.***

More information regarding the modeling analysis used to derive the impacts presented in **Table 4.1-3** are available in **Appendix A**.

4.1.2.3 Impacts to Toxics

As outlined in Section 4.1.2.3, the 8-well pad and ancillary facilities near field assessments modeled for Alternative B would be similar to the planned activities under Alternative A. Therefore, the impacts to air toxics from Alternative B (Section 4.1.2.4) were used as a proxy for Alternative A. The concentrations of HAPs were not modeled for Alternative A; however, near-field HAPs concentrations likely would all be below the acute and chronic inhalation levels. The incremental cancer risk would be within acceptable limits, except within 2 km of gas plants and compressor stations.

Table 4.1-3 Summary of Near Field Criteria Pollutant Results – Alternative A

Pollutant	Averaging Period	Ambient Background (µg/m³)	Maximum Modeled Design Concentration[1] (µg/m³)	Total Impact[2] (µg/m³)	Percent of Standard	NAAQS/ WAAQS (µg/m³)	Modeling Assessment Case
NO_2	1-hour	16.5	***205.8***	***222.3***	***118.2***	188	***Sequential construction, completion, and production on an 8-well pad***
	Annual	2.8	6.53	9.3	9.3	100	Gas Plant
CO	1-hour	574.5	***574.5***	***2244.9***	***5.6***	40,000	One 8-well ***completion*** pad
	8-hour	471.5	***471.5***	***1623.1***	***16.2***	10,000	One 8-well ***completion*** pad
SO_2	1-hour	25.3	***1.5***	26.***8***	13.***7***	196	***Sequential construction, completion, and production on an 8-well pad***
	3-hour	30.7	***2.8***	***33.5***	2.***6***	1,310	One 8-well ***completion*** pad
PM_{10}	24-hour	39	359.49	398.5	265.7	150	Construction of one 8-well pad
	Annual	12	1.65	13.7	27.3	50	Gas Plant
$PM_{2.5}$	24-hour	12.2	***23.0***	***35.2***	***100.6***	35	***Sequential construction, completion, and production on an 8-well pad***
	Annual	3.2	1.65	4.9	40.4	12	Gas Plant

[1] The reported modeled design concentration depends on the statistical form of the NAAQS/WAAQS (shown in **Table 3.1-1**). More detailed information regarding the model processing and reported values can be found in Chapter 3.0 of **Appendix A**.

[2] Total Impact is sum of modeled designed concentration and the ambient background concentration.

4.1.2.4 Impacts at Class I and II Areas – Visibility

Visibility effects were not directly assessed for Alternative A in isolation; however, the number of wells and associated development activity under Alternative A would be less than under Alternative B. Based on a comparison the Project year with the maximum emissions for each alternative (i.e., Year 15 for Alternative A and Year 10 for Alternative B), visibility impacts for Alternative A would be approximately 50 percent of the impacts demonstrated for Alterative B. As shown in Alternative B (Section 4.1.3.5), effects likely would be minor to the point that they may not be perceptible.

4.1.2.5 Impacts at Class I and II Areas – Deposition

Atmospheric deposition effects were not modeled specifically for Alternative A in isolation; however, the number of wells and associated development activity under Alternative A would be less than under Alternative B. Based on a comparison the year with maximum emissions for each alternative (i.e., Year 15 for Alternative A and Year 10 for Alternative B), deposition impacts for Alternative A would be approximately 50 percent of the impacts demonstrated in Alterative B. As shown for Alternative B (Section 4.1.3.6), these effects likely would be negligible for sulfur deposition relative to DATs but potentially could exceed the nitrogen DATs in the CCPA and surrounding areas. The change in ANC likely would not be above the threshold of concern for any sensitive waterbody under Alternative A.

4.1.3 Impacts to Air Quality and Climate from Alternative B – Proposed Action

Under Alternative B, up to 5,000 new oil and gas wells would be drilled on 1,500 multi-well pads at an average rate of approximately 500 wells per year for 10 years. The productive life of each well would be approximately 30 years. For the purpose of analysis, all wells were assumed to be productive. The ultimate recovery from each well would vary depending on individual reservoir conditions.

In addition to new oil and gas well pads, Alternative B also would include the construction of other service well pads (i.e., production pads, water source well pads, and disposal well pads) as well as linear and ancillary facilities. The total number of new pads, roads, and facilities that would be developed or constructed as part of the Alternative B are shown in **Table 2.4-1**.

4.1.3.1 Alternative B Emissions Inventory Summary

The emissions inventory for Alternative B was calculated based on equipment types and predicted use. The Project-specific emission inventory included all emission sources that would result from Alternative B in the CCPA. These emission sources consisted of well site emissions, both from the well development phase (i.e., construction, drilling, and completion activities) and well production phase (i.e., emissions from active, producing wells), construction of linear infrastructure, and construction and operation of ancillary facilities. The total emissions for Alternative B by pollutant and by Project year are provided on **Table 4.1-4**. The peak annual ***Project-only*** emissions would occur during Year 10, which was selected to analyze maximum regional air impacts with the CAMx model. The near-field impact analyses were based on the maximum emissions for the individual activities, which was not a function of Project year. See **Appendix A** for a detailed description of the development of the emission inventory for Alternative B.

Table 4.1-4 Annual Emission Inventory for Criteria and Hazardous Pollutants for Alternative B

Year	Criteria Pollutants (tpy)						HAP (tpy)[1]						
	NO_X	CO	SO_2	VOC	PM_{10}	$PM_{2.5}$	Bz	EtBz	Form	H_2S	n-Hx	Ti	Xy
1	4,246	2,906	7.4	2,918	6,533	868	8.6	2.3	62.5	0.0	24	12	9
2	4,940	3,620	9.8	4,384	7,676	1,004	13.4	3.4	106.3	0.0	41	20	17
3	5,638	4,335	12.2	5,851	8,931	1,171	18.2	4.5	149.7	0.0	58	29	24

Table 4.1-4 Annual Emission Inventory for Criteria and Hazardous Pollutants for Alternative B

Year	Criteria Pollutants (tpy)						HAP (tpy)[1]						
	NO_X	CO	SO_2	VOC	PM_{10}	$PM_{2.5}$	Bz	EtBz	Form	H_2S	n-Hx	Ti	Xy
4	6,336	5,050	14.6	7,317	10,189	1,340	23.0	5.5	193.3	0.0	75	37	32
5	7,244	5,985	17.7	8,935	11,440	1,536	29.6	6.9	250.9	0.0	95	48	40
6	7,932	6,695	20.1	10,261	12,461	1,666	34.4	7.9	294.5	0.0	112	57	48
7	8,624	7,407	22.4	11,587	13,587	1,821	39.2	9.0	338.1	0.0	128	65	55
8	9,315	8,118	24.8	12,913	14,707	1,976	43.9	10.1	381.6	0.0	145	73	63
9	10,006	8,829	27.2	14,239	15,830	2,131	48.7	11.1	425.2	0.0	162	82	70
10	10,696	9,539	29.6	15,506	16,902	2,281	53.4	12.2	468.7	0.0	179	90	77
11	7,356	7,575	25.3	14,148	11,540	1,604	51.4	11.2	463.9	0.0	175	89	77
12	7,347	7,571	25.3	13,949	11,351	1,586	51.4	11.2	463.8	0.0	175	89	77
13	7,339	7,567	25.3	13,750	11,164	1,568	51.4	11.2	463.8	0.0	175	89	77
14	7,330	7,563	25.2	13,551	10,976	1,550	51.3	11.2	463.7	0.0	174	89	77
15	7,327	7,561	25.2	13,492	10,921	1,544	51.3	11.2	463.7	0.0	174	89	77
16	7,325	7,559	25.2	13,433	10,865	1,539	51.3	11.2	463.7	0.0	174	89	77
17	7,322	7,558	25.2	13,374	10,810	1,534	51.3	11.2	463.7	0.0	174	89	77
18	7,320	7,557	25.2	13,316	10,756	1,528	51.3	11.2	463.6	0.0	174	89	77
19	7,318	7,557	25.2	13,257	10,700	1,523	51.3	11.2	463.6	0.0	174	89	77
20	7,317	7,556	25.2	13,218	10,662	1,519	51.3	11.2	463.6	0.0	174	89	77
21	7,315	7,556	25.2	13,179	10,626	1,516	51.3	11.2	463.6	0.0	174	89	77
22	7,314	7,555	25.2	13,140	10,589	1,512	51.3	11.2	463.6	0.0	174	89	77
23	7,312	7,555	25.2	13,101	10,553	1,509	51.3	11.2	463.6	0.0	174	89	77
24	7,311	7,554	25.2	13,062	10,516	1,505	51.3	11.2	463.6	0.0	174	89	77
25	7,309	7,554	25.2	13,023	10,480	1,502	51.3	11.2	463.6	0.0	174	89	77
26	7,308	7,553	25.2	12,984	10,442	1,498	51.2	11.2	463.6	0.0	174	89	77
27	7,306	7,553	25.2	12,945	10,405	1,494	51.2	11.2	463.5	0.0	174	89	77
28	7,305	7,552	25.2	12,906	10,369	1,491	51.2	11.2	463.5	0.0	174	89	77
29	7,303	7,552	25.2	12,867	10,332	1,487	51.2	11.2	463.5	0.0	174	89	77
30	7,303	7,551	25.2	12,848	10,313	1,486	51.2	11.2	463.5	0.0	174	89	77
31	6,619	6,842	22.8	11,639	9,480	1,359	46.5	10.1	420.0	0.0	157	81	69
32	5,895	6,117	20.4	10,426	6,909	1,065	41.7	9.1	376.1	0.0	140	72	62
33	5,216	5,410	18.0	9,217	6,292	959	37.0	8.0	332.7	0.0	124	64	55
34	4,537	4,703	15.6	8,009	5,677	853	32.3	7.0	289.2	0.0	107	56	47
35	3,859	3,996	13.3	6,801	5,062	747	27.5	5.9	245.8	0.0	90	47	40
36	2,968	3,068	10.2	5,301	4,426	626	20.9	4.5	188.3	0.0	70	36	31
37	2,290	2,361	7.9	4,092	3,811	520	16.1	3.5	144.8	0.0	53	28	24
38	1,611	1,655	5.5	2,884	3,195	414	11.4	2.4	101.3	0.0	37	19	16
39	932	948	3.2	1,675	2,579	308	6.7	1.3	57.9	0.0	20	11	9
40	46	21	0.1	658	1,947	187	0.1	0.0	0.4	0.0	0	0	0

[1] Bz = benzene; EtBz = ethyl-benzene; Form = formaldehyde; n-Hx = x-hexane; Ti = toluene; Xy = xylene.

4.1.3.2 Assessing Impacts to Criteria Pollutants

In order to quantify the effects to criteria pollutants under Alternative B, two types of modeling assessments were completed. The near-field modeling assessed the Project effects within and nearby the CCPA, while the regional modeling assessed Project effects across the region.

Near-field Modeling Results

A near-field criteria pollutant assessment was performed to estimate maximum potential effects on NO_X, CO, SO_2, PM_{10}, and $PM_{2.5}$ during construction, drilling, ***completion*** and production phases at individual well pads as well as at gas plants and compressor stations. ***Note that the gas plants and compressor stations were not modeled together as they are not typically located within 1 mile of each other.*** Near-field modeling assessed the following activities:

- A single well per pad during production;
- An 8-well construction pad;
- An 8-well drilling pad;
- ***An 8-well completion pad***
- An 8-well production pad;
- A 16-well construction pad;
- A 16-well drilling pad;
- ***A 16-well completion pad;***
- A 16-well production pad;
- A gas plant; and
- A compressor station.

The modeling scenarios for an 8-well pad are the representative conditions for a successful well pad. The modeling scenarios for a 16-well pad are the maximum well pad density that could possibly occur under Alternative B. As such, the 16-well pad would not be considered a typical well pad density; rather, the impacts would represent the highest potential development on any given well pad. Representative and maximum conditions were modeled for construction, drilling, completion and production to assess both potential representative and maximum development impacts. Various combinations of planned activities were modeled together to assess operations that could occur simultaneously within a square-mile section. The modeling assessment cases were developed to evaluate possible impacts from the Project.. See **Appendix A** for additional details regarding the near-field modeling configuration, emissions, and assessment cases.

Table 4.1-5 provides a summary of the highest near-field modeling criteria pollutant impacts including the model-predicted impact in ***accordance with*** the form of the NAAQS/WAAQS, the ambient background, total impact, and percent of standard for each pollutant. The table provides a summary of the activities that would be predicted to cause the highest impacts for each criteria pollutant. With the exception of 24-hour PM_{10}, ***1-hour-NO_2 and 24-hour $PM_{2.5}$,*** all criteria pollutants and averaging periods were below the NAAQS/WAAQS for all modeling assessment cases. For ***24-hour*** PM_{10}, the 16-well and 8-well construction modeling assessment case***s both*** exceeded the NAAQS/WAAQS. ***The sequential construction, completion, and production modeling assessment showed 1-hour NO_2 exceedances for both the 8-well and 16-well cases. The sequential completion and production activity modeling assessment showed 24-hour $PM_{2.5}$ exceedances for both the 8-well pad and 16-well pad cases as well. The 16-well cases exceeded the NAAQS/WAAQS by a larger amount than the 8-well cases.***

Table 4.1-5 Summary of Near Field Criteria Pollutant Results – Alternative B

Pollutant	Averaging Period	Ambient Background (µg/m³)	Maximum Modeled Design Concentration[1] (µg/m³)	Total Impact[2] (µg/m³)	Percent of Standard	NAAQS/ WAAQS (µg/m³)	Modeling Assessment Case
NO_2	1-hour	16.5	***248.0***	***264.5***	***140.7***	188	***Sequential construction, completion, and production on four 16-well pads***
	Annual	2.8	7.18	10.0	10.0	100	Two 16-well drilling + two 16-well production pads
CO	1-hour	574.5	***1673.0***	***2247.5***	***5.6***	40000	***Two 16-well completion pads + two 16-well production pads***
	8-hour	471.5	***1153.5***	***1625***	***16.3***	10000	Two 16-well ***completion*** pads + two 16-well production pads
SO_2	1-hour	25.3	***2.3***	***27.6***	***14.1***	196	***Sequential construction, drilling, and production on four 16-well pads***
	3-hour	30.7	***2.9***	***33.6***	***2.6***	1310	***Two 16-well completion pads + two 16-well production pads***
PM_{10}	24-hour	39	454.65	493.7	329.1	150	Four 16-well construction pads
	Annual	12	3.00	15.0	30.0	50	Compressor station + two 16-well production pads
$PM_{2.5}$	24-hour	12.2	***28.3***	***40.5***	***115.7***	35	***Sequential completion and production activities on four 16-well pads***
	Annual	3.2	3.00	6.2	51.7	12	Compressor station + two 16-well production pads

[1] The reported modeled design concentration depends on the statistical form of the NAAQS/WAAQS (shown in **Table 3.1-1**). More detailed information regarding the model processing and reported values can be found in Chapter 3.0 of **Appendix A**.

[2] Total Impact is sum of modeled designed concentration and the ambient background concentration.

As a result of the larger well pads, Alternative B exceeded the annual PM_{10} NAAQS/WAAQS by a larger amount than Alternative A. ***For the first 10 years under Alternative B and first 15 years under Alternative A, well sites are anticipated to be constructed and completed within the CCPA. While construction and completion activities frequently are predicted to exceed the NAAQS/WAAQS, the sources are transient and temporary; therefore, impacts would be expected to be localized in the immediate vicinity of the construction and completion activities and after construction and completion activities stops the impacts would end and concentrations would return to background levels.***

<u>PSD Increment Assessment</u>

Project impacts were compared to PSD Significant Impact Levels (SILs) as a screening assessment to determine if a proposed new or modified stationary source could cause or contribute to a PSD increment exceedance. If Project-only impacts (i.e., from Alternative B only) exceeded the screening SILs, a full cumulative PSD increment analysis was conducted to account for other nearby increment consuming sources. If maximum Project-only impacts were predicted to be below the SIL, a cumulative assessment was not necessary. Alternative B includes all Project sources expected to operate simultaneously within 1 square mile, including additional sources that are not regulatorily required for a PSD increment consumption analysis. **Table 4.1-6** provides a summary of the modeled near-field results for Alternative B compared to applicable SILs.

Assessment of individual Project-only impacts predicted an exceedance of PSD SILs for the short-term and annual NO_2, PM_{10}, ***and*** $PM_{2.5}$ ***pollutant*** averaging periods***, as well as the 8-hour CO pollutant*** *averaging period* (**Table 4.1-6**); therefore, a cumulative PSD assessment for impacts within the CCPA was conducted for ***applicable*** pollutants using the CAMx model. Based on the CAMx modeling results (**Table 4.1-7**), PSD increments within the CCPA were predicted to exceed the 24-hour PM_{10}, 24-hour $PM_{2.5}$, and annual $PM_{2.5}$ PSD increments, but were not predicted to exceed the annual NO_2 and annual PM_{10} PSD increments. While ***both*** the interim 1-hour NO_2 ***and the 8-hour CO SIL*** was predicted to be exceeded (**Table 4.1-6**), PSD increments for 1-hour NO_2 ***and 8-hour CO*** have not been established (40 CFR 51.166). Therefore, cumulative impacts were not assessed relative to PSD increments for 1-hour NO_2 ***and 8-hour CO.***

The comparison of impacts to SILs and PSD increments has been provided for informational purposes only and does not represent a regulatory PSD increment consumption analysis. PSD increment consumption would be assessed as part of a formal increment consumption analysis during the permitting process, if required.

Table 4.1-6 Summary of Near Field Criteria Pollutant Results Compared to SILs – Alternative B

Pollutant	Averaging Period	Significant Impact Limit (SIL) Assessment			
		Class II SIL[1] (μg/m³)	Modeled Value (μg/m³)	Modeling Case(s) of Occurrence	Exceed SILs
NO_2	1-hour	7.5[2]	***641.4***[3]	• ***Two 16-well completion pads + two 16 well production pads***	YES
	Annual	1[4]	7.2[5]	• Two 16-well drilling pads + two 16-well production pads	YES
CO	1-hour	2,000[4]	***1,820***[3]	• ***Two 16-well completion pads + two 16 well production pads***	NO
	8-hour	500[4]	***1,349***[3]	• ***Two 16-well completion pads + two 16 well production pads***	***YES***
SO_2	1-hour	6[6]	***3.4***[3]	• ***Two 16-well completion pads + two 16 well production pads***	NO
	3-hour	25[4]	***3.0***[3]	• ***Two 16-well completion pads + two 16 well production pads***	NO
	24-hour	5[4]	1.***5***[3]	• ***Two 16-well completion pads + two 16 well production pads***	NO
	Annual	1[4]	0.27[5]	• Gas plant + two 16-well production pads	NO
PM_{10}	24-hour	5[4]	527[3]	• Four construction pads	YES
	Annual	1[4]	3.0[5]	• Compressor station + two 16-well production pads • Gas plant + two 16-well production pads	YES

Table 4.1-6 Summary of Near Field Criteria Pollutant Results Compared to SILs – Alternative B

Pollutant	Averaging Period	Significant Impact Limit (SIL) Assessment			
		Class II SIL[1] ($\mu g/m^3$)	Modeled Value ($\mu g/m^3$)	Modeling Case(s) of Occurrence	Exceed SILs
$PM_{2.5}$	24-hour	1.2[7]	45.4[3]	• Four construction pads	YES
	Annual	0.2[7]	3.0[5]	• Compressor station + two 16-well production pads • Gas plant + two 16-well production pads	YES

[1] SILs are not to be exceeded for all averaging periods.

[2] Interim SIL based on General Guidance for Implementing the 1-hour NO_2 National Ambient Air Quality Standard in Prevention of Significant Deterioration Permits, Including an Interim 1-hour NO_2 SIL, June 28, 2010. (USEPA 2010a).

[3] The highest first high value of the five individual modeled years.

[4] The Class II SILs for NO_2 (annual), CO, SO_2 (annual, 24-hour and 3-hour), and PM_{10} are found in 40 CFR 51.165(b)(2).

[5] Maximum annual mean value of the 5 individual years.

[6] Interim SIL based on USEPA Memo, Guidance Concerning the Implementation of the 1-hour SO_2 NAAQS for the Prevention of Significant Deterioration Program, August 23, 2010 (USEPA 2010a).

[7] SIL values listed above in accordance with the USEPA recommendations presented in the USEPA Draft Memo, Guidance on SILs for Ozone and Fine Particles in the Prevention of Significant Deterioration Permitting Program, August 1, 2016 (Revised August 18, 2016; [USEPA 2016]).

Table 4.1-7 Summary of Criteria Pollutant Results Compared to PSD Increments – Alternative B

Pollutant	Averaging Period	PSD Class II Increment ($\mu g/m^3$)	Modeled Value ($\mu g/m^3$)	Exceeds Increment
NO_2	Annual	25	2.38	No
PM_{10}	24-hour	30	**135.4**[1]	Yes
	Annual	17	14.3	No
$PM_{2.5}$	24-hour	9	**26.7**[1]	Yes
	Annual	4	**4.9**[1]	Yes

[1] Model-predicted impacts that exceed the PSD increment are shown in **bold** text.

Regional Modeling Results

The CAMx photochemical model was used to estimate the regional effects on criteria pollutants, visibility, and deposition. The Alternative B emissions inventory for Project Year 10 was used in combination with all other regional emissions included in Alternative A to estimate cumulative air quality effects of Alternative B. Results were compared with applicable AAQS and Class I and sensitive Class II PSD increment values.

The brute force method was used to assess Project-only impacts for ozone, PM_{10}, and $PM_{2.5}$. The brute force method calculates the difference between the Cumulative 2028 Alternative B modeling scenario and the cumulative 2028 Alternative A modeling scenario. The APCA method was used to assess Project-only impacts for ozone. The APCA method is a model tool that estimates the amount of ozone that is due to emissions from groups of sources. The Project-only impacts from both methods are shown on **Table 4.1-8**.

Table 4.1-8 Model-Predicted Project-only Impacts within the 4-km Domain

Pollutant	Method	Maximum Project Impact Value	Location
Ozone	Brute Force	0.0026 ppm	~5.5 miles east of CCPA
	APCA	0.0039 ppm	~15 miles north of CCPA
$PM_{2.5}$ (24-hour)	Brute Force	2.8 $\mu g/m^3$	within CCPA
$PM_{2.5}$ (Annual)	Brute Force	0.8 $\mu g/m^3$	within CCPA

Figure 4.1-1 shows the Project-only contributions predicted from both methods. The highest Project-only impacts would occur in areas within or surrounding the CCPA, typically approximately 12 km east of the CCPA. The spatial pattern of Project-only contributions from APCA is consistent with Project-only impacts predicted using the brute force method; however, the highest Project-only contributions from APCA are 3.9 ppb; higher than the 2.6 ppb predicted with brute force (**Table 4.1-8**). It should be noted that the predicted Project-only impacts do not contribute to an exceedance of the ozone AAQS, as the cumulative ozone AAQS values are well below the AAQS.

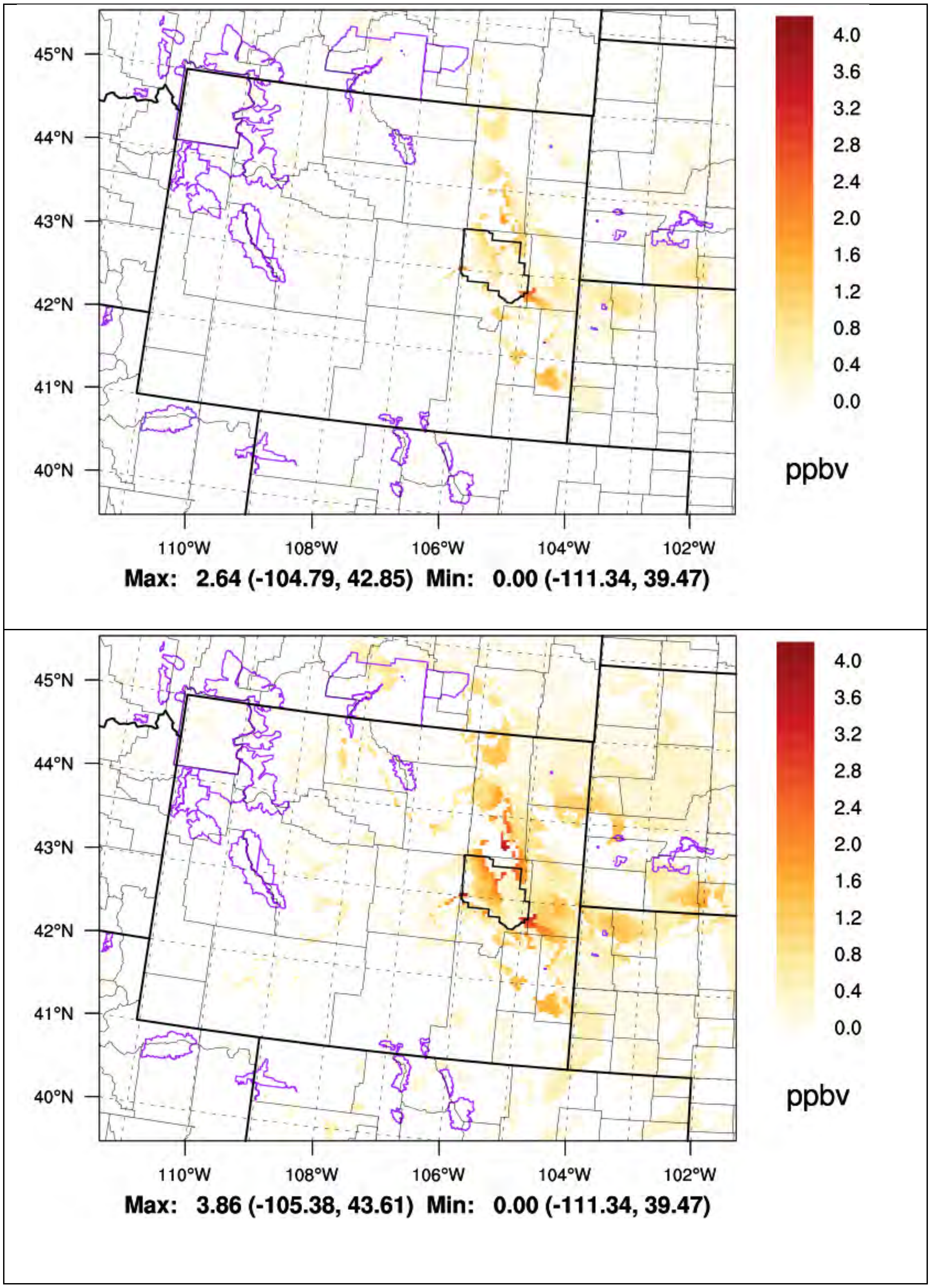


Figure 4.1-1 Fourth Highest Daily Maximum 8-hour Ozone Project-only Impacts from Brute Force (Top) and APCA (Bottom) Methods

Just like ozone, the Project-only impacts to annual and daily $PM_{2.5}$ would be mostly limited to the areas within the CCPA (**Figure 4.1-2**). The Project-only impacts would be the highest within the CCPA and would decrease in magnitude rapidly with distance. The highest Project-only impacts to the annual $PM_{2.5}$ concentrations would range between 0.3 and 1 µg/m^3. In the rest of the 4-km domain, the Project-only impacts would be essentially 0 µg/m^3. For daily $PM_{2.5}$, the highest Project-only impacts to the daily $PM_{2.5}$ concentrations would range from 0.2 and 2.8 µg/m^3. In the rest of the 4-km domain, the Project-only impacts would be less than 0.2 µg/m^3. **Table 4.1-8** provides the largest annual and daily $PM_{2.5}$ Project-only impacts in the form of the standard within the modeling domain. Similar to ozone, the largest Project-only impacts for both annual and daily $PM_{2.5}$ would occur when the cumulative Alternative B concentrations would be below the AAQS.

To assess the Project-only impacts calculated using the brute force method at Class I and sensitive Class II assessment areas, the regional modeling results for ozone and $PM_{2.5}$ are provided for both model-predicted absolute effects as well as model-adjusted effects. **Table 4.1-9** provides the largest Project-only impact from the model-predicted absolute effects and model-adjusted effects at a Class I and Sensitive Class II areas for ozone, PM_{10}, and $PM_{2.5}$. **Table 4.1-10** provides the largest model-adjusted MATS Project-only impacts at a Class I, sensitive Class II areas, and monitoring sites for ozone and $PM_{2.5}$. The model-predicted absolute and model-adjusted effects provide a range of impacts that helps bound the model uncertainty. The Project-only impacts of ozone, PM_{10}, and $PM_{2.5}$ would be negligible or zero at all Class I and Sensitive Class II assessment areas and monitoring sites. While the model predicts exceedances of AAQS for some pollutants and averaging periods, the Project is only predicted to contribute to elevated 24-hour PM_{10} concentrations. As discussed in the Air Quality Technical Support Document (**Appendix A**), the model-predicted AAQS exceedance of cumulative daily PM_{10} primarily was due to large fires in the vicinity of the assessment area. ***The fires are representative of actual fires, which are short-lived and localized to the burn area. The fire impacts to the model-predicted AAQS exceedance of cumulative daily PM_{10} would be isolated to when the fires are occurring. H***owever, Alternative B would not be expected to contribute to further AAQS exceedances in the assessment area. The model-predicted Project-only impacts for NO_2, CO, and SO_2 would be negligible and most modeled cases were zero (data are not shown here, but are available in **Appendix A**).

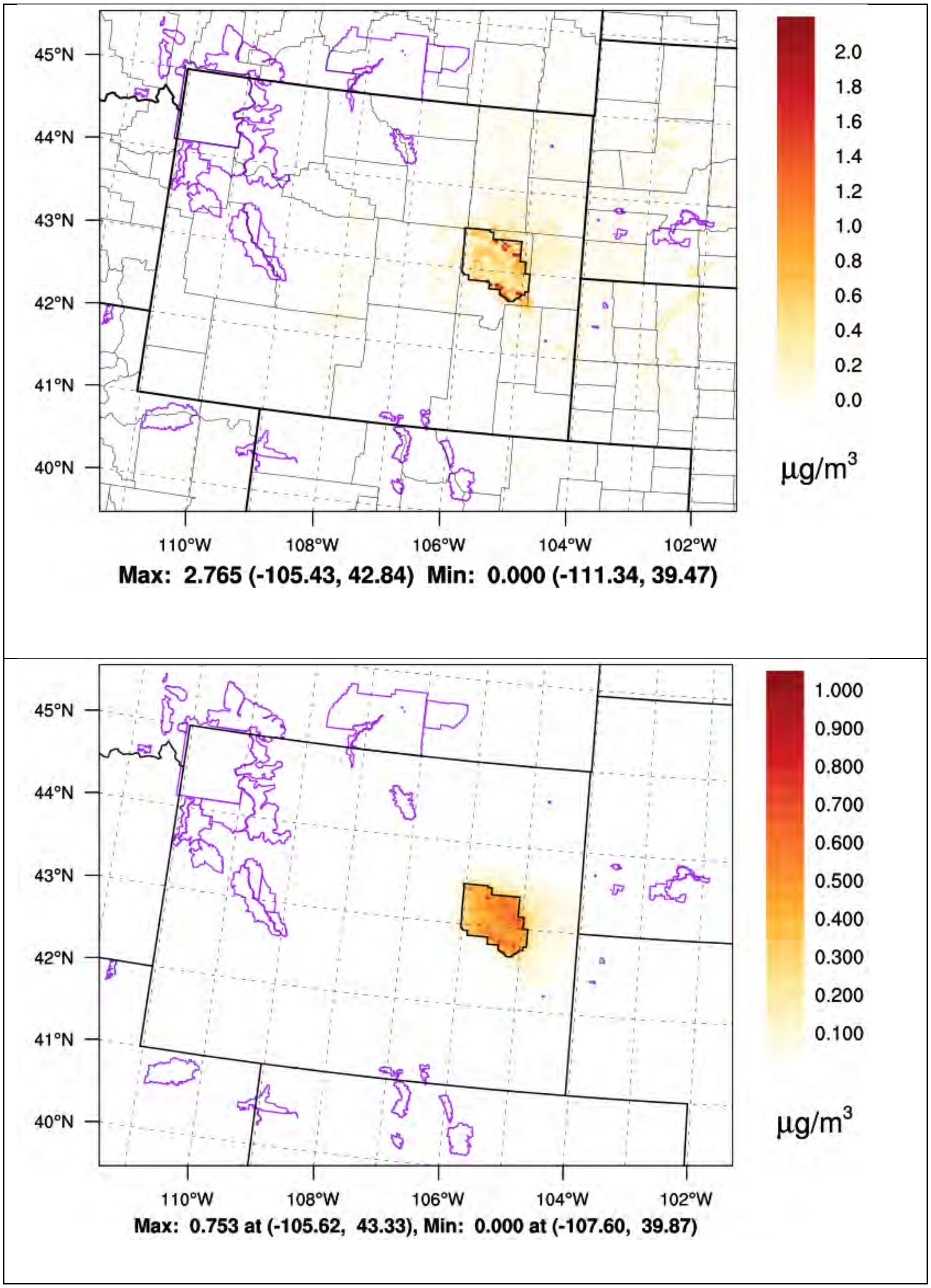


Figure 4.1-2 Project-only Impacts for Annual $PM_{2.5}$ (Top) and Daily $PM_{2.5}$ (Bottom)

Table 4.1-9 Project-only Impacts at Assessment Areas Based on Brute Force Technique

Pollutant	Area Category	Maximum Project Impact Value	Location
Ozone	Class I	0 ppm	-
	Sensitive Class II	0.001 ppm	Fort Laramie National Historic Site
PM_{10} (24-hour)	Class I	10 µg/m^3	North Absaroka WA
	Sensitive Class II	0 µg/m^3	-
PM_{10} (Annual)	Class I	0 µg/m^3	-
	Sensitive Class II	0.2 µg/m^3	Fort Laramie National Historic Site
$PM_{2.5}$ (24-hour)	Class I	0.0 µg/m^3	-
	Sensitive Class II	1 µg/m^3	Fort Laramie National Historic Site and Agate Fossil Beds NM
$PM_{2.5}$ (Annual)	Class I	0.0 µg/m^3	-
	Sensitive Class II	0.1 µg/m^3	Fort Laramie National Historic Site

Table 4.1-10 Project-only Impacts at Assessment Areas and Monitoring Sites Based on Model Adjusted Values

Pollutant	Area Category	Maximum Project Impact Value	Location
Ozone	Class I	0.001 ppm	Northern Cheyenne Indian Reservation
	Sensitive Class II	0 ppm	-
	Monitoring Site	0 ppm	-
$PM_{2.5}$ (24-hour)	Monitoring Site	0.4 µg/m^3	Thunder Basin National Grassland Site, Wyoming
$PM_{2.5}$ (Annual)	Class I	0.0 µg/m^3	-
	Sensitive Class II	0 µg/m^3	-
	Monitoring Site	0.20 µg/m^3	Thunder Basin National Grassland Site, Wyoming

4.1.3.3 Assessing Impacts to Toxics

Near-field HAPs concentrations were calculated to assess effects for short-term (acute) exposure assessment and long-term (chronic) risk. HAPs emissions would occur from fugitives, well blowdown venting, pneumatic devices, and liquid storage tanks as well as other smaller sources such as truck traffic. HAPs would be emitted predominantly during the production phase; therefore, only HAPs emissions from the production scenario were analyzed.

The short-term (1-hour) HAP concentrations were compared to acute RELs, and annual modeled HAP concentrations for all HAPs emitted were compared directly to the non-carcinogenic RfCs. **Table 4.1-11** provides a summary of the maximum modeled concentrations for the RELs as well as the maximum modeled concentrations for the non-carcinogenic RfCs. Model results indicate that HAP concentrations would be below the 1-hour RELs and below the annual RfCs for Alternative B.

Table 4.1-11 Short-term Risks and Long-term Non-carcinogenic Risk from Near-field HAPs – Alternative B

Risk	HAP	Maximum Modeled Concentration ($\mu g/m^3$)	Acceptable Reference Level	Within Acceptable Limits	Modeling Assessment Case
REL	Benzene	14.6	1,300	Yes	Compressor station + two 16 well production pads
	Toluene	36.4	37,000	Yes	Compressor station + two 16 well production pads
	Ethylbenzene	8.5	350,000	Yes	Compressor station alone
	Xylene	47.5	22,000	Yes	Compressor station alone
	n-Hexane	146.3	390,020	Yes	Compressor station + two 16 well production pads
	Formaldehyde	28.7	55	Yes	Gas plant alone
Non-carcinogenic RfC	Benzene	0.9	30	Yes	Compressor station + two 16 well production pads
	Toluene	2.2	5,000	Yes	Compressor station + two 16 well production pads
	Ethylbenzene	0.5	1,000	Yes	Compressor station + two 16 well production pads
	Xylene	2.9	100	Yes	Compressor station + two 16 well production pads
	n-Hexane	8.9	700	Yes	Compressor station + two 16 well production pads
	Formaldehyde	2.1	9.8	Yes	Gas plant + two 16 well production pads

Long-term exposures to emissions of suspected carcinogens were evaluated for potential incremental risk; however, this characterization does not reflect a complete risk analysis. USEPA unit risk factors and adjustment factors are described in detail in the **Appendix A**. **Table 4.1-12** provides a summary of the long-term cancer risks for the total modeled cancer risk from benzene, ethylbenzene, and formaldehyde, which were the only HAPs analyzed for this Project that also are known to have carcinogenic effects. For those modeling assessments predicted to exceed one-in-one million exposure levels, the table provides the distance needed to be below a one-in-one million cancer risk. For both the MLE and MEI, the modeling assessment using the gas plant combined with two 16-well production pads provided the maximum modeled cancer risk and exceeded the one-in-one million risk. For the MLE case, a distance of approximately 180 meters (0.11 mile) from the gas plant was needed to be below a one-in-one million cancer risk for the gas plant combined with two 16-well production pads. For the MEI case, the distance needed to be below the one-in-one million cancer risk would be approximately 2,000 meters (1.24 miles) from the gas plant. Although the single well pads in production are predicted to exceed the one-in-one million cancer risk for the MEI, the distance needed to be below a one-in-one million cancer risk would be less than the WOGCC-required 500-***foot*** (***0.09*** mi) setback between a well and a residence.

Table 4.1-12 Near-field Long-term Cancer Risk – Alternative B

Risk	Case	Total Modeled Cancer Risk	Distance to be Below One-in-one Million Risk	
			meters	miles
MLE	Four single-well pads without high-line power during production	3.7E-07	--	--
	Four electrified 8-well pads during production	3.6E-08	--	--
	Four electrified 16-well pads during production	8.0E-08	--	--
	A gas plant	2.9E-06	180	0.11
	A gas plant and two 16-well pads during production	2.9E-06	180	0.11
	A compressor station	2.4E-06	170	0.11
	A compressor station and two 16-well pads during production	2.5E-06	170	0.11
MEI	Four single well pads without high-line power during production	2.8E-06	40	0.02
	Four electrified 8-well pads during production	2.7E-07	--	--
	Four electrified 16-well pads during production	6.0E-07	--	--
	A gas plant	2.2E-05	2,040	1.27
	A gas plant and two 16-well pads during production	2.2E-05	2,040	1.27
	A compressor station	1.8E-05	1,920	1.19
	A compressor station and two 16-well pads during production	1.8E-05	1,920	1.19

4.1.3.4 Impacts at Class I and II Areas – Visibility

Table 4.1-13 provides the Project-only impacts compared to natural background conditions for visibility for all Class I and sensitive Class II areas. All but four Class I areas were predicted to have zero days exceeding 0.5 delta deciview (dv). Two of the four Class I areas that were predicted to have impacts greater than 0.5 delta dv, Badlands National Park and the Northern Cheyenne Indian Reservation, also would have one or more days with impacts over 1.0 delta dv. Among the sensitive Class II areas, only areas downwind from and closest to the CCPA would exceed 1.0 and 0.5 delta dv. Importantly, when Project-only impacts were adjusted for known model bias, the model-adjusted Project-only impacts were zero at all Class I and sensitive Class II areas.

The 98th percentile highest Project-only visibility impact at a Class I area would be 0.64 delta dv at Badlands National Park. **Figure 4.1-3** shows the Project-only daily average delta dv for Badlands relative to a 0.5 delta dv impact. Note that those days predicted by the model to have visibility improvement or impairment may not be the same days used to determine the 20 percent worst or 20 best days because the 20 percent worst and best days were based on monitoring data, not modeling results. As seen in **Figure 4.3-1**, the highest Project-only visibility impacts measured as delta dv tended to occur during the winter, and the smallest Project-only impacts occurred during the summer.

Table 4.1-13 Proposed Action Visibility Impacts Relative to Natural Background Conditions

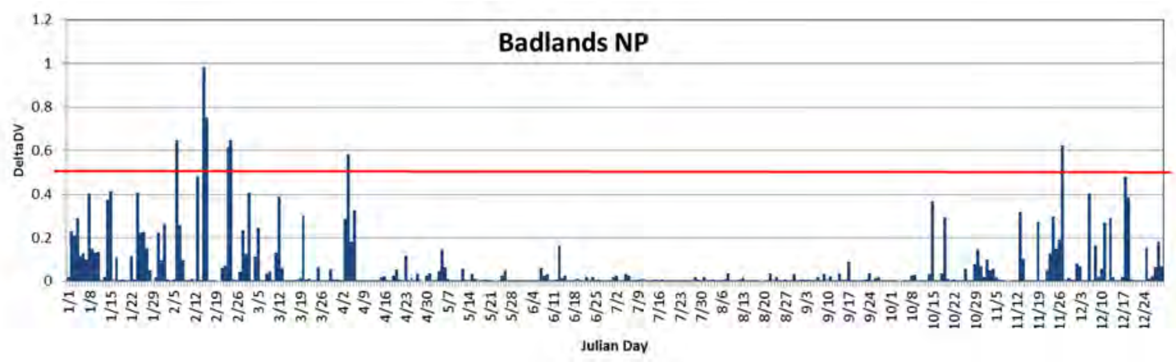
Assessment Areas	Number of Days Exceeding > 0.5 delta dv	Number of Days Exceeding > 1.0 delta dv	98th Percentile delta dv	Maximum delta dv
Class I Areas				
Badlands National Park	**9**	**1**	**0.64**	**1.44**
Bridger Wilderness Area	**1**	0	0.07	**0.60**
Fitzpatrick Wilderness Area	0	0	0.04	0.10
Grand Teton National Park	0	0	0.05	0.09
Mount Zirkel Wilderness Area	0	0	0.11	0.23
North Absaroka Wilderness Area	0	0	0.07	0.30
Northern Cheyenne Indian Reservation	**2**	0	0.24	**0.86**
Rawah Wilderness Area	0	0	0.07	0.11
Red Rock Lakes Wilderness Area	0	0	0.04	0.25
Rocky Mountain National Park	0	0	0.09	0.10
Savage Run Wilderness Area	0	0	0.06	0.20
Teton Wilderness Area	0	0	0.06	0.11
Washakie Wilderness Area	0	0	0.04	0.30
Wind Cave National Park	**1**	0	0.30	**0.54**
Yellowstone National Park	0	0	0.08	0.15
Class II Areas				
Absaroka-Beartooth Wilderness	0	0	0.06	0.20
Agate Fossil Beds National Monument	**15**	**1**	**0.67**	**1.01**
Bighorn Canyon National Recreation Area	0	0	0.07	0.33
Black Elk Wilderness Area	0	0	0.18	0.31
Cloud Peak Wilderness Area	0	0	0.06	0.10
Crow Indian Reservation	**3**	0	0.26	**0.95**
Devil's Tower National Monument	**1**	0	0.25	**0.89**
Dinosaur National Monument [1]	**3**	2	0.43	**1.75**
Encampment River Wilderness Area	0	0	0.06	0.14
Fort Laramie National Historic Site	**25**	**4**	**0.81**	**1.25**
Gros Ventre Wilderness Area	0	0	0.04	0.13
High Uintas Wilderness Area	0	0	0.05	0.14
Huston Park Wilderness Area	0	0	0.09	0.24
Jedediah Smith Wilderness Area	0	0	0.03	0.07
Jewel Cave National Monument	**1**	0	0.23	**0.79**
Lee Metcalf Wilderness Area	0	0	0.05	0.14
Mount Naomi Wilderness Area	0	0	0.03	0.14
Mount Rushmore National Memorial	0	0	0.14	0.28

Table 4.1-13 Proposed Action Visibility Impacts Relative to Natural Background Conditions

Assessment Areas	Number of Days Exceeding > 0.5 delta dv	Number of Days Exceeding > 1.0 delta dv	98th Percentile delta dv	Maximum delta dv
Platte River Wilderness Area	0	0	0.05	0.08
Popo Agie Wilderness Area	0	0	0.04	0.35
Sarvis Creek Wilderness Area	0	0	0.05	0.07
Soldier Creek Wilderness Area	**15**	0	**0.60**	**0.80**
Wind River Roadless Area	0	0	0.03	0.20

[1] Visibility impacts for Dinosaur National Monument may be elevated due to model artifact explained in Attachment F to **Appendix A**.

Note: Model-predicted impacts that exceed established thresholds are shown in **bold** text.



Note: the red line indicates the 0.5 delta dv threshold.

Figure 4.1-3 Project-only Daily Average delta dv in Badlands National Park

4.1.3.5 Assessing Impacts at Class I and II Areas – Deposition

As shown in **Table 4.1-14**, all Class I and Sensitive Class II areas were below the sulfur DATs, while the nitrogen DATs were exceeded at three Class I areas and 10 Sensitive Class II areas. As seen in **Figure 4.1-4**, the greatest Project-only impact on nitrogen and sulfur deposition generally would be concentrated within and directly outside of the CCPA. Project-only impacts would decrease with distance from the CCPA, particularly at Class I and Sensitive Class II areas as well as sensitive lakes that are further from the CCPA. For sulfur, there would be a small amount of Project-only influence.

Note that the DAT is not a threshold for evaluating impact severity, but represents a significance threshold used to determine whether the predicted deposition impacts warrant further evaluation. When the DAT is exceeded, the affected land management agency (e.g., National Park Service or Forest Service) examines whether the ecosystem(s) in the park or wilderness area are sensitive to deposition, and if so, considers whether current deposition levels in the location are of concern.

Table 4.1-15 also shows model-predicted Project Impacts to ANC of sensitive lakes. The table shows background ANC values, modeled acid deposition (Hdep) in terms of free hydrogen ions, and change in ANC from Alternative B relative to both background and Alternative A ANC values. ANC impacts would be within the acceptable limits for lakes with ANCs background values greater than 25 µeq/L and lakes with ANC background values less than 25 µeq/L.

4.1.3.6 Mitigation and Mitigation Effectiveness

In addition to existing rules, regulations, and OG-committed design features in place to reduce air quality impacts, the following mitigation measure would be required.

AQ-1 If located on BLM surface estate, gas plants and compressor stations will be located at least 2,000 meters from residences or other occupied dwellings.

Effectiveness: HAP impacts were predicted to exceed the one-in-one million carcinogenic risk level for ***two*** cases: gas plants, and compressor stations. Mitigation measure AQ-1 would reduce the potential health risks associated with activities at gas plants ***and*** compressor stations.

The following air quality mitigation measures have been added to this section in response to public comment on the Draft EIS. Note that the BLM does not have authority to require application of these mitigation measures.

AQ-2 Description of measure: USEPA, NPS, and Powder River Basin Resource Council (PRBRC) recommended the use of Tier 4 diesel drill rig engines to reduce NO_x emissions. NO_x emission reductions can mitigate nitrogen deposition and visibility impacts and near-field short-term NO_2 impacts.

Effectiveness: Based on a review of the emissions inventory, it was estimated that the use of Tier 4 drill rig engines would reduce the NO_x emissions for the maximum project year 10 by 15 percent. A corresponding reduction in nitrogen deposition and visibility impacts would be anticipated with a reduction in NO_x emissions though the amount of impact reduction can only be quantified through a modeling assessment. As presented in Section 4.1.3.2, near-field short-term NO_2 impacts during drilling are below the NAAQS, and therefore do not need to be mitigated.

AQ-3 Description of measure: USEPA, NPS, and PRBRC recommended the use of Tier 4 diesel engines for all engines used during well completion to reduce NO_x emissions. NO_x emission reductions can mitigate nitrogen deposition and visibility impacts and near-field short-term NO_2 impacts.

Effectiveness: Based on a review of the emissions inventory, it was estimated that the use of Tier 4 engines during well completion would reduce the NO_x emissions for the maximum project year 10 by 7 percent. A corresponding reduction in nitrogen deposition and visibility impacts would be anticipated with a reduction in NO_x emissions though the amount of impact reduction can only be quantified through a modeling assessment. The 1-hour NO_x emissions would be reduced by 75 to 90 percent (relative to Tier 2 engines) depending on number of Tier 4 engines used during completion. The impact of the reduction of the 1-hour NO_x emissions on near-field short-term NO_2 impacts during completion can only be quantified through near-field modeling.

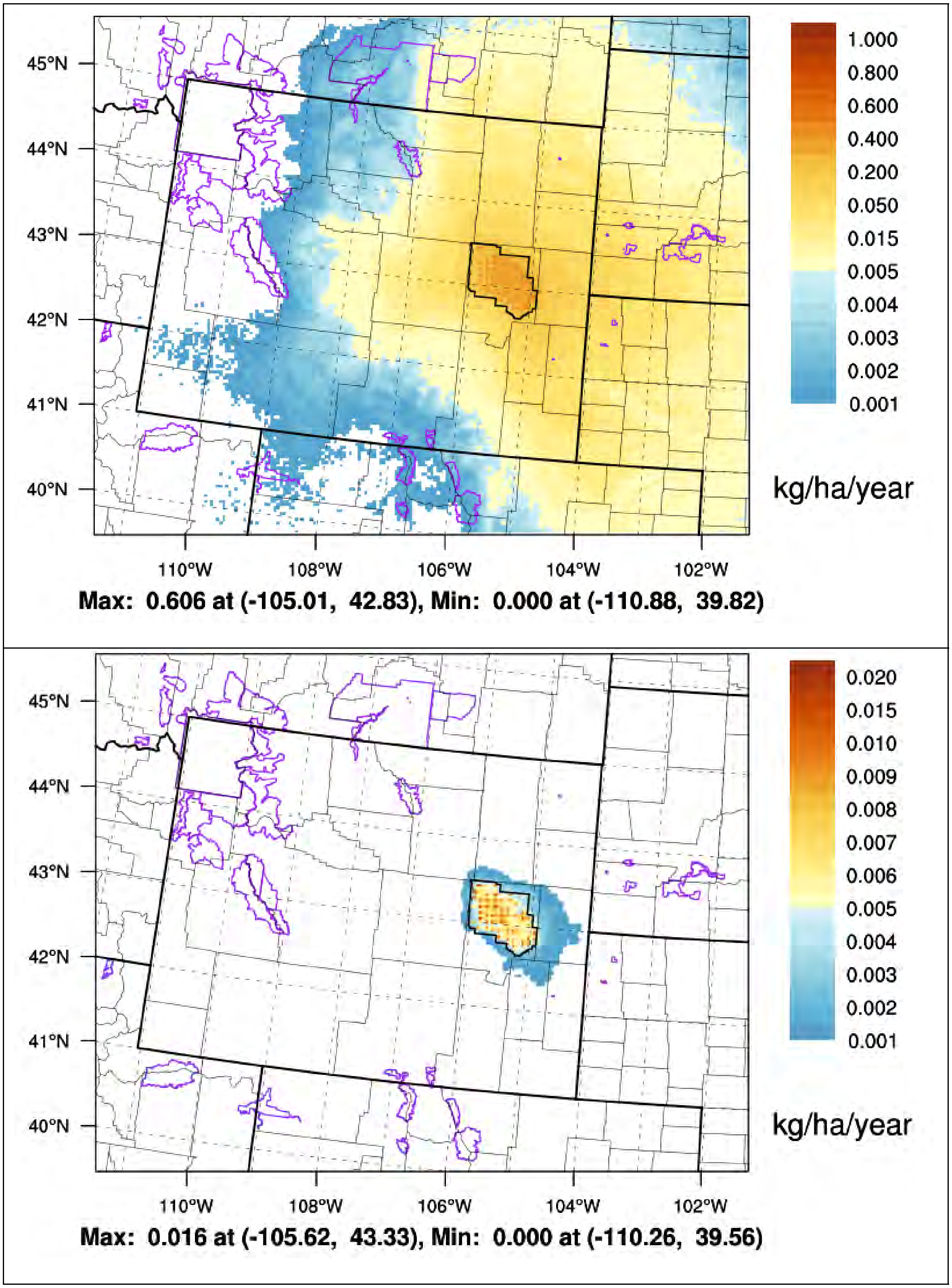


Figure 4.1-4 Project-only Impacts of Nitrogen (top) and Sulfur (bottom) Deposition

Table 4.1-14 Nitrogen and Sulfur Deposition Impacts for Alternative B (Project Only)

Assessment Areas	Annual Deposition	
	Nitrogen (kg N/ha/yr)	Sulfur (kg S/ha/yr)
Class I Areas		
Badlands National Park	**0.022**	0.000
Bridger Wilderness Area	0.001	0.000
Fitzpatrick Wilderness Area	0.001	0.000
Grand Teton National Park	0.000	0.000
Mount Zirkel Wilderness Area	0.001	0.000
North Absaroka Wilderness Area	0.001	0.000
Northern Cheyenne Indian Reservation	**0.007**	0.000
Rawah Wilderness Area	0.002	0.000
Red Rock Lakes Wilderness Area	0.000	0.000
Rocky Mountain National Park	0.002	0.000
Savage Run Wilderness Area	0.002	0.000
Teton Wilderness Area	0.000	0.000
Washakie Wilderness Area	0.001	0.000
Wind Cave National Park	**0.038**	0.000
Yellowstone National Park	0.000	0.000
Class II Areas		
Absaroka-Beartooth Wilderness	0.000	0.000
Agate Fossil Beds National Monument	**0.038**	0.000
Bighorn Canyon National Recreation Area	0.003	0.000
Black Elk Wilderness Area	**0.034**	0.000
Cloud Peak Wilderness Area	0.004	0.000
Crow Indian Reservation	0.003	0.000
Devil's Tower National Monument	**0.021**	0.000
Dinosaur National Monument [1]	0.001	0.000
Encampment River Wilderness Area	0.002	0.000
Fort Laramie National Historic Site	**0.054**	0.000
Gros Ventre Wilderness Area	0.000	0.000
High Uintas Wilderness Area	0.000	0.000
Huston Park Wilderness Area	0.001	0.000
Jedediah Smith Wilderness Area	0.000	0.000
Jewel Cave National Monument	**0.043**	0.000
Lee Metcalf Wilderness Area	0.000	0.000
Mount Naomi Wilderness Area	0.000	0.000
Mount Rushmore National Memorial	**0.030**	0.000
Platte River Wilderness Area	0.002	0.000
Popo Agie Wilderness Area	0.001	0.000
Sarvis Creek Wilderness Area	0.002	0.000
Soldier Creek Wilderness Area	**0.056**	0.000
Wind River Roadless Area	0.001	0.000

[1] Deposition impacts for Dinosaur National Monument may be elevated due to model artifact explained in Attachment F to **Appendix A**.

Note: Model-predicted impacts that exceed nitrogen or sulfur DATs are shown in **bold** text.

Table 4.1-15 Model-predicted Project Impacts to ANC of Sensitive Lakes with Background ANC

Sensitive Lake	Number of Samples	Actual Watershed Area (hectare)	Annual Precipitation (meter)	Background ANC (µeq/L)	Project Deposition ($eq/m^2/yr$) Nitrogen	Project Deposition ($eq/m^2/yr$) Sulfur	ANC(o) (eq)	Hdep[1] (eq)	Alternative B ANC Change[1,2] (percent) from Background ANC	Alternative B ANC Change[1,2] (percent) from Alternative A
Lakes with Background ANC >25 µeq/L										
4D1-044, High Uintas Wilderness Area	3	60	1.01	64.98	1.44E-06	7.06E-09	26,100	1	0.00	0.01
4D2-039, High Uintas Wilderness Area	6	174	0.89	65.16	8.75E-07	3.95E-08	67,269	2	0.00	0.00
Black Joe Lake, Bridger Wilderness Area	72	890	0.86	70.64	4.69E-06	5.19E-08	360,464	42	0.01	0.02
Dean Lake, High Uintas Wilderness Area	1	122	1.10	51.40	4.99E-07	-3.31E-09	46,031	1	0.00	0.00
Deep Lake, Bridger Wilderness Area	62	205	1.00	61.10	5.05E-06	2.12E-08	83,510	10	0.01	0.02
Emerald Lake, Cloud Peak Wilderness Area	40	293	0.51	70.03	2.43E-05	1.61E-07	70,113	72	0.10	0.09
Fish Lake, High Uintas Wilderness Area A	2	220	0.88	104.50	1.57E-06	1.16E-08	135,006	3	0.00	0.01
Florence Lake, Cloud Peak Wilderness Area	42	417	0.51	34.36	2.53E-05	9.63E-08	48,959	106	0.22	0.08
Heart Lake, High Uintas Wilderness Area	7	117	1.03	54.60	3.86E-07	-4.44E-09	44,166	0	0.00	0.00
Hobbs Lake, Bridger Wilderness Area	76	293	0.97	69.75	2.95E-06	3.94E-08	132,215	9	0.01	0.01

Table 4.1-15 Model-predicted Project Impacts to ANC of Sensitive Lakes with Background ANC

Sensitive Lake	Number of Samples	Actual Watershed Area (hectare)	Annual Precipitation (meter)	Background ANC (μeq/L)	Project Deposition ($eq/m^2/yr$)		ANC(o) (eq)	Hdep[1] (eq)	Alternative B ANC Change[1,2] (percent)	
					Nitrogen	Sulfur			from Background ANC	from Alternative A
Island Lake, Rawah Wilderness Area	25	51	1.82	71.88	1.25E-05	2.59E-07	44,661	7	0.01	0.03
Lake Elebert, Mount Zirkel Wilderness Area	68	101	1.88	53.82	1.05E-05	1.72E-07	68,300	11	0.02	0.02
Lazy Boy Lake, Bridger Wilderness Area	1	83	0.83	27.80	4.88E-06	1.06E-07	12,816	4	0.03	0.02
Lower Saddlebag Lake, Popo Agie Wilderness Area	58	155	1.27	55.61	5.06E-06	2.94E-08	73,066	8	0.01	0.02
Rawah Lake, Rawah Wilderness Area	24	71	1.16	41.48	1.46E-05	2.39E-07	22,793	11	0.05	0.04
Ross Lake, Fitzpatrick Wilderness Area	57	4450	0.89	54.00	4.69E-06	1.29E-07	1,429,463	215	0.02	0.02
Seven Lakes, Mount Zirkel Wilderness Area	67	26	1.82	36.42	9.73E-06	1.82E-07	11,492	3	0.02	0.02
Summit Lake, Mount Zirkel Wilderness Area	110	8	1.39	48.00	1.20E-05	1.43E-07	3,480	1	0.03	0.02
Walk Up Lake, Ashley National Forest	6	175	0.88	61.43	1.43E-06	1.08E-08	63,406	3	0.00	0.01

Table 4.1-15 Model-predicted Project Impacts to ANC of Sensitive Lakes with Background ANC

Sensitive Lake	Number of Samples	Actual Watershed Area (hectare)	Annual Precipitation (meter)	Background ANC (µeq/L)	Project Deposition (eq/m²/yr)		ANC(o) (eq)	Hdep [1] (eq)	Alternative B ANC Change[1,2] (percent)	
					Nitrogen	Sulfur			from Background ANC	from Alternative A
Lakes with ANC <25 µeq/L										
Upper Frozen Lake, Bridger Wilderness Area	3	64.8	0.995	13.18	4.86E-06	2.81E-08	--	--	--	0.007

[1] **Bold** text indicates an ANC change (percent) that exceeds the limit of acceptable change of 10 percent for lakes with background ANC greater than 25 µeq/L or an ANC change (µeq/L) that contributes an additional 1 µeq/L at lakes with background ANC equal to or less than 25 µeq/L (Haddow et al. 1998).

[2] The ANC change (percent) is calculated according to the USFS's Screen Methodology for Calculating ANC change to High Elevation Lakes (USFS 2000).

NOTE: The number of samples, actual watershed area, annual precipitation, and background ANC are assumed to remain constant from 2008 Base Year.

AQ-4 Description of measure: NPS, PRBRC, and Wyoming Outdoor Council (WOC) recommended a lower NO_x limit on compressor engines at the compressor stations to reduce NO_x emissions. NO_x emission reductions can mitigate nitrogen deposition and visibility impacts.

Effectiveness: Based on a review of the emissions inventory, it was estimated that using a lower NO_x limit on compressor engines at the compressor station would reduce the NO_x emissions for the maximum project year 10 by 13 percent. For this estimate, it was assumed that all compressor engines would have a lower NOx factor of 0.5 g/hp-hr instead of the NO_x factor of 0.7 g/hp-hr used in the project emission inventory. A corresponding reduction in nitrogen deposition and visibility impacts would be anticipated with a reduction in NO_x emissions though the amount of impact reduction can only be quantified through a modeling assessment. The lower NO_X limit could be achieved by using non-selective or selective catalytic reduction compressor engines. The specific technology used to the achieve the limit would be determined during the permitting process.

AQ-5 Description of measure: USEPA and WOC recommended the electrification of compressor engines at the compressor stations to reduce NO_x emissions. NO_x emission reductions can mitigate nitrogen deposition and visibility impacts.

Effectiveness: Based on a review of the emissions inventory, it was estimated that the use electric compressor engines would reduce the NO_x emissions at the project area for the maximum project year 10 by 35 percent. For this estimate, it was assumed that compressor engines would be running on natural gas 25 percent of the time and powered by electricity the rest of the time. A corresponding reduction in nitrogen deposition and visibility impacts would be anticipated with a reduction in NO_x emissions though the amount of impact reduction can only be quantified through a modeling assessment.

Note that the emission reduction estimate only considers emissions at the project area. Additional emissions outside the project area may result from required electricity generation at the power plant. This mitigation measure may require construction of electrical infrastructure large enough to meet the high power needs of the compressor motors.

AQ-6 Description of measure: USEPA and NPS recommended the electrification of drill rig engines to reduce NO_x emissions. NO_x emission reductions can mitigate nitrogen deposition and visibility impacts and near-field short-term NO_2 impacts.

Effectiveness: Based on a review of the emissions inventory, it was estimated that the use electric drill rig engines would reduce the NO_x emissions for the maximum project year 10 by 13 percent at the project area. For this estimate, it was assumed that the drill rig engines would be running on natural gas 25 percent of the time and powered by electricity the rest of the time. A corresponding reduction in nitrogen deposition and visibility impacts would be anticipated with a reduction in NO_x emissions though the amount of impact reduction can only be quantified through a modeling assessment. As presented in Section 4.1.2.3, near-field short-term NO_2 impacts during drilling are below the NAAQS, and therefore do not need to be mitigated.

Note that the emission reduction estimate only considers emissions at the project area. Additional emissions outside the project area may result from required electricity generation at the power plant. This mitigation measure may require construction of electrical infrastructure large enough to meet the high power needs of the drill rig motors.

AQ-7 Description of measure: USEPA and NPS recommended the electrification of frac pumping operations during completion operation to reduce NO_x emissions. NO_x emission reductions can mitigate nitrogen deposition and visibility impacts and near-field short-term NO_2 impacts.

Effectiveness: The use of this approach is unproven and currently unavailable, and so emissions reductions are not calculated. Unlike drill rigs, frac pumps are mechanical drive; therefore, the switch to electrical drive is very uncertain and may require entirely new technology. In addition, it would require construction of electrical infrastructure large enough to meet the high power needs of the frac pumps.

AQ-8 Description of measure: NPS recommended the use of natural gas-only or bi-fuel drill rig and completion engine to reduce NO_x emissions. NO_x emission reductions can mitigate nitrogen deposition and visibility impacts and near-field short-term NO_2 impacts.

Effectiveness: Emission reduction estimates are difficult to estimate given the rare nature of the rig and engines. Natural gas-only drill rig engines are rare because the technology is incompatible with the highly variable engine load demand. Natural gas-only completion engines are an unproven technology and would not likely work for engines in this type of mechanical service. In addition, it would require the fuel supply to be available at the wellsite, which would need to be transported to the wellsite.

AQ-9 Description of measure: NPS, PRBC, and WOC recommended the reduce the amount of flaring during operation to reduce NO_x emissions. NO_x emission reductions can mitigate nitrogen deposition and visibility impacts.

Effectiveness: Emission reduction due to reducing the amount of flaring are minimal since flaring (wildcat flaring and process flare) emissions account for less than 2 percent of the total NO_x emission of the project. Reducing the amount of wildcat flaring from 10 percent of new wells (50 wells) to one percent of new wells (5 wells) would reduce NO_x emissions by 1 percent. Also, wildcat flaring is for new wells without infrastructure to support routing of gases initially. It may not be possible to capture gasses at additional wells to reduce wildcat flaring.

AQ-10 Description of measure: NPS recommended the use of Tier 4 diesel engines during workovers to reduce NO_x emissions. NO_x emission reductions can mitigate nitrogen deposition and visibility impacts.

Effectiveness: Emission reduction due to the use of Tier 4 diesel engines during workovers are minimal since workover emissions account for about 0.5 percent of the total NO_x emissions. Workover rigs operate for very minimal amounts of time – only 78 hours per new well. Using Tier 4i workover engines instead of Tier 2 would only reduce NO_x for the maximum project year by 0.4 percent.

AQ-11 Description of measure: For heater treaters, NPS recommended lowering the heater treater temperature and/or installing insolation on the separator to reduce NO_x emissions. NO_x emission reductions can mitigate nitrogen deposition and visibility impacts.

Effectiveness: Per a Colorado Department of Public Health and Environment analysis, lowering the temperature of the heater treater and insolating the separator would reduce NOx emissions by reducing the fuel use. However, while the technology is feasible, no information is available to estimate how much NO_x emissions might get reduced. Heater treater NO_x emissions are approximately 13 percent of the maximum project year total emissions.

AQ-12 Description of measure: USEPA and WOC recommended the centralizing production and operation facilities to reduce NO_x emissions. NO_x emission reductions can mitigate nitrogen deposition and visibility impacts.

Effectiveness: Centralizing facilities could reduce NOx emissions by reducing the amount of tanker truck trips and other operations traffic. It could also reduce the amount of operations equipment needed. However, emission reduction estimates cannot be quantified without specific knowledge of project facility locations.

AQ-13 Description of measure: USEPA and WOC recommended increasing the dust abatement effectiveness during construction activities and/or for all project activities to reduce the amount of particulate matter (PM) emissions. PM emission reductions can mitigate dust impacts.

Effectiveness: Emissions reductions due an increase of dust abatement effectiveness during construction and all project activities would reduce daily PM_{10} emissions by 10 percent and 16 percent, respectively. The emission calculation assumes an increase of control efficiency from 50 percent to 60 percent and is a daily rate (tons per day) based on the maximum year (project year 10) total emissions. Dust abatement techniques could include: water treatments, chemical treatments, and use of a different road material. The mitigation measure would reduce the PM_{10} and $PM_{2.5}$ 24-hour near-field impact that occurs during construction.

AQ-14 Description of measure: WOC recommended reducing the number of tanker truck trips to reduce the amount of PM emissions. PM emission reductions can mitigate dust impacts.

Effectiveness: Emissions reductions vary depending on the size of oil and produced water tanker truck. Using a larger tanker truck size may not be feasible depending on road quality. Also, the reduction from fewer trips is offset by increased emissions from heavier trucks. This mitigation measure would not mitigate the PM_{10} and $PM_{2.5}$ 24-hour near-field impact that occurs during construction.

AQ-15 Description of measure: WOC recommended paving or adding low silt content surface material to unpaved roads to reduce the amount of PM emissions. PM emission reductions can mitigate dust impacts.

Effectiveness: Emissions reductions vary depending on the distance of unpaved road that is changed and the vehicle traffic on that road segment. Paving and/or adding surface material to unpaved roads would reduce emissions. This mitigation measure would not mitigate the PM_{10} and $PM_{2.5}$ 24-hour near-field impact that occurs during construction. In order, to reduce the modeled impact, the pad and road very near the pad would need to be paved and/or have surface material added to unpaved ground. There would also be an increase in emissions from additional construction activities and it would make it more difficult to reclaim roads at the end of project life.

Although these mitigation measures have been recommended, it is unlikely that these measures will be implemented. The BLM does not have the authority to require the application of these measures. In addition, no other entity has committed to apply them to the project components.

However, based on the discussion of the above mitigation measures the Operator Group has committed to the following measures.

- ***To address concerns with PM and dust impacts, the OG has agreed to increase the use of dust suppressant during construction and project activities near residences and schools when dust is visible.***
- ***To address concerns with PM and dust impacts, the OG has agreed to reduce speed limits on lease roads to 25 miles per hour.***
- ***To address concerns with near-field 1-hour NO_2 impacts, the OG has agreed to follow the Wyoming Oil and Gas Conservation Commission 500 feet setback guidance for well sites.***
- ***To address concerns with nitrogen deposition impacts, the OG has agreed to a lower compressor engine NO_x factor of 0.5 g/hp-hr.***

4.1.3.7 Residual Impacts

Residual impacts are defined as unavoidable adverse impacts to a resource that remain assuming implementation of proposed mitigation. Maximum concentrations of all criteria pollutants would be well below applicable state and federal criteria. Based on a dispersion modeling assessment predicting potential near-field air quality effects, localized, short-term increases in PM_{10} concentrations would occur. ACEPM and BLM BMPs would minimize PM_{10} effects, which are anticipated to be temporary and quickly would return to background levels after construction operations are completed. OG-committed design features and BLM BMPs are included as assumptions for the modeling analyses; therefore, they not expected to reduce the model-predicted exceedances. No mechanism exists to provide for compensatory mitigation of residual impacts associated with PM_{10} air quality impacts. State and Federal regulations provide the regulatory framework to address new sources of air emissions and compliance with ambient air quality standards.

HAP impacts were predicted to exceed the one-in-one million carcinogenic risk level for three cases: single well pads without available highline power, gas plants, and compressor stations. After mitigation measures are applied, gas plants and compressor stations would be allowed only in areas that are below the accepted one-in-one million risk level. The predicted high levels of nitrogen deposition could have long-term effects causing increased soil acidification at areas within and surrounding the CCPA. Air pollutant concentrations in the vicinity of the CCPA would return to background levels at the end of operations.

4.1.4 Impacts to Air Quality and Climate from Alternative C

Under Alternative C, impacts would be similar to Alternative B, but the 5,000 new oil and gas wells would be drilled from only 938 new multi-well pads over a 10-year period. This would result in approximately 37 percent fewer pads than under Alternative B and would proportionately reduce the surface impact from well pads, access roads, temporary water pipelines, and overhead electrical lines (**Table 2.5-1**). Under Alternative C, a greater number of wells would be drilled from each pad; varying from 4 to 16, with an average of 5 wells per pad. This alternative would not include changes to any of the proposed construction/production facilities discussed under Alternative B; however, there would be an increase in the length of gathering pipelines required for each pad.

4.1.4.1 Emissions Inventory Summary

Although the emissions inventory for Alternative C was not analyzed directly, it is anticipated that the emissions, particularly PM_{10} and $PM_{2.5}$ would be lower than Alternative B due to fewer well pads and less surface disturbance. ***Due to the timing limitations outlined in Chapter 2, well pads within 26 percent of the CCPA would require three drill rig moves during the drilling process while well pads within the remaining 74 percent of the CCPA were assumed to require one drill rig move. This would result in an estimated 1,425 rig moves under this alternative, slightly fewer than would occur under Alternative B. Although, it is expected that there would be a slight increase of emissions in the vicinity of well pads with three rig moves, there would not be a substantial difference in rig move emissions between Alternative C and Alternative B due to the similarity in***

the number of rig moves between the alternatives. The rate of development under Alternative C would occur at the same rate as Alternative B, and the overall level of production would remain the same.

4.1.4.2 Assessing Impacts to Criteria Pollutants

Criteria pollutant concentrations under Alternative C would be consistent with those for Alternative B. Maximum potential near-field criteria pollutant effects from existing activities would be similar to impacts predicted under Alternative B. However, PM_{10} and $PM_{2.5}$ affects both in the near-field and regionally would be lower than Alternative B due to the lower surface disturbance.

4.1.4.3 Assessing Impacts to Toxics

Although HAPs concentrations for Alternative C were not modeled, the effect to HAPs would be equivalent to the model estimates shown for the Alternative B; near-field HAPs concentrations would be below the acute and chronic inhalation levels. The incremental cancer risk would be within acceptable limits, except in proximity to some ancillary facilities, as disclosed under Alternative B.

4.1.4.4 Assessing Impacts at Class I and II Areas – Visibility

Although visibility effects were not directly assessed for Alternative C, the effects analysis for Alternative B showed minimal visibility impacts. The effects on visibility from Alternative C would be similar or slightly less than those discussed for Alternative B.

4.1.4.5 Assessing Impacts at Class I and II Areas – Deposition

Although atmospheric deposition effects were not modeled specifically for Alternative C, effects from Project-related sources would be similar to those discussed for Alternative B.

4.1.4.6 Mitigation and Mitigation Effectiveness

Mitigation measure AQ-1 also would apply to Alternative C for the purpose of reducing the potential health risks associated with activities at gas plants and compressor stations.

4.1.4.7 Residual Impacts

Residual impacts are defined as unavoidable adverse impacts to a resource that remain assuming implementation of proposed mitigation. Maximum concentrations of all criteria pollutants would be well below applicable state and federal criteria. Based on a dispersion modeling assessment, potentially localized, short-term increases in PM_{10} concentrations would occur. ACEPM and BLM BMPs would minimize PM_{10} effects, which are anticipated to be temporary and quickly would return to background levels after construction operations are completed. No mechanism exists to provide for compensatory mitigation of residual impacts associated with PM_{10} air quality impacts. State and Federal regulations provide the regulatory framework to address new sources of air emissions and compliance with ambient air quality standards.

HAP impacts were predicted to exceed the one-in-one million carcinogenic risk level for three cases: single well pads without available highline power, gas plants, and compressor stations. After mitigation measures are applied, gas plants and compressor stations would be allowed only in areas that are below the accepted one-in-one million risk level. The predicted high levels of nitrogen deposition could have long-term effects causing increased soil acidification at areas within and surrounding the CCPA. Air pollutant concentrations in the vicinity of the CCPA would return to background levels at the end of operations.

4.1.5 Impacts to Climate

Climate change analyses are comprised of several factors including, but not limited to, GHG emissions, land use management practices, and the albedo effect. The albedo effect refers to the reflectivity of the earth's surface, resulting in a fraction of the incoming solar radiation being reflected back to the atmosphere. The less reflective the surface, the lower the albedo resulting in more solar radiation absorption. In a changing climate, the surface albedo could change as well, creating a climate change feedback cycle. For example, if there is less snow due to warmer temperatures, then the surface albedo would be less reflective and more solar radiation would be absorbed resulting in more warming.

Quantitative assessment of impacts is necessarily limited by uncertainties regarding the number, nature, and specific location of resources and proposed future activities. In general, however the Project will result in direct GHG emissions associated with installing and producing new wells, and indirect emissions associated with any downstream use of any product produced. The primary sources of GHG emissions from these processes include the following:

Fossil fuel combustion for construction and operation of oil and gas facilities – e.g., vehicles driving to and from production sites, engines that drive drill rigs. These produce CO_2 in quantities Climate change analyses are comprised of several factors including, but not limited to, GHG emissions, land use management practices, and the albedo effect. The albedo effect refers to the reflectivity of the earth's surface, resulting in a fraction of the incoming solar radiation being reflected back to the atmosphere. The less reflective the surface, the lower the albedo resulting in more solar radiation absorption. In a changing climate, the surface albedo could change as well, creating a climate change feedback cycle. For example, if there is less snow due to warmer temperatures, then the surface albedo would be less reflective and more solar radiation would be absorbed resulting in more warming.

Quantitative assessment of impacts is necessarily limited by uncertainties regarding the number, nature, and specific location of resources and proposed future activities. In general, however the Project will result in direct GHG emissions associated with installing and producing new wells, and indirect emissions associated with any downstream use of any product produced. The primary sources of GHG emissions from these processes include the following:

- Fossil fuel combustion for construction and operation of oil and gas facilities – e.g., vehicles driving to and from production sites, engines that drive drill rigs. These produce CO_2 in quantities that vary depending on the age, types, and conditions of the equipment as well as the targeted formation, locations of wells with respect to processing facilities and pipelines, and other site-specific factors;
- Fugitive ***Methane-methane*** that escapes from wells (both gas and oil), oil storage, and various types of processing equipment. This is a major source of global ***CH_4*** emissions. These emissions have been estimated for various aspects of the energy sector, and starting in 2011, producers are required under 40 CFR 98, to estimate and report their ***CH_4*** emissions to the EPA; and
- Combustion of produced oil and gas – BLM expects future operations to produce marketable quantities of oil and gas. Combustion of the oil and gas would release CO_2 into the atmosphere. Fossil fuel combustion is the largest ***anthropogenic*** source of global CO_2.

4.1.5.1 Alternative A- No Action

This analysis of climate change focused on accounting and disclosing GHG emissions that could contribute to climate change (see Section 3.1.5 for information regarding climate science). The GHG emission inventory for Alternative A ***includes a projection of*** all ***potential*** future emissions associated with predicted levels of new development. As shown in **Table 4.1-3**, the directly emitted GHG emissions from new development under Alternative A would range from a maximum of **2.*48*** million metric tons (MMT) CO_2e at Project year 15 to a minimum of **0.*37*** MMT CO_2e at Project year 40. ***The estimated***

quantity of GHG emissions from the combustion of fossil fuels that could be produced from Alternative A for Project year 15 would be approximately equivalent to the GHG emissions emitted from 526,539 cars in one year or the CO_2 emissions from the energy used in 296,970 homes for 1 year (USEPA 2018b).

Table 4.1-16 Direct, Indirect, and Total GHG Emissions by Project Year – Alternative A (No Action)

	CO_2 (million metric tons of CO_2e)		
Year	**Total Direct[1]**	**Total Indirect[2]**	**Total**
1	***0.5***	***3.8***	***4.3***
2	***0.6***	***6.0***	***6.6***
3	***0.7***	***7.7***	***8.5***
4	***0.9***	***9.3***	***10.2***
5	***1.0***	***10.3***	***11.3***
6	***1.1***	***11.1***	***12.3***
7	***1.3***	***12.0***	***13.3***
8	***1.4***	***12.8***	***14.2***
9	***1.7***	***13.6***	***15.3***
10	***1.8***	***14.2***	***16.0***
11	***2.0***	***14.7***	***16.7***
12	***2.1***	***15.2***	***17.3***
13	***2.2***	***15.7***	***17.9***
14	***2.4***	***16.2***	***18.6***
15	***2.5***	***16.7***	***19.2***
16	***2.3***	***13.4***	***15.8***
17	***2.3***	***12.6***	***14.9***
18	***2.3***	***11.8***	***14.1***
19	***2.3***	***11.0***	***13.3***
20	***2.3***	***10.6***	***12.9***
21	***2.3***	***8.0***	***10.3***
22	***2.3***	***7.6***	***9.9***
23	***2.3***	***7.2***	***9.5***
24	***2.3***	***6.8***	***9.1***
25	***2.3***	***6.7***	***8.9***
26	***2.3***	***5.8***	***8.1***
27	***2.3***	***5.6***	***7.9***
28	***2.3***	***5.5***	***7.7***
29	***2.3***	***5.3***	***7.6***
30	***2.3***	***5.1***	***7.3***
31	***1.9***	***3.0***	***4.9***
32	***1.6***	***2.8***	***4.4***
33	***1.4***	***2.6***	***4.0***
34	***1.3***	***2.3***	***3.6***

Table 4.1-16 Direct, Indirect, and Total GHG Emissions by Project Year – Alternative A (No Action)

Year	CO_2 (million metric tons of CO_2e)		
	Total Direct[1]	Total Indirect[2]	Total
35	***1.2***	***2.3***	***3.4***
36	***1.0***	***2.2***	***3.2***
37	***0.9***	***2.1***	***3.0***
38	***0.8***	***2.0***	***2.8***
39	***0.7***	***2.0***	***2.6***
40	***0.4***	***1.8***	***2.2***
Life of Project	***67.2***	***325.7***	***392.8***

1 Source: **Appendix A**.

2 Source: USEPA 2016b.

Indirect GHG emissions were based on estimates of future oil, gas, and/or natural gas liquids production. For the CCPA, indirect GHG emissions were calculated based on an assumed 100 percent combustion of the product, which converts the fuel's carbon into CO_2. Estimated indirect GHG emissions for Alternative A are provided on **Table 4.1-3**. The total GHG estimates shown in **Table 4.1-3** provide a comprehensive estimate of GHG emissions from the first step of site reconnaissance for siting well locations through ***well plugging and*** final site reclamation, and also include indirect emissions *t**hat could result from the*** combustion of the final product ***at downstream locations***.

4.1.5.2 Alternative B- Proposed Action

As shown in **Table 4.1-6**, the direct GHG emissions for Alternative B would range from a maximum of ***5.51*** MMTCO_2e at Project year 10 to a minimum of **0.017** MMT CO_2e at Project year 40. This would be approximately ***an average 3.8 MMT CO_2e per year over the life of project***. ***The estimated quantity of GHG emissions from the combustion of fossil fuels that could be produced from Alternative B for Project year 10 would be approximately equivalent to the GHG emissions emitted from 1,169,851 cars in one year or the CO_2 emissions from the energy used in 659,801 homes for 1 year (USEPA 2018c). Since GHG emissions are cumulative over time, a quantitative comparison of the Project's GHG emissions to local, state, and national GHG totals is done in Section 5.3.1.6.***

Indirect GHG emissions were based on estimates of future oil, gas, and/or natural gas liquids production and are provided on **Table 4.1-6**. The total GHG estimates shown in **Table 4.1-6** provide a comprehensive estimate of GHG emissions from the first step of site reconnaissance for siting well locations through ***well plugging and*** final site reclamation, and also include indirect emissions ***that could result from the*** combustion of the final product ***at downstream locations***. As it is not possible to assign a "significance" value or impact to these numbers, the emissions estimates themselves are presented as a proxy for potential climate effects.

Table 4.1-17 Direct, Indirect, and Total GHG Emissions by Project Year for Alternative B

Year	CO_2 (million metric tons of CO_2e)		
	Total Direct[1]	Total Indirect[2]	Total
1	***1.3***	***17.2***	***18.6***
2	***1.8***	***26.9***	***28.7***
3	***2.2***	***34.8***	***37.0***

Table 4.1-17 Direct, Indirect, and Total GHG Emissions by Project Year for Alternative B

Year	CO_2 (million metric tons of CO_2e)		
	Total Direct[1]	Total Indirect[2]	Total
4	***2.7***	***42.0***	***44.7***
5	***3.3***	***46.3***	***49.6***
6	***3.7***	***50.4***	***54.1***
7	***4.2***	***54.2***	***58.4***
8	***4.6***	***57.9***	***62.5***
9	***5.1***	***61.5***	***66.6***
10	***5.5***	***64.0***	***69.5***
11	***4.8***	***49.2***	***53.9***
12	***4.8***	***41.8***	***46.6***
13	***4.8***	***36.2***	***40.9***
14	***4.8***	***31.2***	***35.9***
15	***4.8***	***29.1***	***33.9***
16	***4.8***	***27.2***	***32.0***
17	***4.8***	***26.1***	***30.9***
18	***4.8***	***25.1***	***29.8***
19	***4.8***	***24.0***	***28.8***
20	***4.8***	***23.3***	***28.1***
21	***4.8***	***19.7***	***24.5***
22	***4.8***	***19.0***	***23.7***
23	***4.8***	***18.3***	***23.0***
24	***4.8***	***17.6***	***22.3***
25	***4.8***	***16.8***	***21.6***
26	***4.8***	***14.7***	***19.5***
27	***4.8***	***14.0***	***18.8***
28	***4.8***	***13.3***	***18.0***
29	***4.8***	***12.6***	***17.3***
30	***4.8***	***7.9***	***12.6***
31	***4.3***	***7.5***	***11.8***
32	***3.9***	***7.2***	***11.0***
33	***3.4***	***6.8***	***10.2***
34	***3.0***	***6.5***	***9.5***
35	***2.6***	***6.1***	***8.7***

Table 4.1-*17* Direct, Indirect, and Total GHG Emissions by Project Year for Alternative B

Year	CO_2 (million metric tons of CO_2e)		
	Total Direct[1]	**Total Indirect[2]**	**Total**
36	***1.9***	***5.8***	***7.7***
37	***1.5***	***5.4***	***6.9***
38	***1.1***	***5.1***	***6.1***
39	***0.6***	***4.7***	***5.3***
40	***0.0***	***4.5***	***4.5***
Life Of Project	***152.2***	***981.5***	***1133.8***

[1] Source: **Appendix A**.

[2] Source: USEPA 2016b.

Indirect GHG emissions were based on estimates of future oil, gas, and/or natural gas liquids production. For the CCPA, indirect GHG emissions were calculated based on an assumed 100 percent combustion of the product, which converts the fuel's carbon into CO_2. Estimated indirect GHG emissions for Alternative A are provided on **Table 4.1-6**. The total GHG estimates shown in **Table 4.1-6** provide a comprehensive estimate of GHG emissions from the first step of site reconnaissance for siting well locations through final site reclamation, and also include indirect emissions emitted by combustion of the final product.

4.1.5.3 Alternative C

The number of new oil and gas wells would be the same for Alternative C as for Alternative B; therefore, the direct, indirect, and total GHG emissions would be identical to Alternative B as shown in **Table 4.1-5**.

4.1.5.4 Uncertainty

<u>Direct and Indirect Emission Estimate Uncertainties</u>

The direct and indirect emission estimates above provide an estimate of the full potential for GHGs released into the atmosphere from initial wellsite construction, well drilling and completion, production, and end use. Although this EIS presents quantified estimates of potential direct and indirect GHG emissions associated with the potential for the Converse County oil and gas development, GHG emission estimates involve significant uncertainty due to unknown factors including actual production, how produced substances are used, the form of regulation of GHG parameters by delegated agencies, and whether any Best Available Control Technologies are utilized at the upstream or downstream activity location(s).

The Operator Group is planning on using horizontal drilling. The vast majority of the horizontal play in Wyoming is still exploratory; as operators increase their reservoir and drilling knowledge, the time to drill, complete and place horizontal wells into production may decrease over time. Ultimately, while estimates in this EIS are based on the best available data, including information from the Operator Group regarding future drilling plans and targets, these estimates are subject to many conditions that are largely beyond the BLM's control. Unforeseen changes in factors such as geologic conditions, drilling technology, economics, demand, and federal, state, and local laws and policies could result in different outcomes than those projected in this EIS.

Oil and Gas Production and End Use Uncertainty

The rough estimates of indirect CO_2e emissions presented above are qualified by uncertainty in potential future production, and in predicting the end uses for the fuels extracted from wells within the CCPA. Future production is uncertain regarding the actual levels of development over time, levels of development over the life of the well, new technology, geologic conditions, and the ultimate level of production from any given well (whether reservoir related, or for economic reasons). After extraction from oil and gas wells, end uses of oil and gas may include refining for transportation fuels, fuel oils for heating and electricity generation, or production of asphalt and road oil.

Additionally, oil and gas may also be used in the chemical industry for the manufacture of medicines and everyday household items, plastics, military defense and for the manufacture of synthetic materials. Fossil fuels can be consumed, but not combusted, when they are used directly as construction materials, chemical feedstocks, lubricants, solvents, waxes, and other products. Common examples include petroleum products used in plastics, natural gas used in fertilizers, and coal tars used in skin treatment products. According to EPA's Energy Star program, in 2017 about 13% of total petroleum products consumed were for non-combustion use. Natural gas non-combustion use accounted for about 3% of the total amount for natural gas, while coal was less than 1%. Information regarding non-combustion use of oil products was not provided. The BLM does not control the specific end use of the oil and gas produced from federal leases. As a result, the BLM can only provide an estimate of potential GHG emissions by conservatively assuming that all produced oil and gas would eventually be combusted.

4.1.5.5 Climate Change Impacts

As discussed in Section 3.1.5.2, various climate change scenarios studies have shown temperatures over the upcoming decades will increase in Wyoming. Extreme events, such as droughts and floods also are expected to be more likely. While increased temperatures likely would not have a strong impact of everyday operations of the Project, additional stresses on the infrastructure is likely to occur. More extreme droughts will likely cause an increase in wind-blown dust and particulate matter, requiring additional mitigation measures. Exacerbated flooding could result in altering flood plains near or within the CCPA, resulting in increased flood risk. Additional general climate change impacts are found in Section 5.3.1.

Mitigation of Impacts

Due to the potential negative effects of climate change, strategies are being formulated to decrease GHG emissions to help decrease the potential for impacts from climate change and the total change in climatic conditions, including any indirect effects. These strategies are being addressed at the federal, state, and local levels. For example, through federal mandates, fuel efficiency of cars is increasing and energy upgrades of millions of homes across the country have taken place. Wyoming is taking some measures to address potential climate change impacts associated with GHG emissions. Since 2008, renewable energy generation from wind, solar, and geothermal sources in Wyoming increased by almost a factor of five (BLM 2019). It is difficult to assess whether additional mitigation strategies would be implemented, and to what extent current mitigation strategies ultimately would curb climate change. The extent of future mitigation strategies also is unknown. The climate system is sensitive to human activities that ultimately are related to demographic, social, ecological, and economic changes.

In addition to BLM's efforts to better respond and adapt to climate change, other Federal initiatives are being implemented to mitigate climate change. For example, the U.S Department of Energy's Carbon Storage Program performs research to enhance carbon storage in geologic

formations in an environmentally responsible manner across various regions in the United States. The program is a collaboration of Federal and nonfederal stakeholders (BLM 2019).

4.1.6 Relationship between Local Short-term Use of the Human Environment and Maintenance and Enhancement of Long-term Productivity

The relationship between local short-term uses of the human environment and maintenance and enhancement of long-term productivity is the disclosure regarding whether the short-term use of a resources associated with a project affects the long-term sustainability of that resource. Increased development activities within the CCPA would lead to increases in greenhouse gas emissions, fugitive dust, HAPs, and nitrogen deposition associated with oil and gas drilling and production equipment. These activities would affect the air quality, soils and vegetation over the duration of the Project (estimated to be approximately 40 years) although effects are anticipated to be highest within close proximity to sources emitting nitrogen oxides, dust and HAPs. Once the wells would be plugged and abandoned, ancillary facilities decommissioned, and the area revegetated, no long-term air quality effects would be anticipated.

4.1.7 Irreversible and Irretrievable Commitment of Resources

Irreversible/irretrievable impacts are subsets of unavoidable adverse/residual impacts. Irreversible impacts are those that cannot ever be restored; they would be lost forever. Irretrievable impacts are those for which the resource value would be irretrievably lost until restoration of that resource takes place. No irreversible or irretrievable air quality effects would be anticipated. As wells are plugged and abandoned, production equipment and their associated emissions would cease. Following reclamation and revegetation, soil would be stabilized and particulate levels and nitrogen deposition should return to what is typical for an arid environment. Once the emissions sources cease to operate and wind erodible surfaces are reclaimed, air quality would revert to its original state.

Increased development of the natural gas and oil resources in the CCPA also would lead to additional GHGs being emitted to the atmosphere. As indicated in previous sections, there is substantial scientific evidence that increased atmospheric concentrations of GHGs and land use changes are contributing to an increase in average global temperature (IPCC 2013). While it is generally agreed upon that human activities are changing the composition of Earth's atmosphere, questions remain about how much warming will occur, how fast it will occur, and how it will affect the rest of the climate system. Neither Alternative B nor Alternative C would be expected to produce detectable effects to global climate resources. However, it is not possible to quantify any effect (positive or negative) of the Project-only GHG emissions on climate with any degree of certainty.

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4.2 Cultural Resources, Historic Trails, and Resources of Native American Concern

The analysis of impacts to cultural resources includes impacts to historic trails (**Figure 3.2-1**) and resources of Native American concern. The analysis area for direct and indirect impacts to cultural resources primarily is the CCPA; however, in cases where landscapes and properties of traditional religious and cultural importance to tribes are located near the edges of the CCPA, the analysis area for impacts extends outside the CCPA to include their ***settings***. The analysis area for direct and indirect impacts for historic trails within and adjacent to the CCPA includes both the physical routes of the trails and the ***setting*** for each trail up to 3 miles from the outside edges of previously determined trail travel corridors. Similarly, the analysis area for resources of Native American concern is the CCPA plus the ***settings*** of those resources and the portions of integrated landscapes that extend outside the CCPA.

To understand the kinds of cultural resources, historic trails, and resources of Native American concern that could be impacted by the Project, the first step was to conduct a literature review of existing information as set forth in BLM Manual 8110 (BLM 2004b). This was assembled from a review of previously recorded sites documented in State Historic Preservation Office (SHPO), BLM, USFS, and other databases (e.g., the WYCRO database) as well as from current published and unpublished literature, chronologies, cultural and historical contexts, and information provided by the BLM, USFS, consulting Native American tribes, and special-interest groups (e.g., historic trails organizations).

In addition to the completion of the literature review, the methodology for analysis of impacts to cultural resources (including historic trails and resources of Native American concern) included the following:

- Determined what qualities make the cultural resources important elements of the human environment, the types of Project elements that could be sited near the various types of cultural resources, and the types of direct and indirect impacts from the Project elements (e.g., direct impacts such as depth, height, and spatial extent of construction; indirect impacts such as noise level and odor).
- Estimated the total numbers of different kinds of resources ***that may be*** present within the CCPA based on the kinds and density of sites ***previously*** recorded within portions of the CCPA that have been previously surveyed.
- Derived all information about cultural resource types within the CCPA from a review of existing literature and information; no new cultural resource surveys were conducted for this analysis.
- Conducted ***GIS*** viewshed analysis to determine locations where Project elements could indirectly impact historic trail ***setting***s (**Appendix B**).
  - ***GIS v***iewshed analyses for Child's Cutoff and the Bozeman Trail were conducted for three infrastructure heights (12 feet, 22 feet, and 60 feet) looking 3 miles out from the outer edges of the travel corridors.
  - ***Key o***bservation points ***(KOPs)*** were established at 500-foot intervals along the edges of the travel corridors. Several additional ***KOPs*** were created on high points within the travel corridors to capture small viewshed gaps within the corridors.
- Visual impacts of Project elements on historic trails were evaluated based on Appendix C of the ***Wyoming*** State Protocol (BLM and SHPO 2014), which contains the Guidelines for Determination of Visual Effects of an Undertaking on the Integrity of a Historic Setting. Impacts were determined to be at one of the following three levels:
  - No Contrast – If the proposed Project elements would not be seen, there would be no contrast between the undertaking and the setting. This would result in no historic properties being affected.

  - Weak Contrast – If the proposed Project elements, or portions of the elements, could be seen but would not dominate the setting or attract the attention of the casual observer because the basic elements of form, line, color, and texture found in the setting would be repeated in the Project's physical elements, there would be a weak contrast between the undertaking and the setting. This would result in no historic properties being affected.
  - Moderate or Strong Contrast – If the proposed Project elements would tend to dominate the setting, there would be a moderate or strong contrast between the undertaking and the setting. This would result in historic properties being affected.
- Determined how Project elements would affect natural resources and important locations that are used by tribes.
- Determined the options that could be considered for avoiding impacts (e.g., re-siting of Project elements) or minimizing impacts (e.g., changing Project element color, orientation, height, lifetime) if avoidance is not possible.

Cultural resources, including historic trails and resources of Native American concern, are managed according to the management goals and objectives from the BLM Casper RMP (BLM 2007b) and the USFS TBNG LRMP (USFS 2001). Additional guidance is contained in the ***Wyoming*** State Protocol (BLM and SHPO 2014), the Section 106 regulations at 36 CFR 800, the Wyoming Comprehensive Statewide Historic Preservation Plan (Wyoming Department of State Parks and Cultural Resources 2016), the Converse County Land Use Plan (Converse County 2015a), the Management and Use Plan Update Final Environmental Impact Statement: Oregon National Historic Trail (NPS 1999)***, and the Memorandum of Understanding Among the U.S. Department of Defense, U.S. Department of the Interior, U.S. Department of Agriculture, U.S. Department of Energy, and the Advisory Council on Historic Preservation Regarding Interagency Coordination and Collaboration for the Protection of Indian Sacred Sites (DOD, USDOI, USDA, DOE, and ACHP 2012)***.

Assumptions used for the analysis of impacts to cultural resources included:

- Cultural resources that have been previously recorded within the CCPA generally are representative of those located in previously un-surveyed portions of the CCPA. Although only a limited portion of the CCPA has been sampled, the sample data does include work across the entire CCPA. Due to the programmatic nature of this EIS, it was assumed that the types and frequencies of cultural resources found in previously surveyed areas were applicable across the CCPA.
- ***Previously estimated routes of historic trails within the CCPA generally are representative of the trails' actual routes. For Child's Cutoff and the Bozeman Trail, the routes fall within the defined travel corridors. Regardless of the specific NEPA process used in a given location, identification of additional cultural resources and segments of historic trails would occur during site-specific NHPA processes.***
- ***The entire CCPA has not been surveyed and tribal consultation is ongoing; therefore, tribes may not have conveyed their knowledge of all of the resources of Native American interest located within or near the CCPA. On-going consultation and field visits will be necessary for identifying the types, qualities, and general locations of those resources. Potential i*****mpacts to cultural resources*****, historic trails and trail-associated sites, and*** resources of ***Native American concern a***re considered, regardless of eligibility for the NRHP.
- ***Surface disturbing activities have the potential to reveal unanticipated discoveries of buried cultural resources.***
- Surface disturbing activities have ***greater*** potential to damage or destroy ***previously undetected*** buried cultural resources ***than visible surface cultural resources***.

- The qualities that make a cultural resource important under NEPA ***or eligible for the NRHP guide*** the types of impacts ***(i.e. if the resources' setting is important to its NRHP eligibility, its setting could be impacted)*** and the avoidance, minimization, and mitigation strategies appropriate to address effects to ***cultural resources and*** historic properties.
- ***All relevant federal laws, ordinances, regulations, and standards, would be followed, including Section 106 of the NHPA and the State Protocol, to avoid (preferable), minimize (less preferable), or mitigate (least preferable) adverse effects to historic properties.***
- ***Potential impacts to Indian sacred sites and TCPs would be managed in accordance with tribal consultation requirements and relevant federal regulations.***

<u>Approach to Estimating Cultural Resources in CCPA</u>

Approximately 15 percent of the CCPA has been surveyed previously for cultural resources, although the exact number of acres previously covered is unknown. As described in Section 3.2.1.5, the pre-2013 file search results suggested that approximately 209,222 acres, or 14 percent of the CCPA, had been covered by previous projects to varying degrees of intensity. Within those acres, 1,956 sites had been recorded, including 1,331 prehistoric sites (68 percent), 508 historic sites (26 percent), and 117 multicomponent sites containing both prehistoric and historic elements (6 percent); an average of one cultural resource site on approximately every 107 acres of the CCPA. When the prehistoric and historic components of the multicomponent sites are added to the pre-2013 file search numbers of prehistoric and historic sites, the total comes to approximately 2,075 components, or 1,448 prehistoric sites/components (70 percent) and 627 historic sites/components (30 percent). This translates into an average of approximately one cultural resource component per 101 acres.

When the post-2013 file search results are added to the pre-2013 numbers, a total of 2,131 sites have been recorded within the analysis area. Those resources include 1,426 prehistoric sites (67 percent), 568 historic sites (27 percent), and 137 multicomponent sites (6 percent). When the prehistoric and historic components of the post-2013 multicomponent sites are added, the total comes to 2,268 total components, or 1,563 prehistoric sites/components (approximately 69 percent) and 705 historic sites/components (approximately 31 percent). These percentages of prehistoric to historic sites (and also the percentages of eligible, not eligible, and unknown eligibility sites) are quite similar to those of the pre-2013 file search results; therefore, the more substantiated pre-2013 information was used to conduct analyses of the kinds of cultural resources, historic trails, and resources of Native American concern that potentially could be affected by each of the alternatives.

Projecting these densities onto the entire CCPA (i.e., approximately one cultural resource site per 107 acres and approximately one cultural resource component per 101 acres), approximately 14,041 sites or 14,876 components would be located within the CCPA, including 9,829 prehistoric sites (10,413 components) and 4,212 historic sites (4,463 components). Of those, approximately 842 sites (893 components) would be located on BLM surface lands and 562 sites (595 components) would be located on USFS surface lands. **Table 4.2-1** provides a summary of estimated numbers of cultural resource components present in the entire CCPA.

Historical research and previous tribal consultation suggest that Native American groups that used the CCPA include the Crow, Eastern Shoshone, Northern Arapaho, Northern Cheyenne, and Sioux. The WYCRO database contains information about two previously identified TCPs within the CCPA. Previous cultural resource inventories also have identified ***cultural resource*** types within the CCPA ***from which additional Indian sacred sites and/or TCPs potentially could be identified through on-going tribal consultation. Those resource types*** include, but are not limited to, rock cairns, alignments, circles, burials/graves, and trails/roads. **Table 4.2-2** provides a recap of the estimated numbers of cultural resource types from **Table 4.2-1** that may be of concern to tribes.

Table 4.2-1 Estimated Types of Cultural Resource Components in the CCPA

Component Type	Number Previously Recorded	Total Number Estimated	Number Estimated		
			Eligible	Not Eligible	Unevaluated
Prehistoric Components	1,563	10,413	1,166	5,571	3,676
Historic Components	705	4,463	321	2,660	1,482
Total Components	**2,268**	**14,876**	**1,487**	**8,231**	**5,158**

Table 4.2-2 Estimated Types of Cultural Resource Components of Possible Concern to Tribes in the CCPA

Component Type	Total Number Estimated	Number Estimated		
		Eligible	Not Eligible	Unevaluated
Prehistoric Components	3,272	424	791	2,057
Historic Components	1,287	71	626	590
Total Components	**4,559**	**495**	**1,417**	**2,647**

4.2.1 Impacts to Cultural Resources, Historic Trails, and Resources of Native American Concern from Alternative A – No Action

Under Alternative A, new development would continue within the CCPA as disclosed under previous NEPA documents (Section 2.3.2). An estimated 10,253 acres of disturbance would result from new development under Alternative A (**Table 2.3-3**).

4.2.1.1 Impacts to Cultural Resources

Direct and indirect impacts to cultural resources include those that displace, destroy, or otherwise physically disturb artifacts, features, and other resource components; alter or relocate resources from their historic locations; change the use or physical features of the resource; expose or bury resources as a result of changes in natural processes from vegetation and topsoil removal and/or soil mounding and compaction; introduce dust or chemicals; degrade potentially dateable organic materials or disturb intact cultural deposits; facilitate ***illegal*** artifact collection, neglect, looting, or vandalism; and/or degrade the setting, feeling, and association of resources by introducing visible, audible, or atmospheric elements that diminish the ***significant*** characteristics of the resource.

Table 4.2-3 provides information regarding estimated types of cultural resource components that could be affected by disturbance under Alternative A. These values were based on the estimated numbers of components extrapolated from the previously recorded per-acre component density within the CCPA as shown on **Table 4.2-1**.

Table 4.2-3 Estimated Types of Cultural Resource Components Affected by Alternative A

Component Type	Total Estimated Number Affected	Estimated Number Affected		
		Eligible	Not Eligible	Unevaluated
Prehistoric Components	71	8	38	25
Historic Components	30	2	18	10
Total Components	**101**	**10**	**56**	**35**

Potential impacts to prehistoric and historic cultural resource components were estimated based on acres of disturbance for Alternative A. The most likely types of prehistoric components that potentially could be affected by new development under Alternative A would be lithic scatters followed by open camps and stone circles, with fewer numbers of rock cairns/caches and hunting blinds. The most likely affected historic components would be homesteads and other structures, trash dumps and debris scatters, and rock cairns and alignments, with very few trails/roads or dams/canals affected.

Disturbance under Alternative A could impact the various types of prehistoric and historic cultural resource components in different ways. Assuming surface disturbing activities have the potential to reveal unanticipated discoveries of buried cultural ***resources***, development under Alternative A would disturb buried sites and could lead to increased off-road vehicle traffic by construction personnel and recreationists. This could result in both accidental and purposeful disturbance of surface and subsurface cultural resources.

Well pads, which average 12 acres each, primarily would cause physical impacts to prehistoric lithic scatters and open camps as well as to historic trash dumps/debris scatters, rock cairns and alignments, and canals by displacing or destroying surface and subsurface artifacts and features, exposing or burying resources, and degrading potentially dateable organic materials. Impacts to prehistoric stone circles, rock cairns, and hunting blinds as well as to historic homesteads/structures and trails/roads could be both direct and indirect, with the movement and noise from construction, pump jacks, and flares adversely affecting the setting and feeling of those resources for which importance often is partially related to setting and feeling. Development of well pad access roads would have similar direct effects. In addition, roads could facilitate greater knowledge and visitation of sites, potentially leading to artifact trampling, displacement, and/or collection. Roads also could cause changes in surface water movement, resulting in the exposure of nearby resources through sediment erosion and/or the burial of resources due to sediment deposition. Roads also would introduce visible, audible, and atmospheric changes to the settings and feelings of prehistoric stone circles, rock cairns, hunting blinds, historic homesteads/structures, and trails/roads. Construction/production facilities that would result in approximately 360 acres of surface disturbance could have the same direct effects on all cultural resources. These facilities would have more pronounced indirect effects than roads, given that they would be permanent structures in constant use, rather than ground-level disturbances in sporadic use. Pipelines within road ROWs would introduce few or no more adverse effects than the roads themselves; although, pipelines running cross-country could have both direct and indirect impacts. Disturbance under Alternative A also could have direct and indirect impacts on Rural Historic Landscapes and properties of traditional religious and cultural importance ***(if either are identified in the future)*** by physically altering those landscapes, introducing modern industrial elements into them, and generally disturbing their traditional setting, feeling, and association.

Cultural resources are non-renewable; therefore, essentially all direct effects to them would be permanent effects even if the cause of the effect is removed. In contrast, indirect effects such as visual disturbances from well pad construction and temporary pipelines could be avoided over the long term if their causes are removed.

It was assumed that under Alternative A, impacts to cultural resources would be avoided, minimized, and/or mitigated under existing stipulations in the BLM Casper RMP (BLM 2007b) and the TBNG LRMP (2001), ***or through the processes set forth under*** the Wyoming State Protocol (BLM and SHPO 2014), and other applicable laws, ordinances, regulations, stipulations, and standards listed in Section 3.2.1.3.

4.2.1.2 Impacts to Historic Trails

Impacts to historic trails include those that displace, destroy, or otherwise physically disturb trail tread and trail-related artifacts, features, and sites; erode or bury trail tread and trail-related resources; degrade potentially dateable organic materials or disturb intact cultural deposits at trail-related sites;

facilitate artifact collection, looting, and/or vandalism of trail tread and associated sites; degrade the setting, feeling, and association of the trail ***and*** associated sites; diminish user experience of the trail; and impact the visual quality of the setting of a historic trail by creating noticeable surface disturbance that contrasts with form, line, color, or texture in the landscape. See Section 4.15, Visual Resources, for a more detailed analysis of potential visual impacts to historic trails from each of the alternatives.

Table 4.2-4 provides estimated acres of historic trail corridors that could experience visual impacts from different heights of oil and gas equipment and infrastructure under Alternative A. These values were based on the results of a historic trails ***GIS*** viewshed analysis (**Appendix B**) and the assumption that development within the CCPA potentially would be visible from trail corridors located up to 3 miles outside the CCPA. In total, an estimated 553,723 acres would be visible from within the historic trails corridors, including those portions that extend up to 3 miles outside the CCPA.

Table 4.2-4 Estimated Acres of Visual Impacts to Historic Trails under Alternative A

Infrastructure Height (feet)	Acres Visible within Trail Corridor	Percent of Trail Corridor	Acres of Visual Impacts from New Disturbances
12	460,046	83	8,518
22	491,324	89	9,098
60	533,894	96	9,886

It was assumed that under Alternative A, impacts to historic trails would be avoided, minimized, and/or mitigated under existing stipulations in the BLM Casper RMP (BLM 2007b), ***or through the processes set forth under*** the Wyoming State Protocol (BLM and SHPO 2014), and other applicable laws, ordinances, regulations, stipulations, and standards listed in Section 3.2.1.3.

4.2.1.3 Impacts to Resources of Native American Concern

Direct and indirect impacts to resources of Native American concern would be the same as those discussed above for cultural resources and historic trails but also would include the disturbance of sacredness by physical destruction of, or visual, auditory, and/or olfactory intrusions into, special areas and landscapes; changes to resource availability resulting from construction or other alteration of faunal and floral habitats and migration patterns; and interruption of access to important locations due to changes in roads and/or use. Estimates of the types of cultural resource components of potential concern to tribes that could be affected by disturbance from Alternative A are provided on **Table 4.2-5**.

Table 4.2-5 Estimated Types of Cultural Resource Components of Possible Concern to Tribes Affected by Alternative A

Component Type	Total Estimated Number Affected	Estimated Number Affected		
		Eligible	Not Eligible	Unevaluated
Prehistoric Components	22	3	5	14
Historic Components	9	0	5	4
Total Components	**31**	**3**	**10**	**18**

The most likely types of prehistoric resources of Native American concern to be affected by new development under Alternative A would be stone circles, followed by cairns/caches and ***a*** few rock alignments/hunting blinds. The most likely affected historic resource of Native American concern would be rock cairns/alignments; potential impacts to trails/roads are described in Section 4.2.1.2. However, given the importance of integrated landscapes to Native Americans, these small estimated numbers would not preclude Alternative A from causing adverse impacts to landscapes of Native American concern.

Disturbance under Alternative A could impact the various types of prehistoric and historic cultural resource components of possible concern to tribes in the same direct and indirect ways as described for cultural resources (Section 4.2.1.1). In addition, they could interrupt site lines between cairns and among important points on the landscape or disturb patches of natural resources important for their traditional cultural uses.

As with non-renewable cultural resources in general, essentially all direct effects to resources of Native American concern would be permanent effects, even when the cause of the effect is removed. One exception to this would be that impacts to native vegetation of Native American cultural value (e.g., medicinal or ceremonial plants) would not be permanent because vegetation generally could be reclaimed after the disturbance is removed. ***I***ndirect effects ***to resources of Native American concern,*** such as visual disturbances from well pad construction and temporary pipelines***, potentially*** could be ***negated*** over the long term when their causes are removed. Therefore, the highest priority for treating resources of Native American concern would be ***avoidance of*** direct ***effects, and irreversible indirect effects***. If ***avoidance*** is not possible, mitigation plans would be developed and implemented in consultation with the BLM/USFS, SHPO, and tribes ***for identified Indian sacred sites and TCPs*** prior to conducting any surface disturbing activities.

It was assumed that under Alternative A, impacts to ***Indian sacred sites and TCPs*** would be avoided, minimized, and/or mitigated under existing stipulations in the BLM Casper RMP (BLM 2007b), ***or through the processes set forth under*** the Wyoming State Protocol (BLM and SHPO 2014), and other applicable laws, ordinances, regulations, stipulations, and standards listed in Section 3.2.1.3.

4.2.2 Impacts to Cultural Resources, Historic Trails, and Resources of Native American Concern from Alternative B – Proposed Action

Under Alternative B, approximately 5,000 new oil and gas wells would be drilled on 1,500 multi-well pads at a rate of approximately 500 wells per year for 10 years. Additional surface disturbance would result from the construction of other service well pads, access roads, pipelines, electric power lines, and ancillary facilities. As a result, an estimated 52,667 acres of land would be disturbed as detailed on **Table 2.4-1**. BLM-standard reclamation to pre-disturbance conditions would be required only on federal surface, which comprises approximately 10 percent of the CCPA.

4.2.2.1 Impacts to Cultural Resources

Table 4.2-6 provides information regarding estimated types of cultural resource components that could be affected by disturbance under Alternative B. As with Alternative A, these values were based on the estimated numbers of components extrapolated from the previously recorded per-acre component density within the CCPA as shown on **Table 4.2-1**.

Table 4.2-6 Estimated Cultural Resource Types Affected by Alternative B

Component Type	Total Estimated Number Affected	Estimated Number Affected		
		Eligible	Not Eligible	Unevaluated
Prehistoric Components	365	40	196	129
Historic Components	156	12	92	52
Total Components	**521**	**52**	**288**	**181**

The types of impacts to cultural resources under Alternative B would be the same as discussed under Alternative A, except additional surface disturbance would occur under Alternative B. Therefore, impacts on cultural resources under Alternative B, especially landscapes, would be more extensive (i.e., would affect more types and larger numbers of cultural resources) than those under Alternative A. In addition to the resource types discussed for Alternative A, development under Alternative B would have a greater potential to encounter at least some prehistoric bison kills/bone beds and quarries as well as historic telegraph/telephone lines, bridges, dams/canals, dugouts, inscriptions, mines, railroads, military sites, corrals, and cemeteries/graves. Alternative B also would affect more areas and larger numbers of cultural resources than Alternative A and could have a greater impact on prehistoric cultural landscapes such as that encompassed by the Pine Ridge Area. For example, the 75-foot-wide ROW for construction of primary collector roads would create broader swaths of disturbance across the landscape than access roads, and portions running across non-federal lands would remain highly visible if not reclaimed. Main trunk pipelines also would contribute to a larger web of physical disturbances. Storage facilities and electrical substations would represent more physical and visual disturbances dotted across the landscape.

Alternative B also could affect cultural resources in new ways. The introduction of 1,500 miles of electrical power distribution lines with approximately 15 presumably 50- or 60-foot-high poles being placed per mile would have impacts on ***cultural*** resources such as prehistoric rock alignments, historic homesteads, and Rural Historic Landscapes ***(if any are identified in the future)*** that are greatly affected by visual intrusions. ***(See Sections 4.2.2.2, 4.2.2.3, and 4.2.2.4 for discussion of potential impacts to and mitigation for historic trails and resources of Native American concern.)*** Although running lines along roads would help to concentrate disturbances and impact fewer resources, those running cross-country could introduce marked indirect effects to numerous resources and extensive landscapes.

4.2.2.2 Impacts to Historic Trails

The types of impacts to historic trails under Alternative B would be the same as discussed under Alternative A, except additional surface disturbance would occur under Alternative B. Therefore, impacts to historic trails under Alternative B would be more extensive than those under Alternative A.

Table 4.2-7 provides estimated acres of historic trail corridors that could experience visual impacts from different equipment and infrastructure heights under Alternative B. As discussed under Alternative A, these values were based on the results of a historic trails ***GIS*** viewshed analysis (**Appendix B**) and the assumption that development within the CCPA potentially would be visible from trail corridors located up to 3 miles outside the CCPA.

Table 4.2-7 Estimated Acres of Visual Impacts to Historic Trails under Alternative B

Infrastructure Height (feet)	Acres Visible within Trail Corridor	Percent of Trail Corridor	Acres of Visual Impacts from New Disturbances
12	460,046	83	43,757
22	491,324	89	46,732
60	533,894	96	50,781

Most of the segments of historic trails and many of the associated sites within the CCPA have not yet been intensively recorded or evaluated for the NRHP. Oil and gas infrastructure would be visible from many more acres of trail corridors under Alternative B than under Alternative A. Under Alternative B, impacts to the trails would be managed on a case-by-case basis rather than at a larger landscape level ***because a comprehensive study of the historic trails is not available for the project area.*** This would lead to piecemealed management and the integrity of trails as a whole would be incrementally lost one segment at a time. At the landscape level, this would lead to an accumulation of effects and substantial impacts to the historic trail***s*** as a whole. To reduce or avoid these adverse impacts, mitigation measures would be developed and implemented in consultation with the BLM/USFS, SHPO, tribes, and other interested parties prior to authorization of ***any*** federal undertaking.

4.2.2.3 Impacts to Resources of Native American Concern

The types of impacts to resources of Native American concern under Alternative B would be ***similar to those*** discussed under Alternative A, ***but with*** additional surface disturbance occur***ring*** under Alternative B. Therefore, direct and indirect impacts to resources of Native American concern, ***particularly those spread over large distances such as in the Pine Ridge area,*** under Alternative B would be more extensive than those under Alternative A ***and there would be greater potential for impacts to Indian sacred sites and TCPs. The BLM would follow the existing laws, regulations, and policies cited in Section 1.4.2 to consult with tribes about potential i***mpacts to ***specific resources of Native American concern*** on a case-by-case basis ***during site-specific NEPA and NHPA analyses.*** This ***site-specific*** approach ***potentially*** would lead to incremental impacts and loss of integrity ***at a landscape level.*** BLM-standard reclamation to pre-disturbance conditions would be required only on federal surface lands; therefore, residual effects under Alternative B would be more likely. **Table 4.2-8** provides information regarding estimated types of cultural resource components of Native American concern that could be affected by disturbance from Alternative B.

Table 4.2-8 Estimated Types of Cultural Resource Components of Possible Concern to Tribes Affected by Alternative B

Component Type	Total Estimated Number Affected	Estimated Number Affected		
		Eligible	Not Eligible	Unevaluated
Prehistoric Components	114	14	28	72
Historic Components	46	2	23	21
Total Components	**160**	**16**	**51**	**93**

4.2.2.4 Mitigation and Mitigation Effectiveness

<u>Cultural Resources</u>

The primary goal would be to avoid or minimize impacts to cultural resources. However, if adverse effects were to remain, the BLM would consider any and all mitigation measures appropriate for addressing the adverse effects. In addition to mitigation measures prescribed by the federal, state, and/or county laws, ordinances, regulations, stipulations, and standards that apply to cultural resource management within the analysis area, and consistent with regulatory authority and jurisdiction, the following mitigation measures would be implemented to reduce impacts to cultural resources:

CR-1 A qualified professional archaeologist will monitor surface disturbing activities during construction in areas that ***have been determined, through the NHPA process, to be likely to*** contain buried cultural ***resources***. A monitoring and discovery plan may be developed for large or complex undertakings or areas known to contain buried cultural sites.

CR-2 Avoidance areas will be fenced or otherwise marked prior to construction activities. Flagging or other marking will be removed once construction is completed in an area.

CR-3 Mandatory training will be provided to all construction personnel and contractors regarding cultural resources and the federal regulations that protect them.

Mitigation CR-1 would assist in identifying and recording any subsurface cultural resources that may be exposed. Mitigation CR-2 would assist in avoiding impacts to known ***cultural resources***.
Mitigation CR-3 would help to reduce or eliminate inadvertent disturbance or destruction as well as collection and vandalism of cultural resources by Project personnel but would not reduce those activities by members of the public.

Additionally, ***per Section V.A of the Wyoming State Protocol (BLM and SHPO 2014),*** where adverse effects are identified on private surface, the BLM would work with willing landowners to avoid, minimize, and/or mitigate (e.g., conduct data recovery) these adverse effects.

Historic Trails

The primary goal would be to attempt to avoid or minimize impacts to historic trails and trail-related sites. However, if adverse effects were to remain, the BLM would consider any and all mitigation measures appropriate for addressing the adverse effects. Mitigation measures CR-1, CR-2, and CR-3 and those prescribed by the federal, state, and/or county laws, ordinances, regulations, and standards that apply to historic trails management within the analysis area, and consistent with regulatory authority and jurisdiction also would reduce impacts to historic trails, particularly under Alternative B (additional mitigation for historic trail ***setting***s can be found in Section 4.15, Visual Resources):

Additionally, ***per Section V.A of the Wyoming State Protocol (BLM and SHPO 2014)***, where adverse effects are identified on private surface, the BLM would work with willing landowners to avoid, minimize, and/or mitigate (e.g., conduct data recovery) these adverse effects.

Resources of Native American Concern

The primary goal would be to attempt to avoid or minimize impacts to resources of Native American concern. However, if adverse effects were to remain, the BLM would consider any and all mitigation measures appropriate for addressing the adverse effects. In addition to mitigation measures CR-1, CR-2, and CR-3 and those prescribed by the federal laws, ordinances, regulations, stipulations, and standards that apply to protection ***of Indian sacred sites and TCPs,*** and consistent with regulatory authority and jurisdiction, the following mitigation measure would be implemented to reduce impacts to ***Indian sacred sites and TCPs***, particularly under Alternative B:

CR-4 ***A qualified tribal monitor will monitor sediment-disturbing activities during construction in areas that have been determined, through tribal consultation and the NHPA process, to contain or be likely to contain Indian sacred sites and/or TCPs. A monitoring and discovery plan may be developed for large or complex undertakings or areas known to contain such resources.***

Mitigation CR-4 would assist in ***avoiding inadvertent impacts to Indian Sacred Sites and TCPs. It would also assist in identifying and recording any additional subsurface cultural resources of Native American concern that may be exposed during construction.***

Additionally, ***per Section V.A of the Wyoming State Protocol (BLM and SHPO 2014),*** where adverse effects are identified on private surface, the BLM would work with willing landowners to avoid, minimize, and/or mitigate (e.g., conduct data recovery) these adverse effects.

4.2.2.5 Residual Impacts

Residual impacts are defined as unavoidable adverse impacts to a resource that remain ***despite*** implementation of proposed mitigation. Cultural resource***s and resources of Native American concern*** that are not eligible for the NRHP, ***and historic*** trail segments and associated sites that do not contribute to the ***trail's overall*** eligibility, would be recorded to BLM and SHPO standards during site-specific

NHPA cultural resource inventories; ***however, these resources would no longer be managed under the NHPA and impacts could occur due to construction***. Although impacts to ***NRHP***-eligible ***cultural*** resources, trail segments and trail-associated sites***, and resources of Native American concern*** would be avoided, minimized, or mitigated, the loss of some eligible resources through data recovery, destruction of non-contributing trail segments or sites, introduction of visible Project elements, accidental disturbance of previously undetected buried cultural resources or unrecorded trail segments and sites, general disruption of surrounding landscapes, and overall diminishment of the historically authentic visitor experience, would still create some residual impacts. Based solely on estimated numbers, at least 20 eligible ***cultural*** resources ***(including resources of Native American concern) and trail-related resources*** could experience residual impacts under Alternative B ***associated with surface disturbance***. All sites, but particularly lithic scatters and open camps, would be expected to experience residual impacts from collection, looting, and vandalism resulting from increased access to sites.

Regardless of resource eligibility and mitigation strategies, the introduction of additional oil and gas infrastructure to formerly natural landscapes ***also*** would represent residual impacts***, specifically*** for resources of Native American concern. Reclamation would be required only on federal surface (i.e., 10 percent of the CCPA); therefore, residual visual impacts would be mo***st*** likely to occur on non-federal surface (90 percent of the CCPA) ***and on federal surface located adjacent to developed non-federal surface***.

4.2.3 Impacts to Cultural Resources, Historic Trails, and Resources of Native American Concern from Alternative C

Under Alternative C, 5,000 new oil and gas wells would be drilled from 938 new multi-well pads over a ten-year period. This would be approximately 37 percent fewer pads than under Alternative B. This would proportionately reduce the surface impact from well pads (including other service well pads), access roads, temporary water pipelines, and overhead electrical lines. The total estimated construction surface disturbance from Alternative C would be approximately 37,267 acres, or approximately 2.5 percent of the CCPA (**Table 2.5-1**). This alternative would not include changes to any of the proposed construction/production facilities discussed under Alternative B.

4.2.3.1 Impacts to Cultural Resources

Under Alternative C, impacts to cultural resources would be similar to those under Alternative B except that less acreage would be disturbed under Alternative C, resulting in less impact. Certain areas of the CCPA would contain stipulations that would restrict or preclude development. **Table 4.2-9** provides information regarding estimated types of cultural resource components that could be affected by disturbance from Alternative C.

Table 4.2-9 Estimated Types of Cultural Resource Components Affected by Alternative C

Component Type	Total Estimated Number Affected	Estimated Number Affected		
		Eligible	Not Eligible	Unevaluated
Prehistoric Components	258	29	138	91
Historic Components	111	8	66	37
Total Components	**369**	**37**	**204**	**128**

Oil and gas development under Alternative C would have similar but less extensive impacts to cultural resources than under Alternative B because Alternative C would have fewer total acres of disturbance. The types of resources that could be affected by Alternative C would be the same as for Alternative B, but in smaller numbers. The cultural resource types most likely to be affected under Alternative C would include prehistoric cairns and caches, stone circles, lithic scatters, and open camps as well as historic cairns/alignments and homesteads/structures. Alternative C could impact prehistoric cultural landscapes; however, it would likely have less of an impact than Alternative B due to its smaller disturbance acreage. Similarly, Alternative C could disturb buried sites in new areas and have direct and/or visual effects on sensitive resources such as prehistoric rock alignments, historic homesteads, and Rural Historic Landscapes ***(if any are identified in the future)*** that are greatly affected by visual intrusions. However, those effects would be less than from Alternative B.

4.2.3.2 Impacts to Historic Trails

The types of impacts to historic trails under Alternative C would be the same as for Alternatives A and B, but would be less extensive than Alternative B, due both to a smaller area of disturbance and greater protections for historic trails under Alternative C.

Table 4.2-10 provides estimated acres of historic trail corridors that could experience visual impacts from different equipment and infrastructure heights under Alternative C. As discussed under Alternative A, these values were based on the results of a historic trails ***GIS*** viewshed analysis (**Appendix B**) and the assumption that development within the CCPA potentially would be visible from trail corridors located up to 3 miles outside the CCPA.

Table 4.2-10 Estimated Acres of Visual Impacts to Historic Trails under Alternative C

Infrastructure Height (feet)	Acres Visible within Trail Corridor	Percent of Trail Corridor	Acres of Visual Impacts from New Disturbances
12	460,046	83	30,962
22	491,324	89	33,067
60	533,894	96	35,932

Under Alternative C, the same protections to historic trails would be provided as those under Alternative B; however, a more landscape-oriented management approach would be taken as it is assumed that the entire length of the trails (not just the individual segments) and their associated setting are intact and contributing. Surface development would not be permitted along any of the trails and any proposal that might impact the trails would be considered an effect. Therefore, oil and gas equipment and infrastructure would be visible from many fewer acres of trail corridors under Alternative C than under Alternative B. In sum, under Alternative C impacts to historic trails would likely be less than what is implied by the estimates provided in **Table 4.2-10**.

4.2.3.3 Impacts to Resources of Native American Concerns

As described for cultural resources in general, oil and gas development under Alternative C would have similar but less extensive impacts to resources of Native American concern than Alternative B because Alternative C would have less disturbance. Additionally, similar to management of historic trails under Alternative C (Section 4.2.3.2), a more landscape-oriented management approach would be taken for resources of Native American concern ***(e.g.,*** the Pine Ridge Area***)***. Under this alternative, the BLM would conduct on-going tribal consultation for all undertakings within the Pine Ridge area to identify ***potential Indian sacred sites and TCPs, not just for undertakings that have identified sites that trigger consultation.*** On-going tribal consultation would allow the BLM to incrementally combine information to better understand the concerns tribes may have about the Pine Ridge area as a whole, allowing new undertakings to minimize impacts by implementing designs that avoid triggering those concerns. The types of impacts to resources of Native American concern under Alternative C would be the same as for Alternatives A and B, but would be less extensive than those under Alternative B. **Table 4.2-11** provides information regarding estimated types of cultural resource components of Native American concern that could be affected by disturbance from Alternative C.

Table 4.2-11 Estimated Cultural Resource Components of Native American Concern Affected by Alternative C

Site/Component Type	Total Estimated Number Affected	Estimated Number Affected		
		Eligible	Not Eligible	Unevaluated
Prehistoric Components	82	11	20	51
Historic Components	33	2	16	15
Total Components	**115**	**13**	**36**	**66**

4.2.3.4 Mitigation and Mitigation Effectiveness

In addition to mitigation measures prescribed by the federal, state, and/or county laws, ordinances, regulations, stipulations, and standards that apply to cultural resource management within the analysis area, and consistent with regulatory authority and jurisdiction, mitigation measures CR-1 through CR-4 also would apply to Alternative C. Mitigation effectiveness under Alternative C for CR-1 through CR-4 would be the same as discussed under Alternative B. Additionally, ***per Section V.A of the Wyoming State Protocol (BLM and SHPO 2014),*** where effects are identified on private surface, the BLM would work with willing landowners to avoid, minimize, and/or mitigate (e.g., conduct data recovery) these effects.

4.2.3.5 Residual Impacts

Residual impacts are defined as unavoidable adverse impacts to a resource that remain assuming implementation of proposed mitigation. Residual impacts to cultural resources, historic trails, and resources of Native American concern from Alternative C would be of the same type as those for Alternative B but they would be less, particularly for historic trails and the Pine Ridge Area, under Alternative C due to the landscape-oriented management of historic trails and the Pine Ridge Area.

4.2.4 Relationship between Local Short-term Uses of the Human Environment and Maintenance and Enhancement of Long-term Productivity

The relationship between local short-term uses of the human environment and maintenance and enhancement of long-term productivity is the disclosure regarding whether the short-term use of a resource associated with a project affects the long-term sustainability of that resource. Under Alternative B, the short-term uses and long-term productivity of cultural resources not eligible for the NRHP and located in proposed disturbance areas ***would no longer be managed under the NHPA and impacts could occur under Alternative B.*** The short-term use of NRHP-eligible sites, located in proposed disturbance areas and requiring data recovery or other destructive mitigation measures, also would be lost; however, their long-term productivity would be preserved through the collection of scientific information during data recovery. Alternative B also would have the potential for long-term loss of cultural resource productivity due to accidental or purposeful disturbance, collecting, and/or looting. Short-term uses and long-term productivity of cultural resources under Alternative C essentially would be the same as under Alternative B.

As with cultural resources in general, the short-term use and long-term productivity of historic trail segments and trail-associated sites not eligible for the NRHP and located in proposed disturbance areas ***would no longer be managed under the NHPA and impacts could occur under Alternative B.*** The short-term uses and long-term productivity of eligible segments and sites generally would be preserved but would be diminished by the introduction of Project elements in the surrounding landscape. In contrast, the short-term use and long-term productivity of all historic trail segments, regardless of eligibility, would be preserved under Alternative C because all segments would be considered contributing to the trail's NRHP eligibility and would be avoided. Under Alternative C, the short-term uses and long-term productivity of all trail segments and of eligible trail-associated sites would be preserved and would be minimally diminished by the introduction of Project elements in the surrounding landscape.

Under Alternative B, the short-term uses and long-term productivity of at least some resources of Native American concern ***c***ould be lost, given that those resources not eligible for the NRHP could still be of concern to tribes. ***However, the BLM would continue to manage sites of Native American concern under other authorities such as AIRFA and EO13007, even if they are not eligible for the NRHP.*** Alternative B also has the potential for long-term loss of productivity and integrity of landscapes of Native American concern due to the incremental loss of related cultural resources, the introduction of Project elements, and the possibility of increased inappropriate public access and use. Short-term uses and long-term productivity of cultural resources under Alternative C would be the same as under Alternative B.

4.2.5 Irreversible/Irretrievable Commitment of Resources

Irreversible/irretrievable impacts are subsets of unavoidable adverse/residual impacts. Irreversible impacts are those that can never be restored; they would be lost forever. Irretrievable impacts are those for which the resource value would be irretrievably lost until restoration of that resource takes place. Under Alternative B, cultural resources potentially could be irreversibly or irretrievably lost through damage to or destruction of ***cultural resources*** or portions thereof. However, this kind of loss would be reduced or prevented by enacting monitoring plans for areas likely to contain buried cultural resources. The same would be true under Alternative C.

Non-contributing historic trail segments and ineligible ***trail-associated sites would not be managed under the NHPA and irreversible or irretrievable loss could occur under Alternative B***, and the overall integrity of the trails and their ***settings*** would be diminished even by small disturbances along their lengths. However, this kind of loss would be reduced by treating unevaluated segments and sites as if they were eligible, and affording them the same prescribed protection. Under Alternative C, impacts to the trails and the Pine Ridge Area at the landscape level would be reduced, with direct impacts to them avoided and indirect impacts avoided or minimized.

Resources of Native American concern potentially could be irreversibly or irretrievably lost under all alternatives through destruction or disturbance of resources, landscapes, and properties of traditional religious and cultural importance. This type of loss would be reduced or prevented by completing mitigation identified during on-going consultation between the BLM and tribes.

4.3 Geology and Mineral Resources

The analysis area for direct and indirect impacts to geology and mineral resources is the CCPA and a 2-mile buffer. Given the programmatic nature of the analysis, the exact locations of oil and gas-related activities cannot be predicted with certainty within the project area. A 2-mile buffer around the CCPA is recommended to account for effects that may extend beyond the Project boundary.

Potential impacts to geology include damage or loss of unique geologic features that have visual, scientific, historical, recreational, and topographic values. The potential hazards include unstable slopes, floods, natural seismicity, and induced seismicity, all of which have the potential to cause injury to humans and/or damage to facilities.

Impacts to mineral resources may include the following:

- The irretrievable and irreversible production of oil and gas resources.
- The construction of roads and pads and other infrastructure likely would stress existing aggregate sources and encourage the development of new sources or result in the transportation of material from sources outside the county.
- The proposed oil and gas development could temporarily restrict access to other minerals including coal, uranium, leonardite, and sand and gravel deposits.

The methodology for analysis of impacts to geology included the following key steps:

- Review geological literature and BLM management documents to determine if there are unique geological features in the CCPA and assess the level of risk posed to these features by proposed activities.
- Review available information regarding geological hazards; describe the potential impacts and provide an assessment of risks posed by those hazards.
- Obtain risk analysis information from the USGS hazards branch for estimates of increased risk due to induced seismicity.
- Review the alternatives and determine the nature and severity of potential impacts.
- Classify each alternative in terms of greater or lesser impact

The methodology for analysis of mineral resources included:

- Review information on mineral resource occurrence to determine the nature and severity of potential impacts.
- Review aggregate production statistics and recent oil and gas EISs to determine if increase in aggregate demand for the Project would stress local and county sources.

Geology and mineral resources are managed according to management goals and objectives of the BLM ROD for the CFO RMP, which contains goals and objectives for the management of unique geological resources and minerals (BLM 2007b). Management direction for geology and mineral resources for the USFS is provided in the TBNG LRMP (USFS 2001).

Assumptions used in the analysis of potential impacts to geological resources and hazards include:

- The assessment of natural seismic risk is based on current knowledge regarding the existence of active faults.
- Current understanding indicates that hydraulic fracturing does not appear to pose a discernable risk for generating damaging induced seismicity (Rubinstein and Mahani 2015).
- Preliminary risk assessments of induced seismicity from subsurface injection available from the USGS and the WSGS were used to make a qualitative assessment of the potential for induced seismicity

Assumptions used in the analysis of potential impacts to mineral resources include:

- Existing mineral resource recovery estimates are reasonable. In other words, the expectation of the drilling of 5,000 wells in 10 years is likely to occur so long as economic conditions provide the necessary incentives.
- Most of the drilling would involve horizontal and directionally drilled wells.
- Expected mineral resource recovery activity for the Project does not include coal bed natural gas.

4.3.1 Impacts to Geology and Mineral Resources from Alternative A – No Action

4.3.1.1 Impacts to Geology

Under Alternative A, no impacts to unique geological features would be expected and there would be a low risk for geologic hazards from natural and induced seismicity and landslides. There would be a potential for flood hazards, which could cause damage to equipment and result in pollution of surface waters. Flood impacts would be expected to be minor to negligible and would be greatly reduced by compliance with guidance and adoption of appropriate best management practices presented in the Gold Book (USDOI–USDA 2007).

Under Alternative A, there would be a low potential for natural seismicity to impact Project facilities. The ground motions from a strong earthquake that could occur in the area would not be expected to damage project facilities, and impacts to well-built and properly designed structures would be negligible (Bolt 1993).

Earthquakes that have been linked with oil and gas production activities have become a concern. Recently, subsurface injection of fluids has been suspected in increased frequency of seismic events in southern Colorado, southern Kansas, central Oklahoma, central Arkansas, and scattered areas in Texas (Rubinstein and Mahani 2015). The primary cause of the earthquakes is thought to be injection disposal of produced water. Other potential causes may be from injection of fluids for secondary hydrocarbon recovery or hydraulic fracturing. Waste water disposal is most likely to be the cause because large volumes of water (hundreds of thousands of barrels per month) are injected over many years through disposal wells. Injection for secondary or enhanced recovery involves injection of fluid into depleted reservoirs to maintain pressure balance so injection does not raise the pressure in the reservoir to preproduction levels, thereby not creating conditions that would result in seismic events. Hydraulic fracturing is a limited duration event that, although may inject thousands of barrels of fluid, injects much less than the amounts of fluid injected by disposal wells (Rubinstein and Mahani 2015). However, hydraulic fracturing can cause damaging or felt induced seismicity under the right conditions, but such events are extremely rare. The USGS reports that as of late 2012, there have been only 3 recorded instances of felt earthquakes caused by hydraulic fracturing (USGS 2015). These induced seismicity events due to hydraulic fracturing have occurred in Great Britain, Canada, and Oklahoma.

An investigation by the WSGS indicated that there were no recorded seismic events that could be related to the underground injection of fluids in Converse County (Larsen and Wittke 2014). Therefore, subsurface disposal of fluid waste would not be expected to cause induced seismicity. The induced seismicity due to cast shots at nearby coal mines would not be expected to have any measureable effects on oil and gas infrastructure because of the low magnitude (less than 3.0) of the events. Given the current knowledge of conditions under which induced seismicity occurs in the Powder River Basin, impacts under Alternative A due to induced seismicity would be negligible.

Faults in close proximity to the point of injection present a geologic condition that appears to contribute to felt-induced seismicity. In Oklahoma, induced seismicity has become widespread, but with little damage. It is believed that the injection disposal of large volumes of produced water into the Arbuckle Formation and subsequent migration of the water into fractures in the basement Precambrian rocks has altered the stress regime and resulted in an increase in frequency and intensity of earthquake activity (Jacobs 2016). The potential injection disposal zones listed in Section 4.15.2.1 are separated from the Precambrian basement in the CCPA by thousands of feet of largely impermeable rock.

Although there are no identified incidents of felt-induced seismicity in the Powder River Basin due to wastewater injection, there is a risk that greatly increasing the injection volumes has the potential to trigger seismic events that would be felt by the public or cause damage to structures. No additional mitigation is recommended because there is not a defined risk. However, the USEPA has published recommendations to reduce and manage injection-induced seismicity for regulators (USEPA 2014a). The approach relies on three major components: site assessment, modification of operational conditions, and monitoring. If felt reports and earthquake documentation indicate a possible increase of seismicity frequency, a first step would be to conduct a site assessment that would include the following activities (USEPA 2014a):

- Review disposal history (especially dramatic increases of injection volumes) to determine possible correlation with increases in area seismicity.
- Review area seismicity data for increases in frequency or magnitude of seismic events.
- Review disposal well operating conditions to identify possible influence on seismic activity.
- Determine the distance and connectivity of the disposal zone to basement rock. This is done because the proximity and potential connectivity to fractured basement rock may have a strong influence on the magnitude and frequency of induced seismicity.

In addition to the preliminary site assessment, an engineering analysis could be conducted on wells suspected of causing induced seismicity. This would include the following (USEPA 2014a):

- Conduct pressure testing to obtain information about injection zone characteristics near the well.
- Conduct static bottom hole pressure monitoring to determine current reservoir pressure.
- Modify permit operational parameters to include reduction of injection rates or specify intermittent injection.
- Operate wells below fracture pressure to maintain the integrity of the disposal zone and confining layers.
- Check for mechanical integrity.

Monitoring could include the following activities (USEPA 2014a):

- Monitoring static reservoir pressure for pressure buildup.
- Installation of seismometers in areas of suspect induced seismicity to more accurately measure magnitude, location, and depth of seismic events.
- Monitoring densities of fluids from different sources in commercial wells because variations in fluid density may affect bottom hole pressure.

4.3.1.2 Impacts to Mineral Resources

Under Alternative A, the drilling of 1,663 wells over a 10-year period would result in the production of an estimated 288 million barrels of oil (OG 2014) and 1.2 trillion cubic feet of gas (i.e., 4,200 cubic feet of gas per barrel of oil; **Table 3.3-2**) over the 30-year life of the well. The production of this oil and natural gas would contribute to the nation's economy because the development and recovery of a valuable natural resource would result in additional taxes, royalties and other economic contributions. Alternative A would impact the access of other mineral resources (e.g., uranium, oil and gas, and coal). In the event of conflicts with surface use, oil and gas resources could be developed by use of off-set directional or horizontally drilled wellbores. Additionally, the WyoDak coal seam thins out south of the Antelope Rochelle Mines, and the Dry Cheyenne Seam has a limited coal resource (Jones and Glass 1991). The Dave Johnston coal mine within the CCPA is no longer in operation and has been reclaimed and redeveloped as a wind farm. At one time, the production of coalbed natural gas was a potential source of conflict with coal mining; however, coalbed natural gas development in Converse County has been very minor.

With regard to uranium, potential conflicts between extraction of locatable and leasable minerals would be addressed through the MMDA. The statute was enacted because locatable minerals such as uranium are present in areas that also are prospective for leasable minerals such as oil and gas and coal (Office of Technology Assessment 1979). The MMDA was passed in 1954, which was soon after the discovery of uranium in sedimentary deposits in the Powder River Basin. In 1951, the USGS found evidence of high-grade uranium ores in the Pumpkin Buttes area of Campbell and Johnson counties, Wyoming (Love 1952). The provisions of the MMDA (Office of Technology Assessment 1979) include:

- A method for validating mineral claims that may be subject to conflict and located after July 31, 1939.
- Leasable minerals can be extracted on all claims and claims located after August 13, 1954.
- Patents are protected for claims susceptible to conflicts when the patents are issued.
- After August 13, 1954 claims can be located on land subject to the conflict-producing conditions.

Given these factors, negligible to no impacts would be expected under Alternative A due to conflicts between oil and gas operators and the extraction of other mineral resources.

In recent years, the total number of oil and gas well completions (including coalbed natural gas) has tended to positively correlate with sand and gravel (aggregate) production. In 2004, there were a total of 17 oil and gas well completions (14 were coalbed natural gas wells), and slightly more than 513,000 tons of aggregate were produced in Converse County (Wyoming Department of Revenue 2017; WOGCC 2015b). In 2014, 170 wells were completed, and 1.94 million tons of aggregate were produced in the county. Of the 170 wells, 160 were oil wells, and most were permitted as horizontal wells. Although it appears that as oil and gas well activity increased from 2004 to 2014, sand and gravel production also increased, it is recognized that aggregates are not just used in oil field construction, but also are used for public roads and other construction. In early 2015, gravel shortages had been reported in the county due to the need for increased repairs on unpaved roads (Converse County Treasurers Office 2015b).

Under Alternative A, construction of roads, well pads, production pads, and other facilities would require approximately 326,000 tons of aggregate per year, based on the acreages provided in **Table 2.3-3** and assuming a 4-inch lift of aggregate on the road sub-base. Oil field development under Alternative A likely would not put undue pressure on aggregate resources in the CCPA and impacts would be minor to negligible based on the projected aggregate needs for this alternative being less than historic aggregate production in the CCPA.

A potential source of road surfacing material is clinker or scoria, which consists of rocks that have been altered by burned coal seams. Clinker beds (often misnamed scoria which is a volcanic rock) are common and widespread in the northern portion of the Powder River Basin but are present only in northeast Converse County in the southern part of the Rochelle Hills area (Heffern et al. 2013). Clinker is inferior to other aggregate sources because it breaks down over time, causes more dust, and has sharp broken surfaces that can be damaging to tires (BLM 2008f). Because of the limited extent and the costs of transportation, clinker likely would only be an important source of road base material in the northern part of the CCPA.

4.3.2 Impacts to Geology and Mineral Resources from Alternative B – Proposed Action

4.3.2.1 Impacts to Geology

Under Alternative B, impacts to geological resources and impacts from geological hazards would be same types as under Alternative A. No impacts to unique geological features would be expected, and there would be a low risk for geologic hazards from natural and induced seismicity and landslides. There would be a potential for flood hazards, which could cause damage to equipment and result in pollution of surface waters. Flood impacts would be expected to be minor to negligible and would be greatly reduced by compliance with guidance and adoption of appropriate best management practices presented in the Gold Book (USDOI-USDA 2007).

There would be a low potential for natural seismicity to impact Project facilities. The ground motions from a strong earthquake that could occur in the area would not be expected to damage Project facilities. Impacts to well-built and properly designed structures under Alternative B would be negligible (Bolt 1993).

Induced seismicity from fluid injection would not be likely to produce damaging earthquakes. However, it is not known how the large increase in the subsurface disposal of produced water and hydraulic fracturing water would affect the subsurface stress regime. The induced seismicity due to cast shots at nearby coal mines would not be expected to have any measureable effects on oil and gas infrastructure because of the low magnitude (less than 3.0) of the events. Given the current knowledge of conditions under which induced seismicity occurs in the Powder River Basin, impacts due to induced seismicity under Alternative B would be negligible.

4.3.2.2 Impacts to Mineral Resources

Under Alternative B, the drilling of 5,000 oil and gas wells over a 10-year period would result in an estimated production of over 1.4 billion barrels of oil and 5.9 trillion cubic feet of oil and gas resource over the 30-year life of the well. The production of oil and natural gas would be beneficial to the nation because of the recovery of a valuable natural resource, the development of which would result in additional taxes, royalties and other economic benefits. Under Alternative B, there would be an increase in resource recovery, taxes, royalties, employment, and other economic benefits as disclosed in Section 3.11, Socioeconomics.

Mineral resource development conflicts are managed under the BLM procedures as summarized in the Casper RMP. In addition to the BLM management procedures, the predominant use of horizontal drilling technology for oil and gas resource recovery for the Project would reduce mineral resource conflicts. The drilling of horizontal laterals to access unconventional and conventional reservoirs would reduce conflicts with surface uses and the extraction of other minerals. Based on the combination of administrative procedures and drilling technologies, Alternative B would have negligible to no impacts to the access of other mineral resources.

Although Alternative B would have little effect on the access to other mineral resources, given the proposed level of activity (drilling 5,000 oil and gas wells on 1,500 pads and construction of facilities and roads), oil field demand for aggregate likely would surpass current local supplies. Based on the acreages provided in **Table 2.4-1** and assuming a 4-inch lift of aggregate, the construction of roads, well pads, production pads, and other facility pads under Alternative B would require an estimated 1.7 million tons of aggregate per year. This need would be close to the county's annual production in 2014 of 1.94 million tons.

The maintenance of existing public roads and other construction would place additional demands on sand and gravel resources. The ensuing potential shortages would result in increased prices and additional transportation charges because distant sources would need to be accessed. Opening new pits and increasing production from existing pits would help alleviate shortages of aggregate. An indirect impact of oil and gas development under Alternative B would be additional disturbance that may occur within and outside of the CCPA for the expansion of existing aggregate sources, but it is not certain what the magnitude of additional disturbance would be.

4.3.2.3 Mitigation and Mitigation Effectiveness

No mitigation measures for geologic resources, geologic hazards, or mineral resources are recommended for Alternative B, the Proposed Action.

4.3.2.4 Residual Impacts

Residual impacts are defined as unavoidable adverse impacts to a resource that remain after implementation of mitigation has been applied. Due to the low level of impacts, no mitigation measures, including compensatory mitigation, are proposed; however, impacts to geology and minerals would include a low risk to personnel and equipment from geologic hazards, potential risks from flood hazards that could impact surface water, and surface disturbance resulting from the need for additional aggregate (Sections 4.3.2.1 and 4.3.2.2).

4.3.3 Impacts to Geology and Minerals from Alternative C

4.3.3.1 Impacts on Geology

Under Alternative C, impacts to geological resources and impacts from geological hazards would be same as under Alternative B. The decrease in surface disturbance would have no effect on the number of wells drilled and ultimately the amount of petroleum and produced water. The risks and expected impacts due to induced seismicity would be the same as Alternative B.

4.3.3.2 Impacts on Mineral Resources

Under Alternative C, beneficial and adverse impacts regarding mineral resources would be the same as under Alternative B with the exception of impacts to aggregate resources. Under Alternative C, the same number of wells would be drilled and the amount of produced hydrocarbons would be the same as under Alternative B. The reduction in surface disturbance would not have a measurable effect on access to other mineral resources, but it would lessen the demand of aggregate. Based on the acreages provided in **Table 2.5-1** and assuming a 4-inch lift of aggregate, the construction of roads, well pads, production pads, and other facilities under Alternative C would require an estimated 1.1 million tons of aggregate per year. This would be 600,000 tons per year less than under Alternative B. Even with the reduction in aggregate demand compared to Alternative B, the increased demand under Alternative C likely would put pressure on aggregate supplies, thereby causing an increase in price and indirect disturbance due to an increase in the number of pits and quarries.

The potential for conflicts between different mineral industries under Alternative C would be the same as under Alternative A and Alternative B, and negligible to no impacts would be expected due to mineral resource extraction conflicts.

4.3.3.3 Mitigation and Mitigation Effectiveness

No mitigation measures for geologic resources, geologic hazards, or mineral resources are recommended for Alternative C.

4.3.3.4 Residual Impacts

Residual impacts are defined as unavoidable adverse impacts to a resource that remain after implementation of mitigation has been applied. Due to the low level of impact, no mitigation measures, including compensatory mitigation, are proposed; however, residual impacts to geology and minerals would include a low risk to personnel and equipment from geologic hazards, potential risks from flood hazards that could impact surface water, and surface disturbance resulting from the need for additional aggregate (Sections 4.3.3.1 and 4.3.3.2).

4.3.4 Relationship between Local Short-term Uses of the Human Environment and Maintenance and Enhancement of Long-term Productivity

The relationship between local short-term uses of the human environment and maintenance and enhancement of long-term productivity is the disclosure regarding whether the short-term use of a resources associated with a project affects the long-term sustainability of that resource. Oil and gas production in the short term would not affect the long-term potential for development of mineral resources in the CCPA. Access to other mineral resources, if present, could be somewhat restrained during active development, production, abandonment, and reclamation. However, the advent of horizontal and directional drilling as the dominant technologies used for oil and gas extraction would reduce conflict between mining and oil and gas development and alleviate potential limitations to long-term productivity regarding the development of other mineral resources.

4.3.4.1 Irreversible/Irretrievable Commitment of Resources

Irreversible/irretrievable impacts are subsets of unavoidable adverse/residual impacts. Irreversible impacts are those that cannot ever be restored; they would be lost forever. Irretrievable impacts are those for which the resource value would be irretrievably lost until restoration of that resource takes place.

The production of oil and natural gas would be an irretrievable and irreversible commitment of resources. The production would be irretrievable because oil and gas are finite resources and not replaceable. The impact of production would be irretrievable because from a practical standpoint, the resource that is recovered cannot be put back in the reservoir. Even if natural gas were temporarily stored in an underground reservoir after being extracted from the CCPA, it eventually would be withdrawn from storage and consumed for fuel or used as petrochemical feedstock. The mining of sand and gravel also would represent an irretrievable and irreversible commitment of resources.

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4.4 Hazardous Materials, Solid Waste, and Public Health and Safety

The analysis area for direct and indirect impacts to hazardous materials, solid waste, and public health and safety includes the CCPA. However, given the programmatic nature of the analysis, the exact locations of oil and gas-related activities cannot be predicted with certainty within the CCPA. The potential impacts associated with hazardous materials and solid waste may occur when the hazardous materials are unintentionally released in quantities above regulatory reporting thresholds. The media that would be impacted include air, water, and soil.

The methodology for analysis of impacts due to hazardous materials, solid waste, and health and safety include the following tasks:

- Review the proposed activities and identify the hazardous materials that would be utilized or produced and solid waste (including hazardous waste) that would be generated.
- Describe how, where, and generalized quantities of hazardous materials that would be utilized during construction, drilling, and production operations.
- Review and summarize applicable rules concerning the transport, storage, handling and disposal of hazardous materials and solid waste. Describe how oil and gas operations would comply with all applicable regulations.
- Analyze impacts based on generic lists of hazardous materials presented in Section 3.4.
- Review the proposed activities that would pose a public health and safety threat to workers and the public.
- Conduct a comparison of oil and gas exploration, production, and transportation activity, along with spill/release and accident information associated with Alternatives A, B, and C relative to baseline conditions. For example, to assess potential impacts associated with trips, define current number of trips in the CCPA and the anticipated truck traffic increase and subsequent health and safety concerns associated with the Project.

Hazardous materials and solid wastes are managed according to the goals and objectives of the BLM ROD and Approved Casper RMP (BLM 2007b) and the USFS TBNG LRMP (USFS 2001).

Assumptions used in the analysis of impacts from hazardous materials, solid wastes, and public health and safety include:

- Management of hazardous materials and solid wastes would be conducted in compliance with applicable rules and regulations. Even under this assumption some level of impacts could occur from unintended spills or incidents.
- Releases below regulatory reporting requirements would not constitute substantial impacts because release reporting requirements are set below levels that could result in substantial adverse impacts to human health or the environment.
- Not all releases above reporting levels would actually result in substantial adverse impacts. The severity of impacts would depend on the material, the quantity, environmental setting, and receptors.
- Transportation-related releases would occur most frequently and the common modes of transportation would be truck and pipeline. The analysis did not consider transportation outside of the CCPA.
- The magnitude of potential impacts generally would be proportional to the level of oil and gas exploration and production.

- Transportation-related accidents during construction and production would consist of a substantial portion of public health and safety related impacts. Analysis for public health and safety consider transportation-related public health and safety impacts within the CCPA and the 2-mile buffer around the CCPA.
- Potential impacts to public health and safety would be most likely to occur during construction when Project activities would be at their greatest.

4.4.1 Alternative A – No Action Alternative

Under Alternative A, new development would include drilling of 1,663 new oil and gas wells on 361 pads and include the construction of other service well pads, roads, production facilities, and pipelines as disclosed under NEPA (Section 2.3.2).

4.4.1.1 Impacts from Hazardous Materials

As discussed in Section 3.4, hazardous materials present at oil field facilities include petroleum fuels (primarily diesel), produced petroleum fluids (including crude oil, natural gas, gas condensate), produced water, hydraulic fracturing chemicals, cement, silica sand, drilling fluids and additives, and well treatment chemicals. This analysis focuses on the risk of impacts during transportation, storage, use, and possible disposal of these materials. Potential impacts of these materials also are discussed in Section 4.16.2, Groundwater.

Petroleum hydrocarbons would be handled in large quantities at the drilling and development sites whether in the form of refined products (fuels) or produced petroleum fluids. These materials are flammable and have varying effects and persistence in the environment. A spill due to a transportation accident of diesel fuel, crude oil, or gas condensate could have impacts to air, water, and soil depending on the location of the incident. Volatile compounds may be released into the air, and if ignition occurs, the uncontrolled burning could lead to the formation of combustion compounds and hydrocarbon particulates. These materials are lighter than water and not very soluble; therefore, if a spill were to go into a stream, the materials would tend to float on the surface and be carried downstream or to banks. This would affect plants and animals within and near the aquatic environment. Over a period of time, the oil may adhere to fine-grained particles and end up entrained in the stream sediments. In contact with soils under optimum conditions (i.e., temperature and moisture) petroleum compounds can rapidly biodegrade (Agency for Toxic Substances and Disease Registry 1995). Groundwater also could be affected by a surface spill, but the magnitude of impacts would depend on the volume of spilled material, the type of soil in the unsaturated zone above the shallow groundwater table, adherence of the contaminant to soil particles, and percolation rates.

For the petroleum substances described above, a large release (i.e., greater than 50 gallons or 1.2 barrels) could have implications for public health and safety, but the location of a spill would be the primary factor in determining the effects of a release. The materials would be transported to and from sites (i.e., fuels transported in and product transported out) unless gathering systems are in place to transport crude and condensate. If transported by truck, the materials generally would follow the same routes, which would include I-25, SH 59, county roads, and various collector, local, and resource roads. The probability of a release anywhere along the potential transportation routes likely would be low. Truck transportation incidents involving a release of flammable liquids (USDOT Hazard Class 3) has been estimated to be 7.0 x 10-7 incidents (accidents or en-route leaks) per 1-million miles (Battelle Memorial Institute 2001).

The population density within the analysis area is low; therefore, the probability of a release within a populated area would be small. Given the general lack of surface water receptors, there also would be a low probability of impacts to surface water. The risk of impacts to groundwater would vary because shallow groundwater in alluvial aquifers would be more vulnerable than groundwater that is deep and under confined conditions.

To lessen the risk of spills at drilling and production sites, operators would prepare plans for spills, incidents, and emergencies as listed below:

- SPCC plans for applicable sites
- Emergency Response Plans
- Plans and inventories of hazardous chemical categories pursuant to Section 312 of Superfund Amendments and Reauthorization Act, as amended
- Storm Water Pollution Prevention Plans (SWPPPs)

Oils and fuels stored and used at sites would be covered by site-specific SPCC plans. The SPCC Plan would provide procedures to deal with spills or releases of oils, including petroleum and mineral oil. A SPCC program also would include written spill prevention and response plans, notification in case of a spill, periodic inspections, tank leak detection systems, spill and overfill protection, external pipe protection, secondary containment, and formal training for personnel. The USEPA has documented that the implementation of SPCC plans has a definable reduction in impacts due to the number of spills, spill volume, cleanup cost, and off-site migration (USEPA 1996). According to the USEPA study, reduction is defined as a 95-percent confidence that SPCC provisions listed above would have a positive effect on reducing the particular spill risk (e.g., leak detection reduces the number of spills). The SPCC Plan would not entirely eliminate spills, but the expectation would be that spills would be reduced in size and frequency.

An emergency response plan would cover spills or releases of non-petroleum hazardous materials and chemicals. The plan would cover procedures for handling hazardous material spills as well as other emergencies. As with oils and petroleum, provisions in an emergency response plan would not entirely eliminate spills, but it would be expected that the magnitude and frequency of spills would be reduced, with commensurate lowering of impacts to people and the environment. As with all industrial activities, in the event of a spill, the personnel on-site would be the first responders. The emergency response plans would provide for training of on-site personnel to respond to spills. Once spilled material is contained, it may be necessary for additional remediation and clean up performed by contractors in accordance with federal and state regulations.

In addition to the plans described above, operators must comply with Onshore Rule #1, which requires that operators develop and submit a hazardous materials and waste management plan with the APD. BLM guidance and rules also require the reporting of all spills (BLM 2013d).

Inventories of hazardous chemical categories pursuant to Section 312 of Superfund Amendments and Reauthorization Act would be provided to emergency planning and fire-fighting authorities so that responders would have knowledge of the hazards and volumes of materials that would be used and stored at sites. The SWPPPs would be site-specific and also would provide information and inventories of hazardous materials and chemicals that may be used at sites.

During transportation of hazardous materials, responsibility for leaks and spills belongs to transporters, whether by pipeline or truck. As indicated above, the probability of truck transportation incidents would be quite low. As for pipeline transportation, the risk of serious incidents also would be quite low. From 1995 to 2014, there was only one serious incident in Wyoming among the various categories of pipelines (i.e., gas gathering, gas transmission, and crude oil) (Pipeline and Hazardous Materials Safety Administration 2015). According to Pipeline and Hazardous Materials Safety Administration, serious incidents “include a fatality or injury requiring in-patient hospitalization” (Pipeline and Hazardous Materials Safety Administration 2015). National data indicates that most pipeline spills from 2002 to 2009 were small with 53 percent of the spills being less than 3.0 barrels (126 gallons) (AECOM 2013). In 85 percent of the cases, the spill volume was less than 100 barrels (4,200 gallons), and in more than 95 percent of the incidents the spill volumes were less than 1,000 barrels (42,000 gallons). Oil spills of 10,000 barrels (420,000 gallons) or larger were rare and occurred in only 0.34 percent of incidents.

Although RCRA exempt, SDSs on produced water have been issued in compliance with OSHA regulations of an employer's obligation to notify employees of hazards under 29 CFR 1910.1200 (Hazard Communication Standard). However, produced water is increasingly being recycled, so it could be considered a by-product rather than a waste. Produced water could contain various constituents including small amounts of crude oil, condensate, or natural gas as well as varying amounts of dissolved chemical compounds including sodium chloride, potassium chloride, and calcium chloride (Devon Energy 2010). As with petroleum hydrocarbons, the media impacted and the severity of a spill would be based on the location of the spill and proximity to sensitive receptors. Shallow groundwater also may be at risk depending on the size of the spill and depth to groundwater. Produced water spills could have adverse effects on soil and vegetation due to the dissolved constituents, especially sodium. The effects of produced water spills on soil and vegetation may be more persistent and long term as opposed to spills of hydrocarbons. Spills to surface water could affect water quality and impact aquatic life. Although no information was available for Wyoming, the Colorado Oil and Gas Conservation Commission issued statistics indicating that spills of produced water in Colorado oil and gas fields accounted for 0.006 percent of total volume of produced water (Colorado Oil and Gas Conservation Commission 2015).

Hydraulic fracturing fluids are comprised of various substances that are used to facilitate the fracturing process. They primarily consist of water, but also contain solids (sand or artificial proppants) and chemicals. A detailed list of these hydraulic fracturing chemicals can be found at the FracFocus chemical disclosure registry (FracFocus 2015). These chemicals generally comprise from 1 to 5 percent of the total hydraulic fracturing fluid mixture and can include but would not be limited to the following: acids, anti-bacterial agents, corrosion inhibitors, gelling agents (polymers), surfactants, and scale inhibitors (BLM 2013d). The 1 to 5 percent of chemical additives translates to a minimum of 5,000 gallons (119 barrels) of chemicals for every 1.5 million gallons (35,715 barrels) of water used to fracture a well.

Data specifically concerning the spillage or release of fracturing fluids on the surface indicated that 95 percent of the spills were less than 3,000 gallons (71.5 barrels) in volume (Gradient 2013). Spills of fracturing fluids potentially could impact soil and groundwater. Based on the higher probability of small spills to occur more often, many spills would only affect the surficial soil and the unsaturated area above the shallow water table. In the case of larger spills, fluids could migrate to very shallow groundwater such as found in alluvial aquifers.

Spills of cement and silica sand would not affect the environment because they are not considered contaminants. They are consumed in the process of drilling and completing wells; however, they do present exposure hazards to workers directly involved in operations with these materials. The use of proper personal protective equipment and handling procedures would reduce the exposure to the hazards these materials may present.

Drilling fluid (or mud) that would be used for drilling wells is classified in two major categories, water-based and oil-based fluid. Water-based drilling mud largely is composed of water, bentonite, barite, and relatively small amounts of the chemicals and other constituents. The chemicals are used to increase the effectiveness of the fluids, much the same as the chemicals in hydraulic fracturing chemicals. Oil-based muds consist of petroleum distillates or other organic oils as the "continuous phase" in an emulsion with much smaller concentrations of water and other additives (Schlumberger 2017). Spills of water-based mud would have a slight impact on the environment because the primary constituents (clay and bentonite) are "inert and non-toxic" (United Nations Environmental Programme 1997). Heavy metals that may be present in the fluid generally are not bioavailable. Water-based drilling fluids have even been used as soil amendments. A constraining factor of water-based drilling fluids may be the use of brine as the primary ingredient rather than fresh water, and the effects of a brine-water drilling mud on soil and vegetation may be similar to the effects of produced water. The impacts of spills of oil-based muds would be similar to impacts from spills of diesel fuel and other hydrocarbons. Oil based muds would be subject to rules regarding handling and storage of petroleum including requirements contained in the site-specific SPCC Plan.

The BLM requires that any spill be reported as soon as possible or within 24 hours and has spill severity thresholds based on the volume of spilled material. Spills of oil, condensate, produced water, or other toxic materials greater than 100 barrels (4,200 gallons), unintended venting of 500,000 cubic feet of gas, releases to sensitive areas including waterbodies, fatalities, and loss of well control (blowout) are considered major undesirable events. Notice to Lessees (NTL) 3A contains detailed requirements for reporting spills and documentation of spill incidents and cleanup. The WDEQ requires immediate reporting of releases that enter or threaten to impact waters of the state (WDEQ Water Quality Rules, Chapter 4). If waters of the state are not affected, releases of 10 barrels (420 gallons) or less of crude, condensate, or produced water are not required to be reported. Spills of refined petroleum products and oils that are less than 25 gallons also do not need to be reported. The WOGCC rules (Chapter 4, Section 3) require that contained spills greater than 10 barrels (420 gallons) must be reported within one working day. Spills that threaten or have impacted water must be reported within 24 hours. Each of the agencies has their own report submission requirements. Notification to the USEPA National Response Center may be necessary depending on the hazardous substance and quantity that is spilled.

4.4.1.2 Impacts from Solid Waste

Typical waste that would be generated by oil and gas operations include produced water, drilling fluids, drilling fluid cuttings, and petroleum contaminated soil, trash, and debris.

Produced water (including hydraulic fracturing flowback water) is the primary waste product of oil and gas production in terms of volume. When brought to the surface, produced water is separated from the hydrocarbons and typically temporarily stored at the production sites in tanks within secondary containment, usually together with tanks used to store produced liquid hydrocarbons. Produced water may either be hauled by truck to disposal sites or moved by pipeline to centralized disposal facilities. The primary disposal methods would be deep injection disposal or evaporation. The concentrations of TDS in produced water (**Table 3.16-6**) would preclude it from being discharged to the surface due to the substantial adverse effects that would occur to exposed soil and plants as well as to surface water resources. Potential impacts from deep disposal are discussed in Section 4.16.2, Groundwater. Potential impacts to surface resources are discussed under hazardous materials (Section 4.4.1.1).

Drilling fluid and the rock chips (cuttings) account for a large amount of the waste stream from oil and gas operations. At the discretion of the authorizing agency based on environmental considerations (e.g., absence of shallow groundwater, not close to wetlands and drainages, residences, and other sensitive receptors), water-based muds and associated drill cuttings could be buried on-site. Potential impacts due to on-site disposal would be minimal due to the relatively benign nature of water-based mud and associated cuttings. Cuttings from oil-based drilling fluid systems would need to be disposed of in a permitted oil field waste facility or treated (solidified) for burial on site. Although oil-based drilling fluids would be used, they would be expected to cause negligible impacts from onsite disposal because the BLM usually requires closed-loop drilling mud systems, which necessitates the off-site disposal at a permitted oil field waste facility unless the operator files a plan for other disposition (BLM 2011c). ***T***he WOGCC requires that oil-based muds be removed to a permitted disposal facility or be treated or handled in accordance with WOGCC or WDEQ (WOGCC Chapter 4, Environmental Rules).

According to BLM guidance, closed-loop systems must be used for oil-base drilling mud systems (BLM 2011c). Closed-loop drilling fluid systems are used to lessen the risk of impacts from drilling fluids by eliminating the use of reserve pits. Even when water-based mud systems are used with an associated reserve pit there are potential risks. Closed loop drilling fluid systems have environmental advantages (BLM 2011c), which include the following:

- Minimization of waste.
- Less risk to wildlife.
- Reduction in fugitive air emissions.
- Reduction of the risk of soil and groundwater contamination.
- Facilitate complete interim reclamation.
- Operational costs reduced because of no solidification treatment or netting needed.

Other waste materials would be disposed of according to the requirements for each of the main groups of waste, RCRA exempt waste, and RCRA non-exempt waste. TENORM would be managed and disposed according to WDEQ SHWD Guideline #24. No disposal would occur onsite and inert materials such as construction debris, trash, and sewage would be disposed of off-site in compliance with rules and regulations governing the disposal of such materials.

4.4.1.3 Impacts on Public Health and Safety

Impacts to public health and safety under Alternative A would consist of traffic hazards as well as occupational hazards from existing oil and gas activities within the CCPA. As noted in Section 3.4.2.1, highway accidents in 2008 account for approximately 75 percent of U.S. oil and gas industry transportation-related fatalities and comprised 31 percent of all fatalities for that year (U.S. Bureau of Labor Statistics 2010). Development under Alternative A would contribute to the risk of transportation-related incidences, both to the public as well as to oil and gas employees associated with development and operations.

The anticipated increase in traffic volume from oil and gas vehicles on highways and roads in the area would increase the potential for accidents on roads with both public and industry-related motor vehicle traffic. The risk for vehicle accidents would increase during the winter when roads would be affected by adverse winter weather conditions.

Construction of and subsequent production activity on well pads, roads, and production and linear facilities would result in an increased potential for accidental releases and/or worker incidents regarding hazardous materials. Adverse winter weather conditions also would pose a risk for health and safety effects to personnel. Drilling operation plans approved by the BLM would address the potential for accidental releases of hazardous materials. Adherence to relevant safety regulations and enforcement by the respective agencies would reduce the probability of accidents. Activities such as flaring also could pose a safety impact to personnel. All flaring would occur at a distance from the wellhead that protects equipment, structures, and personnel safety. Additionally, pursuant to the new WOGCC Well Setback Rule (detailed in Wyoming Statutes Chapter 3, Section ***47***), a 500-foot setback is required as measured from the wellhead or nearest production facilities to the closest occupied structure. Placement of wellhead and production facilities within 1,000 feet from occupied structures would require notification of the offset to the owners of the structure as well as the development of mitigation measures to address issues such as noise, light, dust, traffic, and orientation of the well pad (WOGCC 2015a). Additionally, the Notice of Competitive Oil and Gas Lease Sale states under Lease Notice No. 1 that appropriate modifications to imposed restrictions will be made for the maintenance and operation of producing wells within 500 feet of Interstate highways and 200 feet of other existing ROWs (i.e., U.S. and State highways, roads, railroads, pipelines, power lines) and within 0.25 mile of occupied dwellings (BLM 2017a). This applies to all leases in the state of Wyoming. Concerns regarding worker and public safety from hydrogen sulfide would be reduced by Onshore Order Number 6, Hydrogen Sulfide Operations (BLM 1990), which would require a Hydrogen Sulfide Drilling Operation Plan to be submitted with the APD "for proposed drilling operations where formations will be penetrated which have zones known to contain or which could reasonably be expected to contain concentrations of H2S of 100 ppm in the gas stream." If applicable, the operator also must submit a Public Protection Plan as required under Onshore Order Number 6, Hydrogen Sulfide Operations (BLM 1990). The plan would vary according the site-specific characteristics expected to be encountered and the proximity of the population potentially at risk, and may include public education seminars, mass alert systems, and use of sirens, telephone, radio, and television depending on the number of people at risk and their location with respect to the well site. The threshold hydrogen sulfide concentration of 100 ppm would not be expected in oil and gas wells that would be drilled and produced within the CCPA.

The potential for firearms-related accidents primarily would occur during hunting season, although the risk would be minimal because the increased activity during drilling and field development would likely discourage hunting in the immediate vicinity of oil and gas exploration and development. The relatively few personnel on-site during production would experience a somewhat higher risk of firearm-related accidents; however, this risk would be highly localized from recreational target shooting or hunting activities.

The risk of wildland fires could increase in areas associated with oil and gas construction activities due to vehicle collisions, industrial development, and the presence of fuels, storage tanks, pipelines, and production equipment. Additionally, there could be an increased risk of wildland fire ignition if welding and other equipment were placed in or near vegetation.

4.4.2 Alternative B – Proposed Action Alternative

Under Alternative B, approximately 5,000 new oil and gas wells would be drilled on 1,500 multi-well pads over a period of 10 years (500 new wells per year). Additional service well pads, access roads, pipelines, electric power lines, and ancillary facilities also would be constructed (**Table 2.4-1**).

4.4.2.1 Impacts from Hazardous Materials and Solid Waste

Impacts under Alternative B would be similar to those discussed under Alternative A except that a greater frequency of occurrence (spills or releases) would be expected due to the greater number of new wells (approximately 3 times more than under Alternative A) and similarly greater activity. However, it does not necessarily follow that 3 times the volume of spills would occur, only that given the probabilities provided in the Section 4.4.1.1, it is reasonable to assume that spills would occur at the same frequency for a given amount of projected activity. As also discussed in Section 4.4.1.1, regardless of regulation and preventive measures, accidents would occur. However, if operators carry out activities in compliance with the rules and in a workmanlike manner, the occurrence and number and volume of spills could be reduced and the impacts minimized.

As discussed for hazardous materials, potential impacts from the generation and handling of solid waste under Alternative B would be the same as discussed for Alternative A. However, since the magnitude of proposed activities would be much greater, there would be a greater overall impact. And as with hazardous materials, accidents and mishandling occur in spite of the regulatory frame work, but risks can be minimized by conducting activities in compliance with applicable rules and BMPs.

4.4.2.2 Impacts on Public Health and Safety

Similar to Alternative A, health and safety impacts to operators, contract workers, residents, and public land users primarily would result from industrial accidents and traffic-related incidents under Alternative B. However, health and safety risks also could arise from firearms-related accidents during hunting season as well as from wildland fires. Fire suppression equipment, fencing and netting of pits, shutdown devices, and other safety measures typically incorporated into drilling and production activities would reduce the risk to public health and safety. Furthermore, adherence to relevant safety regulations by operators and enforcement by the respective agencies would reduce the probability of wildland fire ignition. See Section 3.14, Vegetation, for more discussion regarding wildland fire risks.

The estimated average annual vehicle round trips during well development based on a 10-year construction average under Alternative B would be approximately 200,900 light truck trips and 290,900 heavy truck trips (**Table 4.13-1**). As detailed on **Table 4.13-4**, traffic increases on various highways and roads from 2013 traffic levels would range from 6 percent to 316 percent (disregarding the outlier at Wyoming 93 at the junction of Route 504 and Wyoming 95 where the estimated increase of both light and heavy trucks would be approximately 1,319 percent). Overall, estimated traffic increases on CCPA highways would be substantial when compared to 2013 levels. The anticipated increase in traffic volume from oil and gas vehicles on highways and roads in the area would increase the potential for accidents on roads with both public and industry-related motor vehicle traffic. The risk for vehicle accidents would increase during the winter when roads would be affected by adverse winter weather conditions. When these roads are not snow-covered, reducing fugitive dust through the application of water or chemical dust suppressants would help maintain visibility for drivers and could indirectly reduce the potential for vehicle accidents in localized areas. However, dust control measures would be subject to surface landowner approval. Additionally, appropriate speed limits would be posted along all access roads and enforced during construction and operations to reduce speed related incidents.

4.4.2.3 Mitigation and Mitigation Effectiveness

No additional mitigation measures for, including compensatory mitigation, hazardous materials, solid waste, or public health and safety are recommended beyond the existing rules, regulations, and guidance in place to reduce the risks of hazardous material spills and releases.

4.4.2.4 Residual Impacts

Residual impacts are defined as unavoidable adverse impacts to a resource that remain assuming implementation of proposed mitigation. As discussed in Section 4.4.2.1, impacts could remain if remediation of spills does not entirely remove contaminants from impacted media; however, this is unlikely due to current requirements. Hydrocarbons may be persistent for many years, especially if natural attenuation is the selected alternative for remediation. Produced water spills could be especially difficult to remediate and impacts from salt contamination could persist for many years. However, because of the greater magnitude of Alternative B compared to Alternative A, these impacts would be correspondently larger.

Residual impacts to public health and safety resulting from Alternative B would include the potential for public health and safety impacts from construction and operation of Project facilities such as well pads, pipelines, and roads (**Table 2.4-1**). Increased usage of highways as well as local and county roads also would result in the potential for public health and safety impacts from increased accident rates, especially during the winter months when adverse weather conditions would be more likely to affect travel.

4.4.3 Alternative C

Under Alternative C, approximately 5,000 new oil and gas wells would be drilled from 938 new multi-well pads over a 10-year period. This would be approximately 37 percent fewer well pads than under Alternative B. Additional service well pads, access roads, pipelines, electric power lines, and ancillary facilities also would be constructed (**Table 2.5-1**).

4.4.3.1 Impacts from Hazardous Materials and Solid Waste

The potential impacts from hazardous materials and solid waste under Alternative C would be similar to Alternative B, but to a lesser degree. The restriction of closed-loop drilling fluid systems on all federal mineral estate potentially would reduce impacts from reserve pits. The reduction in direct and indirect impacts is difficult to quantify; however, because the federal mineral estate comprises approximately

64 percent of the CCPA, the reduction in impacts related to reserve pits and drilling fluids handling and disposal could be considerable.

4.4.3.2 Impacts on Public Health and Safety

Under Alternative C, the area where surface disturbance associated with oil and gas exploration and development could occur would be less than under Alternative B; therefore, the level of construction activity and subsequent occupational hazards that could occur also would be less than under Alternative B.

The development of fewer well-pads under Alternative C when compared to Alternative B would result in construction of 33 percent fewer new roads than under Alternative B. This would result in a 36 percent reduction in light and heavy truck trips associated with well-pad construction (**Table 4.13-5**), and a 34 percent reduction in light and heavy truck trips associated with pipeline and road construction (**Table 4.13-6**). The decrease in traffic volume from oil and gas vehicles on highways as well as local and county roads relative to Alternative B would decrease the potential for vehicle accidents involving oil and workers and local users such as ranchers and recreationists.

Under Alternative C, the concentration of activities on fewer well pads would minimize health and safety threats from wildland fire and firearms as facilities would be fewer and less densely distributed. Timing Limitation Stipulations would result in less drilling during the spring and summer months, possibly concentrating construction activities in the winter months, enhancing the risk to personnel from injuries and vehicle accidents related to adverse winter weather conditions.

4.4.3.3 Mitigation and Mitigation Effectiveness

No additional mitigation measures, including compensatory mitigation, for hazardous materials, solid waste, or public health and safety are recommended beyond the existing rules, regulations, and guidance in place to reduce the risks of hazardous material spills and releases.

4.4.3.4 Residual Impacts

Residual impacts are defined as unavoidable adverse impacts to a resource that remain assuming implementation of proposed mitigation. As discussed in Section 4.4.2.1, impacts could remain if remediation of spills does not entirely remove contaminants from impacted media. However, impacts from reserve pits would be reduced compared to Alternative B because a substantial number of drilling locations would be closed-loop drilling fluid systems.

Residual impacts to health and safety resulting from Alternative C would be similar to Alternative B but with the following differences:

- Reduction in the number of well pads developed would reduce the potential for personnel health and safety impacts during construction;
- Reduction in miles of roads constructed would reduce the potential for personnel and public health and safety impacts from increased local and county, and state highway usage; and
- Timing Limitation Stipulations would result in less drilling during the spring and summer months, possibly concentrating construction activities in the winter months, enhancing the risk to personnel from injuries and vehicle accidents related to adverse winter weather conditions.

4.4.4 Relationship between Local Short-term Uses of the Human Environment and Maintenance and Enhancement of Long-term Productivity

The relationship between local short-term uses of the human environment and maintenance and enhancement of long-term productivity is the disclosure regarding whether the short-term use of resources associated with a project affects the long-term sustainability of that resource. Due to the persistent and long-term effects produced water spills could have on soil and vegetation, soils impacted by produced water spills may have total or partial loss of productivity into the foreseeable future. Workers or members of the public who would be impacted by injuries from Project development or production activities may have total or partial loss of productivity into the foreseeable future.

4.4.5 Irreversible/Irretrievable Commitment of Resources

Irreversible/irretrievable impacts are subsets of unavoidable adverse/residual impacts. Irreversible impacts are those that cannot ever be restored; they would be lost forever. Irretrievable impacts are those for which the resource value would be irretrievably lost until restoration of that resource takes place. Soil that is damaged by produced water spills may not be repairable and may be an irreversible loss of productivity.

There would be a potential for injuries or fatalities to workers from construction and operation of oil and gas facilitates. Fatalities are irretrievable and some injuries would be irreversible depending on the nature of the injury. Engineering controls and training and safety programs would reduce but not eliminate the potential for injuries or fatalities to workers.

4.5 Land Use

The analysis area for direct and indirect impacts to land use is the CCPA.

Potential direct and indirect impacts to land use include interference with existing land uses such as livestock grazing, recreation, agriculture, multiple types of energy development, as well as management areas.

The methodology for analysis of impacts to land use included the following key steps:

- Estimate, and where applicable, quantify the extent to which the Project would impact areas committed to other land uses.
- Identify conflicts with land and resource use plans or regulations.
- Reference potential impacts or conflicts with other resource areas to appropriate EIS section (e.g., grazing, recreation, wildlife, visual, etc.).

Land use is managed according to the goals and objectives from the BLM Record of Decision and Approved Casper RMP (BLM 2007b), the USFS LRMP for the Thunder Basin National Grassland (USFS 2001), and the 2015 Converse County Land Use Plan (Converse County 2015a).

Assumptions used in the analysis of impacts to land use included:

- Project would not permanently limit public access to federal lands.
- Grazing, recreation (including aesthetics/visual resources), and wildlife habitat are important land use values; therefore, the Project would minimize disturbance to these key resource areas. Grazing (i.e., ranch lands) is the primary land use in the CCPA. Impacts to these resources have been fully described in their respective section and cross-referenced in this Land Use discussion.

4.5.1 Impacts to Land Use from Alternative A – No Action

Under Alternative A, new drilling and completion of wells and infrastructure would continue as disclosed under NEPA (Section 2.3.2), resulting in an estimated 10,253 acres of new disturbance (**Table 2.3-3**).

The greatest impact to landowners would be on private land, which makes up approximately 83 percent of the CCPA, followed by State lands, BLM-administered land, and lastly USFS-administered land (**Table 3.5-1**). It is estimated that surface disturbance would be proportional to surface ownership within the CCPA. Impacts to land use would be highest during the construction phase of the previously authorized activities. Impacts would include removal of lands from current land uses, such as agriculture, ranching, and recreation. The estimated new surface disturbance potentially would affect approximately 71 acres of land in agricultural production, 4,954 acres of grazing allotments, 10,253 acres of coal fields, and 6,562 acres and 3,486 acres of Class 3/4 and Class 5/6 wind potential, respectively.

4.5.2 Impacts to Land Use from Alternative B – Proposed Action

4.5.2.1 Impacts to Land Use

Under Alternative B, approximately 5,000 new oil and gas wells would be drilled on 1,500 multi-well pads over a period of 10 years (500 new wells per year). Additional surface disturbance would result from the construction of other service well pads, access roads, pipelines, electric power lines, and ancillary facilities (**Table 2.4-1**). The proposed development would be constructed on approximately 52,667 acres throughout the CCPA. The total disturbance is broken out as follows: 13,121 acres from access roads; 21,400 acres from well pads; and the remainder would be from a combination of production and linear facilities. The greatest impact to landowners would be on private land, which makes up approximately 83 percent of the CCPA, followed by State lands, BLM-administered land, and lastly USFS-administered land (**Table 3.5-1**). As with Alternative A, it is estimated that surface disturbance by surface ownership under Alternative B would be proportional to surface ownership within the CCPA.

The impacts to specific land use types would be varied, as would the impact on recreational activities. Although recreational opportunities may increase with greater access provided by new roads in the CCPA, the increased human disturbance would intrude upon recreational activities such as hiking, hunting, and visitation of historic trails. Greater access also could result in an elevated risk of trespass onto private lands. Increased wildlife habitat fragmentation from surface disturbance could further affect recreational hunting opportunities. Refer to Section 4.10, Recreation, for a more detailed discussion regarding impacts to recreation resources in the CCPA. A detailed discussion of impacts to Wildlife is located in Section 4.18.

Less than one percent of the CCPA is classified as agricultural land; however, cattle and sheep grazing is a substantial land use within the CCPA. The estimated new surface disturbance potentially would affect approximately 360 acres of land in agricultural production. Should development take place on agricultural land, impacts would be resolved based on negotiated surface use agreements with private landowners. Impacts from construction and production activities to grazing allotments would include the loss of forage, impacts to lambing areas, potential disruption of lambing periods, and increased mortality and injuries to livestock resulting from increased vehicle traffic. In addition, livestock could be displaced from preferred grazing areas and range improvements (including water sources) by construction and production activities. The estimated new surface disturbance potentially would affect approximately ***32,054*** acres of grazing allotments. Impacts to rangelands would be ***reduced*** by the implementation of a site-specific Reclamation Plan to be developed by the operator and submitted with the APD. Refer to Section 4.9, Range Resources, for a discussion regarding impacts to grazing in the CCPA.

In addition to oil and gas development, multiple other types of energy production occur within the CCPA, including wind energy and uranium mining (**Figures 3.5-2** and **3.5-3**). In addition, there are coal fields just north and east of the CCPA. Permanent acreage occupied by aboveground facilities potentially would preclude future use of the land by these other industries. Potential acreage impacts potentially would include 52,667 acres of coal fields as well as 33,707 acres and 17,907 acres of Class 3/4 and Class 5/6 wind potential, respectively. Potential inference with other types of energy production, in some instances, could be resolved on a case-by-case basis. Potential conflicts with private landowners also could be resolved on a case-by-case basis, as well as by implementation of BLM oil and gas BMPs, and adherence to surface and operating standards and guidelines for oil and gas exploration and development in the BLM and USFS Gold Book (USDOI-USDA 2007).

Approximately 2,006 acres of the 20,090-acre Sand Hills Management Area that fall within the CCPA (**Figure 3.5-1**) is designated as a ROW exclusion area and therefore, is administratively unavailable for oil and gas leasing. These protections would preserve land uses within the management area, although adjacent construction and production activities may affect the setting of certain land uses within the management area.

Under Alternative B, facilities would be sited in such a way as to conform to BLM, USFS, and county land use planning objectives, as applicable.

4.5.2.2 Mitigation and Mitigation Effectiveness

No mitigation measures, including compensatory mitigation, have been identified for Alternative B.

4.5.2.3 Residual Impacts

Residual impacts are defined as unavoidable adverse impacts to a resource that remain assuming implementation of proposed mitigation. Residual impacts to land uses resulting from Alternative B would include the following:

- Less available acreage for land uses such as recreational and grazing uses;
- Potential preclusion of future use of land by other energy industry types; and
- Degradation of the natural setting within the Sand Hills Management Area from adjacent construction and production activities.

4.5.3 Impacts to Land Use from Alternative C

4.5.3.1 Impacts to Land Use

Under Alternative C, 5,000 new oil and gas wells would be drilled from 938 new multi-well pads over a ten year period. This would be approximately 37 percent fewer pads than under Alternative B. Additional surface disturbance would result from the construction of other service well pads, access roads, pipelines, electric power lines, and ancillary facilities; however, this additional disturbance also would be less than under Alternative B (**Table 2.5-1**). This development would be constructed on approximately 37,267 acres throughout the CCPA. Of this total disturbance; 8,388 acres would be from access roads; 13,544 acres would be from well pads; and the remainder would be from a combination of production and linear facilities. This would result in a 29 percent reduction in disturbance acreage compared to Alternative B. As under Alternative B, the greatest impact to landowners would be on private land, followed by state lands, BLM-administered land, and lastly USFS-administered land (**Table 3.5-1**). As with Alternative A and Alternative B, it is estimated that surface disturbance by surface ownership under Alternative C would be proportional to surface ownership within the CCPA.

The impacts to land use types would be similar to Alternative B except less acreage would be disturbed from activities under Alternative C, resulting in an anticipated reduction in impacts. Under Alternative C, recreational access would increase less than under Alternative B as fewer roads would be developed in the CCPA. Additionally, the impact from increased human disturbance on recreational activities such as hiking, hunting, and visitation of historic trails would be less than under Alternative B as less acreage would be disturbed. Increased wildlife habitat fragmentation and the associated impact on hunting opportunities also would be slightly less under Alternative C. Refer to Section 4.10, Recreation, for a more detailed discussion regarding impacts to recreation resources in the CCPA. A detailed discussion of impacts to Wildlife is located in Section 4.18.

Less surface disturbance from Alternative C on agricultural land compared to Alternative B would result in a corresponding decrease in potential impacts to agricultural land use types, such as cattle and sheep grazing. Under Alternative C, the estimated new surface disturbance potentially would affect approximately 255 acres of land in agricultural production and ***22,682*** acres of grazing allotments. Refer to Section 4.9, Range Resources, for a discussion regarding impacts to grazing in the CCPA.

Impacts to other energy industries and potential impacts to the Sand Hills Management Area under Alternative C would be slightly less than under Alternative B due to the decrease in acreage that would be disturbed under Alternative C compared to Alternative B. Impacts from other energy industries potentially would include 37,267 acres of coal fields as well as 23,851 acres and 12,670 acres of Class 3/4 and Class 5/6 wind potential, respectively.

As under Alternative B, facilities under Alternative C would be sited in such a way as to conform to BLM, USFS, and county land use planning objectives, as applicable.

4.5.3.2 Mitigation and Mitigation Effectiveness

No mitigation measures, including compensatory mitigation, have been identified for Alternative C.

4.5.3.3 Residual Impacts

Residual impacts are defined as unavoidable adverse impacts to a resource that remain assuming implementation of proposed mitigation. Residual impacts to land uses resulting from Alternative C would be similar to those for Alternative B, but with the following differences:

- Loss of available acreage for land uses such as recreation and grazing would be 29 percent less than Alternative B;
- Potential for preclusion of future use of land by other energy industries would be less than under Alternative B as a result of less acreage disturbance; and
- Degradation of the setting within the Sand Hills Management Area from adjacent construction and production activities would be less than under Alternative B as a result of less acreage disturbance.

4.5.4 Relationship between Local Short-term Uses of the Human Environment and Maintenance and Enhancement of Long-term Productivity

The relationship between local short-term uses of the human environment and maintenance and enhancement of long-term productivity is the disclosure of whether the short-term use of a resource associated with a project affects the long-term sustainability of that resource. Many of the aboveground facilities, such as drill rigs and water tanks, eventually would be removed at the end of their relatively short-term life spans and the land would be reclaimed. While the reclamation of arid lands could take several decades, these actions potentially would reduce the long-term impacts to public land resources such as grazing and recreational opportunities.

4.5.5 Irreversible/Irretrievable Commitment of Resources

Irreversible/irretrievable impacts are subsets of unavoidable adverse/residual impacts. Irreversible impacts are those that cannot ever be restored and would be lost forever. Irretrievable impacts are those for which the resource value would be irretrievably lost until restoration of that resource takes place. Impacts to land use generally would be reversible through reclamation efforts, following irretrievable loss of use during production would be irretrievable. It is anticipated that increased acreage would be reclaimed under Alternative C relative to Alternative B as interim reclamation would be required on lands overlying federal mineral estate.

4.6 Lands and Realty

The analysis area for direct and indirect impacts to lands and realty is the CCPA.

Lands and realty are considered a resource that is managed by the BLM and the USFS. The analysis of impacts on lands and realty was limited to the effects on authorized uses and issuance or denial of lands and realty authorizations.

The methodology used for analysis of impacts to lands and realty was to compare the estimated Project footprint to the existing lands and realty designations to quantify potential reduced opportunity for non-oil and gas use authorizations that could be considered on lands that would be used for oil and gas development.

Lands and realty is managed according to the goals and objectives from the BLM Record of Decision and Approved Casper RMP (BLM 2007b) and the USFS LRMP for the Thunder Basin National Grassland (USFS 2001).

Assumptions used in the analysis of lands and realty included:

- Existing ROWs would be managed to protect valid existing rights. The ROW holders would maintain access consistent with the terms of their grant.
- Infrastructure associated with oil and gas development (e.g., well pads, facilities, local and resource access roads, pipelines, power lines, and communications facilities) would be compatible with existing ROW land uses.
- APDs would address potential conflicts between oil and gas development and other land use authorizations on a site-specific basis. Approval of permits would require analysis of the existing or future ability of the BLM and USFS to grant land use authorizations within site-specific areas.
- Management plans, ROWs, lease information, and any other supporting documentation provided by the requisite governing bodies are the most current and available for public use and review.

4.6.1 Impacts to Lands and Realty from Alternative A – No Action

Under Alternative A, the BLM and the USFS would permit development of up to 386 new well pads (including other service well pads), which would require lands and realty authorizations for associated facilities (pipelines, local and resource access roads, and associated utilities) that transect BLM- or USFS-administered land. Approximately 4,482 acres would be disturbed from well pads, 2,339 acres from roads, 361 acres from construction and production facilities, and 3,071 acres from linear facilities. This would result in a total new surface disturbance of 10,253 for construction (**Table 2.3-3**).

Approximately 10 percent of the surface within the CCPA is administered by the BLM and USFS; therefore, it is assumed that approximately 10 percent of the total new disturbance disclosed under NEPA would occur on federal surface estate. This would be approximately 1,025 acres for Alternative A. The BLM and USFS would evaluate and administer ROWs from previous NEPA projects on public lands that meet public, industry, and environmental needs. Construction of linear facilities would be within the existing corridor networks or would require the creation of new ROWs.

Under Alternative A, new lands and realty authorizations from previously disclosed NEPA projects (e.g., for pipelines, local and resource access roads, and associated utilities) would be considered on a case-by-case basis but would be denied in exclusion areas (Section 3.6.2). The placement or routing of systems or facilities also could be restricted in avoidance areas, which could limit access or delay the development of projects. If these areas could not be avoided, lands and realty authorizations may be allowed as long as impacts could be mitigated through additional design and siting requirements. Additionally, land under NSO or CSU stipulations may result in project components being sited along alternative routes or sites. This could increase the number of land use authorizations in other areas. Lands managed under NSO or CSU are depicted in **Figure 3.6-1**. Ultimately, the presence of ROW exclusion and avoidance areas or land under NSO and CSU stipulations could necessitate development in alternate locations and possibly alter the cost of lands and realty actions related to previous and future projects.

4.6.2 Impacts to Lands and Realty from Alternative B – Proposed Action

4.6.2.1 Impacts to Lands and Realty

Under Alternative B, approximately 5,000 new oil and gas wells would be drilled on 1,500 multi-well pads over a period of 10 years. Additional disturbance would result from the construction of other service well pads, access roads, pipelines, electric power lines, and ancillary facilities (**Table 2.4-1**). The proposed development would be constructed on approximately 52,667 acres. Of the total surface disturbance, approximately 21,400 acres would be attributed to well pads, and the remainder to infrastructure such as compressor stations, roads, and other facilities (**Table 2.4-1**).

Lands and realty authorizations (e.g., ROWs, leases, and permits) related to Alternative B development would be considered on a case-by-case basis but denied in ROW exclusion areas. Approximately 5,555 acres within the CCPA have been designated as ROW exclusion areas. The BLM and USFS also would strive to limit ROW authorizations within the 80,181 acres of ROW avoidance areas that occur within the CCPA. Additionally, 33,074 acres within the CCPA are under NSO stipulations, and 464,398 acres are under CSU stipulations. Timing limitation stipulations also would limit permitted surface-disturbing lands and realty activities and could affect the feasibility to construct and maintain ROWs to protect sensitive areas. Lands and realty authorizations related to Alternative B would be re-routed to avoid these areas and would have design stipulations imposed on them if development in these areas could not be avoided. The areas currently identified as avoidance and exclusion areas or land under NSO, CSU, or timing limit stipulations, combined with increased well pads requiring lands and realty authorizations could result in elevated costs of lands and realty actions associated with oil and gas development. It also would likely concentrate oil and gas activities and associated infrastructure, as well as other types of lands and realty authorizations not related to oil and gas development, into certain areas.

The increase in well pads without expansion of energy corridors could result in BLM and USFS lands and realty authorizations being sited outside of designated corridor networks; however, new pipeline corridors could be established when capacities of existing pipeline corridors have been exhausted, or when it would further facilitate BLM and USFS land management objectives. Not all infrastructure development would require a ROW across publicly owned surface. Other non-oil and gas related authorizations may be impacted by being forced to route around ROWs and development related to Alternative B, which could result in higher costs to those industries. Companies would be encouraged to request small ROW widths for pipeline installation, as well as to place pipelines adjacent to newly constructed energy-associated roads.

Approximately 64,785 acres within the CCPA have been identified for disposal and 604 acres within the CCPA have been withdrawn from various types of activities such as locatable and leasable minerals. Land tenure adjustments, as identified in the BLM RMP and USFS LRMP, would continue on lands identified for disposal but would not be allowed on lands that have been withdrawn for locatable and leasable minerals. Lands and realty authorizations on formerly used defense sites would be allowed with notification of the risk and a requirement to submit a safety plan prior to use.

Approximately 10 percent of the surface within the CCPA is administered by the BLM and USFS; therefore, it was assumed that approximately 10 percent of the total new disturbance acreage from Alternative B (5,267 acres) and subsequent lands and realty authorizations requests would occur on federal surface estate. Additionally, existing ROWs would be protected from new Project-related ROW authorization requests under valid existing rights. The BLM and USFS would continue to process land tenure adjustments and grant lands and realty authorizations on a case-by-case basis, although the acreage available would be less under Alternative B than under Alternative A as a result of increased surface disturbing activities.

4.6.2.2 Mitigation and Mitigation Effectiveness

No mitigation measures, including compensatory mitigation, have been identified for Alternative B.

4.6.2.3 Residual Impacts

Residual impacts are defined as unavoidable adverse impacts to a resource that remain assuming implementation of proposed mitigation. Acreage used by Project components would limit the BLM and USFS ability to provide opportunities for lands and realty authorizations and ROWs throughout the BLM- and USFS-administered land within the CCPA. These restrictions could require the closing of roads and trails, which could adversely affect holders of lands and realty authorizations or ROWs if they could not access existing or proposed facilities for maintenance or construction. Furthermore, implementation of Alternative B likely would increase the potential for conflict with other lands and realty actions, possibly resulting in increased costs for lands and realty authorizations related to oil and gas development.

4.6.3 Impacts to Lands and Realty from Alternative C

4.6.3.1 Impacts to Lands and Realty

Under Alternative C, 5,000 new oil and gas wells would be drilled; however, the number of new well pads would be reduced compared to Alternative B by approximately 37 percent from 1,500 to 938. This would result in a corresponding reduction in disturbance from 52,667 acres to 37,267 acres.

Similar to Alternative B, lands and realty authorizations (e.g., ROWs, leases, and permits) related to development under Alternative C would be considered on a case-by-case basis, but development would be denied in ROW exclusion areas and limited in ROW avoidance areas or areas under NSO, CSU, or timing limit stipulations restrictions within the CCPA. Costs of lands and realty actions associated with oil and gas development under Alternative C would be less than under Alternative B as a reduced Project footprint would result in less potential conflict with areas identified as avoidance and exclusion areas. Alternative C also would lead to less concentrated areas of oil and gas activities and associated infrastructure, as well as other types of lands and realty authorizations not related to oil and gas development.

Similar to Alternative B, the increase in well pad development under Alternative C without expansion of energy corridors could result in BLM and USFS lands and realty authorizations being sited outside of designated corridor networks. However, the increase in well pad development and subsequent siting of land and realty authorizations outside of designated corridor networks would be less than under Alternative B, as the footprint under Alternative C would be reduced.

Potential impacts to lands identified for lands and realty authorizations under Alternative C would be similar to those under Alternative B but smaller in magnitude because the construction footprint under Alternative C would be 29 percent less than Alternative B. Similar to Alternative B, approximately 64,785 acres within the CCPA have been identified for disposal and 604 acres within the CCPA have been withdrawn from various types of activities such as locatable and leasable minerals. The reduced footprint under Alternative C would lessen the opportunity for conflict between Project facilities and lands identified for disposal or that have been withdrawn. Land tenure adjustments, as identified in the BLM RMP (BLM 2007b) and USFS LRMP (USFS 2001) would continue on lands identified for disposal but would not be allowed on lands that have been withdrawn for locatable and leasable minerals. Lands and realty authorizations on formerly used defense sites would be allowed with notification of the risk and a requirement to submit a safety plan prior to use.

As detailed under Alternative B (Section 4.6.2.1), approximately 10 percent of the surface within the CCPA is administered by the BLM and USFS; therefore, it was assumed that approximately 10 percent of the total disturbance acreage from Alternative C (3,727 acres) and subsequent lands and realty authorization requests would occur on federal surface estate. This would result in a 29 percent reduction in new disturbance acreage when compared to Alternative B. Additionally, existing ROWs would be protected from new Project-related ROW authorization requests under valid existing rights. The BLM and USFS would continue to process land tenure adjustments and grant lands and realty authorizations on a case-by-case basis, although the acreage available for these authorizations would be greater under Alternative C than under Alternative B as a result of a reduced disturbance footprint.

4.6.3.2 Mitigation and Mitigation Effectiveness

No mitigation measures, including compensatory mitigation, have been identified for Alternative C.

4.6.3.3 Residual Impacts

Residual impacts are defined as unavoidable adverse impacts to a resource that remain assuming implementation of proposed mitigation. Residual impacts under Alternative C would be similar to but less than those detailed in Alternative B. A reduced Project footprint would increase the amount of acreage available to the BLM and USFS for lands and realty authorizations and ROWs. It also would minimize the closing of roads and trails, which could adversely affect holders of lands and realty authorizations or ROWs. Furthermore, implementation of Alternative C likely would increase the potential for conflict with other lands and realty actions, possibly resulting in increased costs for lands and realty authorizations related to oil and gas development.

4.6.4 Relationship between Local Short-term Uses of the Human Environment and Maintenance and Enhancement of Long-term Productivity

The relationship between local short-term uses of the human environment and maintenance and enhancement of long-term productivity is the disclosure of whether the short-term use of a resource associated with a Project affects the long-term sustainability of that resource. This topic does not apply to lands and realty. New ROWs or other land use authorizations potentially would remove lands from other uses and authorizations; however, over the long term as authorizations are terminated, lands would return to other uses and be available for new authorizations.

4.6.5 Irreversible/Irretrievable Commitment of Resources

Irreversible/irretrievable impacts are subsets of unavoidable adverse/residual impacts. Irreversible impacts are those that cannot ever be restored and would be lost forever. Irretrievable impacts are those for which the resource value would be irretrievably lost until restoration of that resource takes place. Project activities would result in ROW development and other lands and realty authorizations. For the life of those developments and authorizations, the lands would be irretrievably unavailable for other lands and realty authorizations. However, land would be available again for lands and realty authorizations after decommissioning when facilities would be removed. Therefore, there would be no irreversible commitments of lands and realty resources.

4.7 Noise

The analysis area for direct and indirect impacts from noise includes the CCPA with a 1-mile buffer.

Noise-related impacts from construction and operations could affect residences within and near the CCPA, dispersed recreation, recreation along historic trails, and wildlife, such as greater sage-grouse PHMAs. Potential noise impacts are be analyzed primarily on the basis of dBA, estimated to be produced during different activities and development stages of the Project. Estimates of Project-related vehicle traffic during the different activities and development stages of the Project also would be analyzed based on dBA sound levels.

The methodology for analysis of impacts to noise included the following:

- Direct, indirect, and cumulative impacts were analyzed primarily on the basis of dBA sound levels produced during different activities and development stages of the Project.
- Potential impacts would be analyzed for noise disturbance associated with construction and production activity in greater sage-grouse PHMAs, GHMAs (within the TBNG), recreational areas, and near residences.

Noise is managed according to the goals and objectives from the TBNG LRMP as amended (USFS 2001). The BLM ROD and Approved Casper RMP (BLM 2007b) does not detail goals and objectives for noise, although noise concerns are linked with specific resource discussions.

Assumptions used in the analysis of impacts to noise included:

- Traffic-related noise can be extrapolated in proportion to anticipated changes in traffic volume. See Section 4.13, Transportation, for estimates of existing and Project-related vehicle traffic.
- For a general assessment of construction impacts, it was assumed that only two of the noisiest pieces of equipment would operate simultaneously.

4.7.1 Impacts from Noise from Alternative A – No Action

Under Alternative A, drilling and completion of wells and infrastructure would continue as disclosed under NEPA (Section 2.3.2). In addition to noise associated with new and existing oil and gas field development, ambient noise would consist of wind, highway noise, as well as agricultural machinery noise.

As shown on **Table 4.7-1**, noise levels for typical construction equipment used for well development would be in the range of 80 to 90 dBA at a distance of 50 feet. Average noise levels for typical construction equipment range from 81 dBA for a generator, to 85 dBA for a bulldozer, to 88 dBA for a crane (Harris, Miller, Miller, and Hanson, Inc. 2006). In general, the dominant noise source from most construction equipment would be the diesel engine, which continuously operates around a fixed location or with limited movement. This would be particularly true if the diesel engine were poorly muffled. Other sources of continuous noise would include field compressors, bulldozers, and backhoes. Assuming geometric spreading only (i.e., a decrease of approximately 6 dBA per doubling of distance from a point source) and an 8-hour work day with the two noisiest pieces of equipment operating simultaneously at peak load, noise levels would exceed the USEPA guideline for residential noise (55 dBA) for a distance of approximately 1,600 feet (USEPA 1974). The actual anticipated workday would be longer than 8-hours. The 1,600-foot distance would decrease considering reasonable factors for noise attenuation (e.g., air absorption and ground effects due to terrain and vegetation). Residences within 1,600 feet of peak construction could experience temporary noise levels exceeding the USEPA guidelines. The construction activity impacting these residences would consist of improving access roads as well as well pad and ancillary facility development. Noise from construction activities potentially could affect greater sage-grouse as well. See Section 4.18, Wildlife, for a more detailed discussion on noise impacts to greater sage-grouse and other wildlife

Table 4.7-1 Noise Levels at Various Distances from Typical Construction Equipment

Construction Equipment	Noise Level[1] at Distances (dBA)					
	50 feet	100 feet	200 feet	400 feet	800 feet	1,600 feet
Bulldozer	85	79	73	67	61	55
Concrete Mixer	85	79	73	67	61	55
Concrete Pump	82	76	70	64	58	52
Crane, Derrick	88	82	76	70	64	58
Crane, Mobile	83	77	71	65	59	53
Front-end Loader	85	79	73	67	61	55
Generator	81	75	69	63	57	51
Grader	85	79	73	67	61	55
Shovel	82	76	70	64	58	52
Truck	88	82	76	70	64	58

[1] The equivalent steady-state sound level that contains the same varying sound level during a 1-hour period.

Source: Harris, Miller, Miller, and Hanson, Inc. 2006.

On-road vehicular construction traffic would include hauling of materials in and out of the construction site, movement of heavy equipment, and some commuter traffic. The associated noise levels would increase and decrease rapidly. The number of truck trips associated with well development would vary depending on the construction stage. Potential noise impacts would be greatest at the highest number of peak-hour trips and total heavy-duty truck trips. Local area construction traffic would consist mostly of light-duty vehicles with lower level noise sources (see Section 4.13.2 for definitions of light-duty and heavy-duty tasks). Other vehicular construction traffic, such as transport of heavy equipment, delivery of general construction materials, and water trucks for fugitive dust control, would be anticipated; however, the noise contribution from these sources likely would be short-lived, ending when construction activities terminate.

Impacts during the production phase would include noise from the more intensive aspects of operations, such as from gas flaring and maintenance vehicles. Noise levels from a representative high pressure flare at 1,600 feet, peak at approximately 80 dBA. Noise levels immediately adjacent to flaring peak at 110 dBA (Baukal 2001). Flaring does not occur at a high frequency. It is typically allowed for short-term emergency situation to relieve system pressure or during the drilling and completion phases of a well where gas should be released to reduce safety risks. Additional noise sources during production would include compressors, pump jacks (especially if run by propane or gas, if not muffled), and ancillary facilities such as gas plants and compressor stations.

In general, noise impacts from decommissioning activities would be similar to, but less than, those associated with construction activities because the activity type and level would be shorter in duration. As with the construction phase, most of the decommissioning activities would occur during the day when noise would be tolerated better than it would be at night because of the masking effect of background noise. Nighttime noise levels would drop to the background levels of a rural environment because decommissioning activities would cease at night. Like construction activities, decommissioning activities would be temporary and last for a short period compared with the oil and gas production phase; therefore, the potential impacts also would be temporary and intermittent in nature.

4.7.2 Impacts from Noise from Alternative B – Proposed Action

4.7.2.1 Impacts from Noise

Under Alternative B, approximately 5,000 new oil and gas wells would be drilled on 1,500 multi-well pads over a period of 10 years (500 new wells per year). Additional surface disturbance would result from the construction of other service well pads, access roads, pipelines, electric power lines, and ancillary facilities (**Table 2.4-1**). Under Alternative B, the proposed well pads, pipelines, access roads, and ancillary facilities would be constructed on approximately 52,667 acres throughout the CCPA. Of this total disturbance, approximately 21,400 acres would be from well pads, approximately 13,121 acres from access roads, and the remainder from a combination of production and linear facilities. Noise impacts to sensitive receptors most likely would occur during construction and specific aspects of the production phase. Impacts during construction would include temporary noise from heavy construction machinery and construction activities, as well as light and heavy vehicle construction traffic.

The relatively high level of ambient noise emanating from within and near the southern portion of the CCPA would be from wind, existing local traffic, the town of Douglas, I-25, and the BNSF and UP railways. This ambient noise would result in a low impact to noise sensitive receptors such as local residences. Impacts from construction impacts may be more pronounced in the northern portion of the CCPA where ambient noise would be more rural in nature; however, the noise contribution from these construction sources likely would be short-lived, ending when construction activities terminate. Major activities and associated timeframes with construction of multiple wells include rig mobilization and de-mobilization (5 days), drilling (42 days), and completion (8 days). See Section 4.13, Transportation, for further analysis and details regarding traffic impacts.

Impacts during the production phase of Alternative B would include noise from the more intensive aspects of operations, such as from gas flaring and maintenance vehicles. Additional noise sources during production would include compressors, pump jacks (especially if run by propane or gas, if not modified), and ancillary facilities such as gas plants and compressor stations. To determine potential noise impacts from production at nearby sensitive receptors, sound levels would need to be estimated. **Table 4.7-1** details sound levels associated with construction equipment. However, using these levels to serve as a baseline for the more sound intensive operational activities, such as flaring, when considering geometric spreading only, would result in a sound level of 55 dBA at a distance of 1,600 feet, which is approximately the same level as conversational speech at a 15-foot distance. Sensitive receptors within 1,600 feet may encounter noise levels in excess of 55 dBA. As shown on **Figure 3.7-1**, noise impacts would be considered intrusive and could result in substantial impacts to sensitive receptors starting at 70 dBA.

Noise from traffic during production would be from light- to medium-duty vehicles, and would be negligible. See Section 4.13, Transportation, for further analysis and details regarding traffic impacts. Overall, the noise levels of continuous site operations during production would be lower than the noise levels associated with construction activities and would result in a minor impact to noise sensitive receptors in the CCPA when considered in conjunction with existing ambient noise.

Both hunters and visitors to historic trails may experience a diminished recreational and/or tourist experience due to Project-related noise during construction and production, although the limited amount of federal and state surface estate relative to private surface estate could limit access to the CCPA and subsequent impacts from noise. The effects of noise from oil and gas development and production on big game species and hunting are largely unknown. Studies have shown that big game species tend to avoid human disturbance. However, some species may readjust and reoccupy a disturbed area during the production phase when construction noise and human presence are both diminished. Hunting opportunities could be reduced due to the displacement of some species, but this likely would be caused less by noise generated from production than the overall loss of habitat. Noise from production potentially would affect greater sage-grouse as well. See Section 4.18, Wildlife, for a more detailed discussion on noise impacts to greater sage-grouse and other wildlife.

Noise impacts from decommissioning activities under Alternative B would be the same as those discussed under Alternative A.

Due to the programmatic approach of this analysis, it is not possible to quantitatively determine noise impacts at specific sensitive receptors. On USFS-administered lands, noise levels from oil and gas production facilities within 0.25 mile of developed recreation sites would be limited to no more than 70 dBA at the edge of the developed site. This standard would apply only to constant, routine, day-to-day production noises; it would not apply to noise from drilling and testing of production nor temporary noises such as work-over rigs and maintenance or repair tasks. Furthermore, per USFS Standard greater sage-grouse-TDDD-ST-014, new surface disturbing and disruptive activities that create noise at 10 dBA above ambient measured at the perimeter of an occupied lek during leking (i.e., from March 1 to May 15) from 6 p.m. to 8 a.m. would not be authorized. Ambient noise resulting from human activities that have been authorized and initiated within the past 10 years would not be included in the ambient baseline because noise from recent development would not be considered typical for rural rangeland Wyoming. The BLM Approved Resource Management Plan Amendment establishes the following required design features that mitigate noise impacts in the vicinity of sage-grouse leks and PHMAs (BLM 2015b):

- Limit noise to less than 10 decibels above ambient measures at sunrise at the perimeter of a lek during active lek season;
- Require noise shields when drilling during the lek, nesting, brood-rearing, or wintering season; and
- Locate new compressor stations outside priority habitats and design them to reduce noise that may be directed toward priority habitat.

Although these required design features are intended to mitigate noise-related disturbance to sage-grouse, all sensitive receptors in these spatial and temporal domains would incur reduced impacts as a result of these design features.

4.7.2.2 Mitigation and Mitigation Effectiveness

No mitigation measures, including compensatory mitigation, have been identified for Alternative B.

4.7.2.3 Residual Impacts

Residual impacts are defined as unavoidable adverse impacts to a resource that remain assuming implementation of proposed mitigation. Residual impacts from noise resulting from Alternative B would include:

- Potential substantial increases in noise levels in excess of USEPA guidelines for residences and sensitive receptors near development and operation activities; and
- Potential noise impacts to tourists at historical trails and to recreationists such as hunters and dispersed campers.

These residual impacts would be temporary, ending once construction activities were completed in a given area, although localized noise impacts may persist during production depending on the activity.

4.7.3 Impacts from Noise from Alternative C

4.7.3.1 Impacts from Noise

Under Alternative C, approximately 5,000 new oil and gas wells would be drilled from 938 new multi-well pads over a 10-year period. This would be approximately 37 percent fewer well pads than under Alternative B. Additional surface disturbance would result from the construction of other service well pads, access roads, pipelines, electric power lines, and ancillary facilities (**Table 2.5-1**). Under Alternative C, the proposed wells, pipelines, access roads, and ancillary facilities would be constructed on approximately 37,267 acres throughout the CCPA. Of this total disturbance, approximately 13,544 acres would be from well pads, approximately 8,388 acres from access roads, and the remainder from a combination of production and linear facilities. This would result in a 29 percent reduction of construction disturbance compared to Alternative B.

Noise impacts from Alternative C activities would be similar in type but less in intensity then under Alternative B. Noise impact to sensitive receptors would be most likely to occur during construction and specific aspects of the production phase. Impacts under the construction phase of Alternative C would include temporary noise from heavy construction machinery and construction activities, as well as light vehicle construction traffic. These impacts would be less than under Alternative B as a result of the reduced construction footprint (i.e., less area of disturbance) and the potential for less noise near historic trails associated with construction traffic because historic trails would be considered avoidance areas.

Under Alternative C, a condition of approval added to all development on federal minerals would require a setback of 0.25 mile (1,320 feet) near occupied dwellings of structures. This would apply to approximately 65 percent of the CCPA. Residences within 1,600 feet of peak construction could experience temporary construction impacts including noise levels exceeding the USEPA guidelines. The construction activity impacting these residences would consist of improving access roads as well as well pad and ancillary facility development. Similar to Alternative B, noise from construction activities potentially could affect greater sage-grouse as well. See Section 4.18, Wildlife, for a more detailed discussion on noise impacts to greater sage-grouse and other wildlife under Alternative C.

Impacts from vehicular construction traffic from Alternative C would be similar in type but less in duration than under Alternative B because the construction footprint and subsequent road development would be 29 percent less under Alternative C. In addition, there would be no ***relief from timing limit stipulations,*** and noise impacts to raptors and sage-grouse associated with construction traffic would be reduced seasonally on approximately 20 percent of the CCPA. Less construction traffic associated noise near historic trails would be experienced as historic trails would be considered avoidance areas (see Section 4.2.3.2). The relatively high level of ambient noise emanating from within and near the southern portion of the CCPA would be from wind, existing local traffic, the Town of Douglas, I-25, and railways. This ambient noise would result in a low impact to noise sensitive receptors, such as local residences. Vehicular noise impacts from construction may be more pronounced in the northern portion of the CCPA under any alternative, where ambient noise would be more rural in nature. See Section 4.13, Transportation, for further analysis and details regarding traffic impacts.

Impacts during the production phase of Alternative C would be similar in type but less in duration than under Alternative B because the construction footprint (including road development) would be 29 percent less under Alternative C (i.e., less area of disturbance). Alternative C would result in the potential for less production traffic and associated noise near historic trails (considered avoidance areas), and there would be fewer heavy vehicle trips as more oil would be transported by pipeline. Similar to Alternative B, Alternative C would include noise from the more intensive aspects of the production phase, such as gas flaring and maintenance vehicles. **Table 4.7-1** details sound levels associated with construction equipment. Sensitive receptors within 1,600 feet may encounter noise levels in excess of 55 dBA, which would be considered intrusive impacts to sensitive receptors starting at 70 dBA (**Figure 3.7-1**).

Noise from light- to medium-duty vehicle traffic during production under Alternative C would be negligible. See Section 4.13, Transportation, for further analysis and details regarding traffic impacts. Noise during production from vehicle activities under Alternative C would be less than under Alternative B as a result of a less extensive network of new roads as well as a reduction in truck traffic because 40 percent of the oil transportation would utilize pipelines instead of truck transportation. Overall, the noise levels of continuous site operations during production would be lower than the noise levels associated with construction activities and would result in a minor impact to noise sensitive receptors in the CCPA when considered in conjunction with existing ambient noise. An exception would occur during specific noise intensive aspects of operations such as flaring, which could result in substantial noise impacts to nearby sensitive receptors.

Under Alternative C, impacts to both hunters and visitors to historic trails would be similar in type to Alternative B but there would be 29 percent less construction acreage disturbance and associated noise, and Project facilities would be placed away from historic trails because historic trails would be considered avoidance areas. Additionally, the limited amount of public surface ownership relative to private ownership would result in limited public access to the CCPA and subsequent impacts to public land users from noise.

Noise impacts from decommissioning activities under Alternative C would be the same as those described under Alternative A. As noted in Section 4.7.2.1 for Alternative B, due to the programmatic approach of this analysis, it is not possible to quantitatively determine noise impacts at specific sensitive receptors. On USFS-administered lands, operators would follow noise level guidance and timing stipulations for greater sage-grouse as outlined in Section 4.7.2.1.

4.7.3.2 Mitigation and Mitigation Effectiveness

No mitigation measures, including compensatory mitigation, have been identified for Alternative C.

4.7.3.3 Residual Impacts

Residual impacts are defined as unavoidable adverse impacts to a resource that remain assuming implementation of proposed mitigation. Residual impacts from noise resulting from Alternative C would include:

- Potential increases in noise levels in excess of USEPA guidelines to residences and sensitive receptors near construction and production activities. These levels would be less under Alternative C than under Alternative B because the construction footprint would be 29 percent less (resulting in a smaller area of influence), there would be less heavy vehicle traffic as more oil would be transported by pipeline, and implementation of a 0.25-mile setback near occupied residences would increase the distance between the source and receptor.
- Potential noise impacts to tourists at historical trails and to recreationists such as hunters and dispersed campers would be less under Alternative B because the construction footprint would be 29 percent less than under Alternative B, historic trails would be considered avoidance areas and heavy truck traffic would be reduced as 40 percent of the oil would be transported by pipeline instead of truck.

These residual impacts would be temporary, ending once construction activities were completed in a given area, although localized noise impacts may persist during production depending on the activity.

4.7.4 Relationship between Local Short-term Uses of the Human Environment and Maintenance and Enhancement of Long-term Productivity

The relationship between local short-term uses of the human environment and maintenance and enhancement of long-term productivity is the disclosure regarding whether the short-term use of a resources associated with a project affects the long-term sustainability of that resource. This would not be applicable to this resource.

4.7.5 Irreversible/Irretrievable Commitment of Resources

Irreversible/irretrievable impacts are subsets of unavoidable adverse/residual impacts. Irreversible impacts are those that cannot ever be restored and would be lost forever. Irretrievable impacts are those for which the resource value would be irretrievably lost until restoration of that resource takes place.

Impacts to residences and sensitive receptors (e.g., tourists, hunters, and dispersed campers) from construction and operation noise would be irretrievable; however, these impacts would be reversible after decommissioning.

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4.8 Paleontological Resources

The analysis area for direct and indirect impacts to paleontological resources is the CCPA because impacts on paleontological resources from the project would be limited to direct surface disturbance and drilling activities.

Paleontological resources would be at risk for direct and indirect adverse impacts (destruction or damage) from surface disturbing activities associated with construction of roads, pads, and other infrastructure. Direct impacts during construction could include the erosion of exposed fossil beds due to slope grading and vegetation clearing, and the unauthorized collection of scientifically important fossils by construction workers. A potential indirect impact would be the unauthorized collection of paleontological resources that could increase due to increased public access to fossil localities due to project development activities.

The analysis method for paleontological resources consisted of the following steps:

- Describe paleontological resources and high-potential formations that have been identified in the CCPA. Individual paleontological localities cannot be made public, but fossil assemblages can be described.
- Map high-potential formations using PFYC data from the BLM or using existing geologic maps.
- Estimate the potential surface disturbance within the CCPA.

Management direction for the protection of paleontological resources is contained in the BLM ROD for the CFO RMP (BLM 2007b) and the USFS TBNG LRMP (USFS 2001). ***Paleontological resources can be protected by application of the following protection measure as stated in the BLM Casper RMP: "Require an on-the-ground survey prior to approval of surface-disturbing activities or land-disposal actions for Class 4 and 5 formations. Monitor during surface-disturbing activities only as appropriate. Apply, as deemed necessary, for Class 3 formations" (BLM 2007b, Table 1-1, Decision 5018, Goal/Objective HR 2.1).***

Analysis of impacts to paleontological resources was based on the following assumptions:

- Given the programmatic nature of the EIS, it is not possible to predict with certainty where development and ground disturbing activities would occur. Therefore, adverse impacts may occur to fossils in any moderate to high potential formation impacted by disturbance.
- Ground disturbing activities pose a risk to fossil resources.

4.8.1 Impacts to Paleontological Resources from Alternative A – No Action

4.8.1.1 Impacts to Paleontological Resources

Under Alternative A, new development would include drilling of 1,663 oil and gas wells on 361 pads and include the construction of other service well pads, roads, production facilities, and pipelines. This development was disclosed under previous EAs as listed in Section 2.3.2. The new development would result in disturbance of 10,253 acres (**Table 2.3-3**), which potentially would cause the damage or loss of scientifically important fossil resources; although, some of the disturbance could occur in areas that have been previously disturbed. There may be a lesser risk of impacts in areas with thick alluvium or grassland groundcover, high-risk areas likely would occur on rock outcrops or bedrock with thin surficial cover.

As shown on **Table 3.8-1** and **Figure 3.8-1**, approximately 6 percent of the CCPA is underlain by bedrock ranked under the PFYC system as a PFYC rank 5, or high potential; however, most of the

CCPA (approximately 90 percent) is underlain by bedrock with medium potential (i.e., PFYC rank 3). The remaining 4 percent is underlain by PFYC rank 2.

4.8.2 Impacts to Paleontological Resources from Alternative B – Proposed Action

4.8.2.1 Impacts on Paleontological Resources

Under Alternative B, 5,000 oil and gas wells would be drilled on 1,500 pads (**Table 2.4-1**). Activities also would include the construction of other service well pads, access roads, production facilities, pipelines, electric power lines, and other related facilities. Alternative B would result in disturbance of 52,667 acres (**Table 2.4-1**), which potentially would cause damage or loss of scientifically important fossil resources. The disturbance area would be much larger than the estimated disturbance area under Alternative A; therefore, there would be a greater risk that paleontological resources would be damaged or lost under Alternative B.

4.8.2.2 Mitigation and Mitigation Effectiveness

The risk to paleontological resources under Alternative B cannot be predicted because of the programmatic nature of the project. ***Given this uncertainty, paleontological resources can be protected by application of a protection measure from the Casper RMP (BLM 2007b). In addition to the guidance provided by the RMP, the following mitigation measures would add additional protection for paleontological resources that may be discovered:***

PALEO-1: Require an on-the-ground survey prior to approval of surface-disturbing activities or land-disposal actions for Class 4 and 5 formations (Probable Fossil Yield Classification). Monitor during surface-disturbing activities only as appropriate. Apply, as deemed necessary, for Class 3 formations.

PALEO-2: The operator will suspend all activities in the vicinity of such discovery until notified to proceed by the BLM AO and will protect the discovery from damage or looting. However, the operator may not be required to suspend all operations if activities can be adjusted to be continued elsewhere or otherwise avoid further impacts to a discovered locality.

PALEO-3: The BLM AO will evaluate, or will have evaluated, such discoveries as soon as possible, but not later than 10 working days after being notified. Appropriate measures to mitigate effects to significant paleontological resources will be determined by the BLM AO after consulting with the operator.

PALEO-4: Within 10 days, the operator will be allowed to continue construction through the site or will be given the choice of either (1) following the BLM AO's instructions for stabilizing the fossil resource in place and avoiding further disturbance to the paleontological resources, or (2) following the BLM AO's instructions for mitigating impacts to the fossil resource prior to continuing construction. Stabilization will be conducted by a BLM-qualified and permitted paleontologist.

The conditions for the mitigation would provide a high degree of protection for paleontological resources by providing a mechanism for the preservation and potential curation of specimens. The protection measure would have no effect in areas outside of BLM jurisdiction. As shown on **Table 2.1-1**, 64 percent of the CCPA is federal mineral estate where oil and gas activities are managed by the BLM.

4.8.2.3 Residual Impacts

Residual impacts are defined as unavoidable adverse impacts to a resource that remain after implementation of mitigation has been applied. There would be a low probability that residual impacts would occur beyond the implementation of protection measures or other mitigation except if scientifically important fossils are present in an area not identified prior to surface disturbing activity as having a moderate to high paleontological resource potential. Due to the low level of residual impacts, no compensatory mitigation is warranted.

4.8.3 Impacts to Paleontological Resources from Alternative C

4.8.3.1 Impacts on Paleontological Resources

Under Alternative C, 5,000 oil and gas wells would be drilled on 938 pads (**Table 2.5-1**). Activities also would include the construction of other service well pads, access roads, production facilities, pipelines, electric power lines, and other related facilities. Alternative C would result in disturbance of 37,267 acres (**Table 2.5-1**), and the potential damage or loss of scientifically important fossil resources. The frequency of potential impacts to paleontological resources would be less under Alternative C than under Alternative B because development of fewer pads would reduce the acreage that would be affected (37,267 acres of new disturbance for Alternative C compared to 52,667 acres for Alternative B). Although the frequency of potential impacts would be less, impacts would be the same because ground disturbance could result in the loss and destruction of scientifically valuable or important fossils.

4.8.3.2 Mitigation and Mitigation Effectiveness

The mitigation measures and mitigation effectiveness would be same as recommended and discussed for Alternative B (Section 4.8.2.2).

4.8.3.3 Residual Impacts

Residual impacts are defined as unavoidable adverse impacts to a resource that remain after implementation of mitigation has been applied. There would be a low probability that residual impacts would occur beyond the implementation of protection measures or other mitigation except if scientifically important fossils are present in an area not identified prior to surface disturbing activity as having a moderate to high paleontological resource potential. Due to the low level of residual impacts, no compensatory mitigation is warranted.

4.8.4 Relationship between Local Short-term Uses of the Human Environment and Maintenance and Enhancement of Long-term Productivity

The relationship between local short-term uses of the human environment and maintenance and enhancement of long-term productivity is the disclosure regarding whether the short-term use of a resources associated with a project affects the long-term sustainability of that resource. Short-term impacts to paleontological resources would include the loss of fossils present within the proposed disturbance areas. However, moderate to high potential formations comprise a large portion of areas that may be disturbed; therefore, the short-term impacts could affect the long-term potential for recovery of similar fossil resources regionally.

4.8.5 Irreversible/Irretrievable Commitment of Resources

Irreversible/irretrievable impacts are subsets of unavoidable adverse/residual impacts. Irreversible impacts are those that cannot ever be restored; they would be lost forever. Irretrievable impacts are those for which the resource value would be irretrievably lost until restoration of that resource takes place. The loss or destruction of paleontological resources would constitute an irreversible impact because once lost or destroyed, the fossils cannot be replaced. Even if fossils are salvaged and scientifically documented, there would be an irretrievable impact because the fossils cannot be put back into the place where they originated.

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4.9 Range Resources

The analysis area for direct and indirect impacts to range resources consists of the grazing allotments completely or partially within the CCPA. Approximately 61 percent (***914,382*** acres) of the CCPA consists of grazing allotments. Of this ***914,382*** acres, 76 percent are on privately owned lands, 7 percent are on state-owned lands, and 17 percent are on federal surface estate (10 percent are BLM-administered and 7 percent are USFS-administered).

Potential direct and indirect impacts to range resources include those that eliminate or compromise forage vegetation, cause stress, injury, or death to livestock, or incur additional financial or operational burdens to livestock operators.

The methodology for analysis of impacts to rangelands included the following key steps:

- Loss of forage vegetation based on an estimation of the reduction ***in acreage and to federally*** permitted AUMs, which was based on the assumed acreage of disturbance and federal AUM data.
- Potential impacts to grazing allotments were estimated by multiplying the total allotment acreage by the proposed disturbance acreage ***for each alternative*** as a percentage of the CCPA acreage.
- Level of disturbance (overall increase in human presence, traffic, type of activity, and fugitive dust emissions) and potential effects to livestock and livestock operations were analyzed qualitatively.

Range resources are managed according to the management goals and objectives contained in the BLM ROD and Approved Casper RMP (BLM 2007b), the BLM Standards for Healthy Rangelands and Guidelines for Livestock Grazing Management for Public Lands Administered by the BLM in the State of Wyoming (BLM 1997), and the USFS TBNG (USFS 2001).

Federally permitted AUMs are those that take into account the federal surface acreage only and do not account for AUMs that may occur on private surface. The BLM and USFS do not have the authority to regulate grazing on private surface; therefore, analysis of impacts for this EIS in terms of AUMs was based on federally permitted AUMs only. Acres of impact to allotments as a whole were analyzed to reflect impacts on private surface as well as federal and state surface.

Assumptions used in the analysis of impacts to range resources include:

- ***Federally managed lands that undergo reclamation may be available for grazing.***
- ***In instances where deferment from grazing is deemed necessary, these sites could be fenced. Fencing and deferment of reclamation sites on federally managed lands would not be required in all instances and should only be done based on site conditions and objectives.***
- Current allotment carrying capacities are appropriate and reflect the desired level for present and future livestock grazing.
- Although variations in vegetation communities exist within allotments, uniform production was assumed to be 5 acres per ***federally permitted*** AUM for estimating reductions to forage vegetation on BLM ***allotment*** lands and ***4*** acres per ***federally permitted*** AUM for USFS ***units***.

4.9.1 Impacts on Range Resources from Alternative A – No Action

Under Alternative A, new development would continue to occur within the CCPA as disclosed under NEPA (Section 2.3.2). An estimated 10,253 acres of disturbance would result. **Table 4.9-1** provides the estimated surface disturbance and associated loss of ***federally permitted*** AUMs based on proposed disturbance as a percentage of the CCPA occupied by BLM and USFS grazing allotments. Surface disturbing activities would include the development of wells and well pads (including other service well pads), access roads, pipelines, electrical power lines, and production facilities (**Table 2.3-3**).

Table 4.9-1 Disturbance and Loss of Federally Permitted AUMs under Alternative A

Allotments	*Total Acres within CCPA[1]*	*Surface Disturbance (acres)[2]*	*Total Federally Permitted AUMs within CCPA[1]*	*Loss of Federally Permitted AUMs[2]*	*Percent of Total Federally Permitted AUMs Lost*
BLM Grazing Allotments	*787,327*	*5,373*	*16,333*	*111*	*0.6*
USFS Range Management Units	*127,055*	*867*	*14,582*	*100*	*0.4*

[1] Values can be found on Table 3.9-1.

[2] Calculations are based on the total allotment acreage or AUMs within the CCPA multiplied by the total proposed disturbance as a percentage of the CCPA (i.e., 10,253/1,502,381).

In addition to the loss of ***acreage and federally permitted*** AUMs, construction, maintenance, and decommissioning activities also could impact livestock grazing operations in the following ways:

- Generate fugitive dust emissions;
- Damage range improvements or preclusion of use;
- Increase the potential for livestock/vehicle collisions;
- Increase the potential for trespass (accidental or intentional);
- Cause stress to livestock (calves and lambs) due to increased human presence; and
- Cause invasion and spread of noxious weeds and invasive plant species.

Surface disturbing activities and vehicular travel on unpaved roads typically would produce fugitive dust emissions. Deposition areas for this dust vary greatly depending on particle size, wind speed, and wind direction. Fugitive dust emissions have been known to result in a type of pneumonia in livestock known as Bovine Respiratory Disease. This disease typically affects calves that are frequently exposed to dust emissions. The dust irritates the bronchial tubes and creates pneumonia-like symptoms. Livestock operators may need to alter their typical pasture rotation to avoid prolonged exposure of their livestock to dust emissions. Fugitive dust emissions also could have a negative impact on forage vegetation within the deposition area, especially vegetation with flat horizontal leaves, which could become covered with dust. This would compromise the photosynthetic capability, growth, and overall vigor of the affected vegetation, making it less nourishing and less palatable. Factors that would determine the degree and extent of effects from fugitive dust emissions include wind speed, precipitation events, and the application and effectiveness of dust suppression techniques. The USFS has adopted guidelines for which they partner with state and local agencies as well as energy developers to create dust control plans for unpaved roads within the TBNG (USFS 2001).

Construction and operation activities could result in damage to range improvements. This typically includes fences, gates, cattle guards, outbuildings, and artificial water supply facilities. Livestock also could abandon the use of improvements such as water tanks, wells/windmills, reservoirs, and vegetation improvement areas if project facilities are located in close proximity.

Livestock operators could incur a financial loss based on increased traffic volumes due to vehicle/livestock collisions, frightened livestock running through fences, or calf/lamb separation from their mothers resulting in lower weight gain.

The proliferation of roads within the CCPA could result in increased trespass; both accidental and intentional. Approximately 83 percent of the surface in the CCPA is privately owned; therefore, the large majority of the 386 miles of new roads likely would cross private lands managed for livestock grazing. Trespass has the potential to lead to road rutting, vandalism, and livestock theft.

Increased road networks and traffic volumes have a strong correlation to the spread of noxious weeds and invasive plant species. The disturbance and redistribution of seed propagules are difficult to control. Even if care is taken to identify and pretreat infested areas and establish vehicle wash stations, the construction of 386 miles of new roads likely would spread noxious weeds and invasive plant species to some extent, which would impact livestock operations. Some noxious weeds and invasive plant species are poisonous to livestock while others are less palatable and nourishing than the more desirable vegetation that they displace.

All of these impacts could result in a financial loss for livestock operators. However, development of new roads could create conveniences for livestock operators, so it is not uncommon for landowners to request that roads remain un-reclaimed on their lands.

4.9.2 Impacts on Range Resources from Alternative B – Proposed Action

4.9.2.1 Impacts on Range Resources

Under Alternative B, approximately 5,000 new oil and gas wells would be drilled on 1,500 well pads over a period of 10 years with the ability to request exceptions to timing stipulations. Additional surface disturbance would result from the construction of other service well pads, access roads, pipelines, electric power lines, and ancillary facilities (**Table 2.4-1**). An estimated 52,667 acres of disturbance would result from oil and gas development under Alternative B. **Table 4.9-2** provides the estimated surface disturbance and associated loss of ***federally*** permitted AUMs based on disturbance acreages under Alternative B.

Table 4.9-2 Disturbance and Loss of Federally Permitted AUMs under Alternative B

Allotments	*Total Acres within CCPA*[1]	*Surface Disturbance (acres)*[2]	*Total Federally Permitted AUMs within CCPA*[1]	*Loss of Federally Permitted AUMs*[2]	*Percent of Total Federally Permitted AUMs Lost*
BLM Grazing Allotments	*787,327*	*27,600*	*16,333*	*573*	*3.0*
USFS Range Management Units	*127,055*	*4,454*	*14,582*	*511*	*1.9*

[1] Values can be found on Table 3.9-1.

[2] Calculations are based on the total allotment acreage or AUMs within the CCPA multiplied by the total proposed disturbance as a percentage of the CCPA (i.e., 52,667/1,502,381).

The estimated ***impacts*** provided for this analysis ***may*** be re-evaluated as part of subsequent NEPA analysis conducted during the APD process ***once*** the ***actual site-specific disturbance has been determined***. Per 43 CFR 4110.2-4, after consultation, cooperation, and coordination with the affected grazing permittees or lessees and the agency managing lands or resources within the area, the authorized officer may designate and adjust grazing allotment boundaries. The authorized officer may combine or divide allotments, through an agreement or by decision, when necessary for the proper and efficient management of public rangelands.

As with Alternative A, impacts to livestock grazing operations in addition to the loss of ***acreage and federally permitted*** AUMs could include the following:

- Generate fugitive dust emissions;
- Damage range improvements or preclusion of use;
- Increase the potential for livestock/vehicle collisions;
- Increase the potential for trespass (accidental or intentional);
- Cause stress to livestock (calves and lambs) due to increased human presence; and
- Cause invasion and spread of noxious weeds and invasive plant species.

For the purpose of comparison, Alternative B would increase oil and gas development by approximately five times that of new ***development*** under Alternative A; therefore, impacts on range resources would be more extensive and intensive (i.e., would affect more types and larger numbers of range resources). There would be a greater volume of fugitive dust emissions, increased potential for damage to range improvements (or preclusion of use), livestock/vehicle collisions, trespass, livestock stress, and spread of noxious weeds and invasive plant species. The majority of impacts would occur during the first 10 years while construction activities are occurring and, to a lesser extent, during project operation and decommissioning.

In an effort to reduce impacts associated with fugitive dust emissions, the OG has committed to applying water or chemicals for dust abatement during dry periods. Additionally, speed limit signage, with a 25-mile per hour limit, would be posted along access roads and enforced during construction, operation, and maintenance activities. This measure also would reduce the potential for livestock/vehicle collisions, frightened livestock, and calf/lamb separation from their mothers. The OG also has committed to recognizing on and off-road travel restrictions and communicating those restrictions with their employees and contractors. See Chapter 6.0 for OG-committed design features.

Under Alternative B, the OG would reserve the ability to request ***relief from timing limit stipulations*** (this does not include greater sage-grouse leks in PHMAs, eagle nests, or any timing stipulations on USFS-managed lands). Although no timing stipulations are designed to protect livestock, livestock and livestock operators could receive seasonal relief from impacts due to existing timing stipulations, which would not occur under Alternative B. However, ***relief from timing limit stipulations*** would expedite well pad development and result in fewer rig relocations, which would reduce the potential for vehicle/livestock accidents, overall stress to livestock, and the spread of noxious weeds and invasive plant species. ***A***dherence ***to timing limit stipulations*** would carry the greatest benefit to livestock and livestock operators because most of the stipulations overlap in time with the spring season, which is when livestock birth. For cow/calf and sheep/lamb operations that overlap in space with stipulations areas, the lack of Project activity during this time could be advantageous for the birth and early development of calves and lambs.

Disturbance of livestock would occur to a greater degree during the construction phase of oil and gas development. This would be in the form of human presence but with much less surface disturbing activities. Interim reclamation would occur on well pads after drilling activities are complete in areas of the pad that are not needed for production. This typically would occur within 6 months of drilling completion and would only be required on the 10 percent of the CCPA that is federal surface estate. Pipeline ROWs would be re-seeded as soon as practical using the requested seed mix of the land owner, BLM, or USFS. Reclamation on federal surface estate would be conducted with the goal of establishing a self-sustaining perennial vegetation community with appropriate composition, cover, and diversity for the site consistent with pre-disturbance conditions. Livestock would be excluded from reclaimed sites while vegetation communities become established as required by the BLM or USFS or as defined in surface use agreements. Reclamation on private lands also would comply with surface use agreements.

4.9.2.2 Mitigation and Mitigation Effectiveness

The following mitigation measures would be implemented to reduce impacts to range ***resources***, livestock, and livestock operators on federal surface estate managed by either agency (BLM or USFS):

RANGE-1: All range improvements in the vicinity of construction activities will be documented prior to initiating construction activities. Any improvements moved or damaged will be returned to their original location or pre-damaged or better condition according to the BLM, USFS, or landowner standards.

RANGE-2: All incidents resulting in livestock injury or fatality will be reported to the livestock operator, and the affected livestock operator will be compensated at fair market value, as determined by the USDA using the U.S. Standards for grades of feeder cattle.

RANGE-3: The oil and gas operator will communicate and coordinate construction schedules with livestock operators to allow adequate time and opportunity for livestock operators to make adjustments to pasture rotation, particularly during calving/lambing seasons.

RANGE-4: Site-specific Reclamation Plans (including seed mix composition and timing of reclamation planting) that are created to minimize impacts on privately owned rangeland within the CCPA will be developed with full coordination and consultation with the landowner.

Mitigation measures RANGE-1 and RANGE-2 would ensure accountability for any damage to range improvements or livestock as a result of oil and gas development in the CCPA. Implementation of these mitigation measures would protect livestock operators from incurring financial loss. Mitigation measure RANGE-3 would require communication between the oil and gas operators and livestock operators for the purpose of scheduling activities in the least impactful manner. This measure also would protect livestock operators from incurring financial losses. ***Mitigation measure RANGE-4 would help to prevent irretrievable impacts to range productivity.***

4.9.2.3 Residual Impacts

Residual impacts are defined as unavoidable adverse impacts to a resource that remain after implementation of mitigation has been applied. Residual impacts to range resources, livestock, and livestock operators resulting from Alternative B would include the following:

- Regardless of speed limit signage, some potential for livestock stress- and dust-related illness would still exist during construction, maintenance, and decommissioning activities.
- Regardless of trespass signage, the proliferation of roads would increase the possibility for intentional and unintentional trespass for the life of the project and possibly beyond.

- Adherence to the guidance in BLM IM No. WY-2012-032 (BLM 2012i) would not completely eliminate the spread of noxious weeds and invasive plant species. This would remain as a potential impact throughout project construction, maintenance, decommissioning, and reclamation.

Due to the low level of residual impacts, no compensatory mitigation is warranted.

4.9.3 Impacts on Range Resources from Alternative C

4.9.3.1 Impacts on Range Resources

Under Alternative C, development would include drilling of 5,000 new oil and gas wells from 938 new well pads over a 10-year period. This would be approximately 37 percent fewer pads than under Alternative B. It is assumed that approximately 55 percent of the oil and gas pads would contain up to 4 wells, 35 percent would contain up to 8 wells, and 10 percent would contain up to 16 wells. Additional surface disturbance would result from the construction of other service well pads, access roads, pipelines, electric power lines, and ancillary facilities; however, the total disturbance for these project components would be 14,699 fewer acres than under Alternative B (**Table 2.5-1**). An estimated 37,267 acres of disturbance would result from development under Alternative C. **Table 4.9-3** provides the estimated surface disturbance and associated loss of ***federally*** permitted AUMs based on disturbance acreages under Alternative C.

Table 4.9-3 Disturbance and Loss of Federally Permitted AUMs under Alternative C

Allotments	***Total Acres within CCPA[1]***	***Surface Disturbance (acres)[2]***	***Total Federally Permitted AUMs within CCPA[1]***	***Loss of Federally Permitted AUMs[2]***	***Percent of Total Federally Permitted AUMs Lost***
BLM Grazing Allotments	***787,327***	***19,530***	***16,333***	***405***	***2.1***
USFS Range Management Units	***127,055***	***3,152***	***14,582***	***362***	***1.4***

[1] Values can be found on Table 3.9-1.

[2] Calculations are based on the total allotment acreage or AUMs within the CCPA multiplied by the total proposed disturbance as a percentage of the CCPA (i.e., 37,267/1,502,381).

As with Alternatives A and B, impacts to livestock grazing operations in addition to the loss of ***acreage and federally permitted*** AUMs could include the following:

- Generate fugitive dust emissions;
- Damage range improvements or preclusion of use;
- Increase the potential for livestock/vehicle collisions;
- Increase the potential for trespass (accidental or intentional);
- Cause stress to livestock (calves and lambs) due to increased human presence; and
- Cause invasion and spread of noxious weeds and invasive plant species.

Alternative C would increase oil and gas development by approximately three times that of Alternative A; therefore, impacts on range resources would be more extensive and intensive (i.e., would affect more types and larger numbers of range resources) than under Alternative A, but less extensive and intensive than under Alternative B.

Fugitive dust emissions could potentially impact the health of livestock and vegetation in the deposition area, but the intensity would be reduced compared to Alternative B due to 717 fewer miles of access and collector roads, primarily due to fewer well pads. This would result in lower fugitive dust emissions during construction and operational activities. Fewer miles of roads would result in a reduction to the potential for vehicle/livestock collisions, frightened livestock, trespass, and the spread of noxious weeds and invasive plant species. Additionally, compared to Alternative B, 519 fewer miles of pipelines and 562 fewer miles of electrical lines would be required. This also would result in a reduction to fugitive dust emissions during the 10-year construction phase of development.

Under Alternative C, development on approximately 20 percent of the CCPA would be estimated or precluded due to existing timing limit stipulations and by extension, impacts to allotments in proximity to these areas would be less than under Alternative B. The areas that would be protected by timing limit stipulations include known black-footed ferret locations, burrowing owl nests, eagle nests and roosts, ferruginous and Swainson's hawk nests, merlin nests, mountain plover nests, occupied sage-grouse leks, greater sage-grouse wintering habitat, sharp-tailed grouse nests, and swift fox dens. Even though development would be allowed in these areas, development would ***be subject to timing limit stipulations for these species***. Following the guidance presented in the Approved Resource Management Plan Amendment (BLM 2015b), the DDCT was run and reported disturbance densities of 23.6, 28.3, and 12.2 percent in the Douglas, North Glenrock, and Thunder Basin DDCT assessment areas, respectively. Due to the current disturbance density exceedance of the 5 percent disturbance cap established by the Approved Resource Management Plan Amendment, new surface disturbance would not be allowed in these three sage-grouse PHMAs.

Allotments or portions of allotments in the vicinity of the Child's Cutoff of the Oregon-California NHT and the Bozeman Trail may not experience surface disturbance due to CFO RMP Decisions 7072, 7074, and 7078, which state that unless trail surveys determine otherwise, trail segments are assumed to be contributing. No surface development would be permitted along either of these trails on the parcels identified in Appendix W of the Casper RMP as exclusion areas (**Figure 3.2-1**). Controlled surface use would be extended to the viewshed foreground out to a maximum of three miles or the visual horizon to ensure that surface-disturbing activities avoid trail remains and lands surrounding them.

4.9.3.2 Mitigation and Mitigation Effectiveness

Mitigation measures RANGE-1 through RANGE-4 also would apply to Alternative C, and the effectiveness would be the same as discussed under Alternative B; however, the measures would apply to federal mineral estate as well as federal surface estate.

4.9.3.3 Residual Impacts

Residual impacts are defined as unavoidable adverse impacts to a resource that remain after implementation of mitigation has been applied. Residual impacts to rangeland resources, livestock, and livestock operators resulting from Alternative C would be similar to those for Alternative B but with the following differences:

- Loss of ***federally*** permitted AUMs would be ***405*** and ***362*** for BLM- and USFS-managed allotments, respectively. ***Surface disturbance impacts would be 19,530 and 3,152 acres on BLM- and USFS-managed allotments, respectively.*** For Alternative C, the loss ***of federally permitted AUMs and surface disturbance*** would be approximately ***29*** percent ***less than under Alternative B.***
- Fewer miles of roads, pipelines, and electrical lines combined with mitigation measures Range 3 and 4 would incrementally reduce fugitive dust emissions, the potential for livestock stress and

dust-related illness, trespass, and the spread of noxious weeds and invasive plant species; however, these impacts would not be eliminated.

Due to the low level of residual impacts, no compensatory mitigation is warranted.

4.9.4 Relationship between Local Short-term Uses of the Human Environment and Maintenance and Enhancement of Long-term Productivity

The relationship between local short-term uses of the human environment and maintenance and enhancement of long-term productivity is the disclosure regarding whether the short-term use of a resources associated with a project affects the long-term sustainability of that resource. The productivity of grazing allotments is determined through a combination of two factors; healthy forage vegetation and healthy livestock. Short-term and long-term use of grazing allotments within the CCPA would be impacted for six months (i.e., short-term) up to 55 to 60 years (including an estimated 15 to 20 years for complete reclamation). Successful reclamation, and the time it takes to be considered successful, varies according to vegetation communities and management objectives. Once reclamation is complete, allotment use would return to pre-disturbance conditions. Despite the loss of ***acreage and*** available ***federally permitted*** AUMs during the life of the project and reclamation, it is likely that livestock operators would be able to maintain sufficient healthy vegetation and healthy livestock.

4.9.5 Irreversible/Irretrievable Commitment of Resources

Irreversible/irretrievable impacts are subsets of unavoidable adverse/residual impacts. Irreversible impacts are those that cannot ever be restored; they would be lost forever. Once reclamation is complete the impacts of the project would return to pre-disturbance conditions, and livestock operations would no longer be affected by the proposed development.

Irretrievable impacts are those for which the resource value would be irretrievably lost until restoration of that resource takes place. Long-term loss of ***federally permitted*** AUMs as a result of the project would range from a minimum of ***211*** AUMs (Alternative A) to ***1,084*** AUMs (Alternative B). Under Alternative B, reclamation on private lands (83 percent of the CCPA) would occur according to the surface use agreement between the oil and gas operator and the landowner. Therefore, reclaimed forage vegetation potentially could provide increased available AUMs compared to pre-disturbance conditions depending on what vegetation community type is selected for reclamation. Under Alternative C, reclamation over federal minerals (64 percent of the CCPA) would return the vegetation community to the suitable wildlife habitat.

4.10 Recreation

The analysis area for direct and indirect impacts to recreation is the CCPA. Direct and indirect impacts could occur to recreational activities such as fishing, hunting, hiking or backpacking, camping and horseback riding, wildlife watching, scenic driving, OHV use, and visitation of historical sites.

Potential impacts to recreation generally would be expected from land disturbance during construction of well pads, flowlines, and ancillary facilities, as well as access road improvements. Impacts on recreation quality could result from delays reaching recreation destinations, additional traffic on roads within the analysis area, and a modified recreational setting from surface disturbance and aboveground Project components.

The methodology for analysis of impacts to recreation includes:

- Assess potential direct and indirect effects to recreation resources, the recreation setting, and the recreation experience caused by the construction and operation of the Project.
- Assess basic design criteria and standard mitigation measures provided by the BLM, if applicable, to determine if there are impacts in the form of loss of recreation opportunities, deterioration to the recreation experience, and impacts to developed recreation sites.
- Reference potential impacts or conflicts with other resource areas to the appropriate EIS section (e.g., wildlife, cultural, transportation, visual).

Recreation is managed according to management goals and objectives of the BLM ROD and Approved Casper RMP (BLM 2007b), the USFS LRMP for the TBNG (USFS 2001), the State of Wyoming Statutes Title 23 for Game and Fish, and the 2015 Converse County Land Use Plan (Converse County 2015a).

Assumptions used in the analysis of impacts to recreation include:

- Most recreation activities primarily are located on private lands (83 percent of CCPA) and, to a lesser extent, on BLM- and USFS-administered lands (combined 10 percent of CCPA).
- A smaller number of state, county, municipal, and privately operated recreational facilities, such as parks and reservoirs, also could be affected.
- Management plans, ROWs, lease information, hunter and angler data, and any other supporting documentation provided by the requisite governing bodies are the most current and available for public use and review.

4.10.1 Impacts on Recreation from Alternative A – No Action

Under Alternative A, new development would occur within the CCPA as disclosed under NEPA (Section 2.3.2). An estimated 10,253 acres of surface disturbance would result, approximately 10 percent of which (or 1,025 acres) would occur on federally administered lands. Recreation impacts from these planned developments would include modifications to the recreational setting from construction noise and increased traffic levels as well as visual impairment to the recreational setting from surface disturbance and construction of new facilities. With the exception of SRMAs associated with the NHTs, there are no designated recreation areas within the CCPA; however, impacts to dispersed recreation would occur. These dispersed recreation impacts would be highest during the construction phase but would continue throughout production, although at a reduced level.

4.10.2 Impacts on Recreation from Alternative B – Proposed Action

4.10.2.1 Impacts on Recreation

Under Alternative B, approximately 5,000 new oil and gas wells would be drilled on 1,500 multi-well pads over a period of 10 years (500 new wells per year). Additional surface disturbance would result from the construction of other service well pads, access roads, pipelines, electric power lines, and ancillary facilities (**Table 2.4-1**). An estimated 52,667 acres of disturbance would result from oil and gas development under Alternative B, approximately 10 percent of which (or 5,267 acres) would occur on federally managed lands.

New drill rigs, increased traffic, and other activities associated with oil and gas development would limit or alter the experience of recreational users by introducing an enhanced industrial presence on the landscape and potentially delaying access during development activities. However, in areas that already have existing oil and gas infrastructure and an associated transportation network within the CCPA the impact on recreation would be expected to be less than in areas not already experiencing oil and gas development.

The potential for impacts on federally administered lands would be limited to the 10 percent of the CCPA that is administered by the BLM or USFS. There are no developed campgrounds on BLM- or USFS-administered lands within the CCPA, but hiking***, wildlife watching,*** and dispersed camping activities could be impacted. Construction activities would generate increased noise and traffic primarily during the day, which temporarily would diminish the hiking and dispersed camping experience, and possibly cause delays in accessing recreation opportunities. The bulk of these delays and impairments of dispersed recreational opportunities would end upon the completion of construction; however, Project facilities would remain in place and some traffic would continue during the production phase. Dispersed camping could be impacted as there would be less available acreage for camping from permanent facilities and roads, although the extent of this impact could be minor compared to the overall Project due to the relatively small portion of federal surface estate within the CCPA.

Development under Alternative B would result in impacts to big game, small game, and upland bird hunting***, as well as wildlife watching,*** within the CCPA. As discussed in Section 4.18 (Wildlife), habitat for pronghorn, the most commonly hunted big game species within the CCPA, is widespread, as is habitat for various types of small game and upland birds. Development under Alternative B would lead to a decrease in the amount of habitat available, thereby reducing hunting opportunities for pronghorn, mule deer, and elk, and small game and upland birds and possibly jeopardizing recent increases in harvest and hunter numbers. This reduction in hunting opportunities primarily would occur during the construction and drilling phases of the Project due to disruptions from increased noise, traffic, construction activities, and human interaction. Hunting activities within the CCPA may be impacted should construction activities take place during hunting season; however, hunting activities also would be affected during production due to maintenance traffic as well as the presence of new aboveground facilities. Businesses that rely heavily or exclusively on tourism or outdoor recreation visitors, such as hunting outfitters, could experience declines in business and subsequent lower income. Additionally, some residents might be affected by a loss of access to private lands for hunting and changes in the outdoor experience due to the oil and gas development in the CCPA. Hunters may choose other areas in which to hunt, which could increase hunting on private lands; however, the impact on federal land would be limited due to the relatively small percentage of federal land (10 percent) within the CCPA. Hunting is popular within the Sand Hills Management Area. Although the BLM Casper RMP includes decisions that protect recreational values within the Sand Hills Management Area, such as designation as a ROW exclusion area and closed to oil and gas leasing, development activities adjacent to the area may affect the quality of the hunting experience within the area.

A greater impact to recreation would occur in areas where new access roads and facilities would be built to service new well development. Traffic on these roads would be heaviest during construction activities and lessen considerably during production. Dispersed camping also would be impacted because the setting would be modified by new access road construction activities, although this impact would be minor due to the limited amount of federal surface estate. Although recreational opportunities likely would be expanded by the creation of new access roads, increased noise and dust from traffic, and the presence of new oil and gas facilities during production would balance any perceived gains from increased access for OHV users and dispersed recreationists. Increased roads for OHV use also could create conflicts with private landowners due to potential accidental or intentional trespass or property damage. See Section 4.13, Transportation, for a detailed discussion of transportation impacts.

Visitors to historic trails could be impacted by surface disturbance, construction activity, and the presence of new facilities within the setting and viewshed of historical trails. Construction traffic could alter the visitor setting by increases in noise and human presence. Some of these impacts would last only as long as construction; however, the aboveground facilities and some noise related to maintenance would continue through the production phase. Implementation of best-management practices for reducing visual impacts, including using intervening topography to hide Project elements from trails and trail-associated sites, would serve to reduce the visual impact and protect the viewshed and subsequent historical setting. Further measures are detailed in Section 4.2, Cultural Resources.

Impacts to fishing and other water-based recreation in the CCPA would be greatest during construction activities, when noise, traffic, and human presence would be the greatest. Erosion and surface disturbance could increase sediment input to waterbodies, resulting in changes to water quality that could impact game fish and associated fishing opportunities. Fuel or lubricant spills into waterbodies also could pose a risk to game fish species and subsequent fishing opportunities. Access to the North Platte River would not be impeded, as existing access points are located outside the CCPA; however, construction noise and activities adjacent to the North Platte River could affect the recreational setting for fishing, boating, and other aquatic activities. The quality of recreational activities on the North Platte River also could be reduced by traffic and flaring noise during production as well as impairment of the visual setting by permanent aboveground facilities. See Section 4.18 for a more detailed analysis of impacts to aquatic biological resources.

Under Alternative B, facilities would be sited on BLM-, USFS-, and county-administered lands to conform to agency recreational planning goals and objectives. Specific recreation goals and objectives that may apply to siting oil and gas facilities include, but are not limited to: 1) develop and maintain appropriate recreational facilities, balancing public demand, protection of public land resources, and fiscal responsibility, and 2) maintain availability of public lands to meet the habitation, cultivation, trade, mineral development, recreation and manufacturing needs of external customers and the general public. Additionally, impacts would be minimized through adherence to requirements outlined in the TBNG LRMP (USFS 2001) and the CFO RMP (BLM 2007b) as well as to BLM and USFS requirements outlined in the Gold Book (USDOI-USDA 2007), such as re-contouring disturbed areas to existing grades and minimizing the sky lining of structures. Further stipulations pertaining to cultural, visual, and wildlife resources are detailed in Sections 4.2, 4.15, and 4.18, respectively.

4.10.2.2 Mitigation and Mitigation Effectiveness

No additional mitigation measures, including compensatory mitigation, have been identified for Alternative B.

4.10.2.3 Residual Impacts

Residual impacts are defined as unavoidable adverse impacts to a resource that remain after implementation of mitigation has been applied. No additional mitigation measures are proposed and would be implemented; however, impacts to recreation would include the presence of construction activities and Project facilities that would compromise the quality and opportunities for camping, hiking, fishing, hunting, visitation to historic trails, and water-based activities (Section 4.10.2.1).

4.10.3 Impacts on Recreation from Alternative C

4.10.3.1 Impacts on Recreation

Under Alternative C, development would include drilling of 5,000 new oil and gas wells from 938 new multi-well pads over a 10-year period. This would be approximately 37 percent fewer pads than under Alternative B. It is assumed that approximately 55 percent of the pads would contain up to 4 wells, 35 percent would contain up to 8 wells, and 10 percent would contain up to 16 wells. Additional surface disturbance would result from the construction of other service well pads, access roads, pipelines, electric power lines, and ancillary facilities; however, the total disturbance for these Project components would be 14,699 fewer acres than under Alternative B (**Table 2.5-1**). An estimated 37,267 acres of disturbance would result from development under Alternative C, approximately 10 percent of which (3,727 acres) may be located on federally administered lands. This reduction in disturbance subsequently would result in less impact to recreational users within the CCPA than under Alternative B.

As under Alternative B, the potential for impacts on federally administered lands would be limited to the 10 percent of the CCPA that is administered by the BLM or USFS. Impacts such as delays and the impairment of dispersed recreational opportunities under Alternative C would be less than under Alternative B as would the impact to small and big game hunting within the CCPA due to less traffic, road construction, and surface disturbance. See Section 4.18 for a more detailed analysis of estimated disturbance to small and big game habitat as well as impacts to aquatic biological resources.

Although there are no developed campgrounds on BLM- or USFS-administered lands within the CCPA, access to and the setting of dispersed recreation activities such as hiking and camping could be impacted by development activities; however, as a result of a smaller disturbance footprint, impacts from Alternative C would be expected to be less than from Alternative B. Development activities adjacent to the Sand Hills Management Area may affect the quality of the hunting and recreation experience; however, these impacts are anticipated to be reduced under Alternative C relative to Alternative B as a result of the lower amount of surface disturbance under Alternative C. Ultimately, the impact to dispersed recreation on federal land would be limited as a result of the small percentage of federal land within the CCPA that would be affected.

As under Alternative B, OHV access would increase under Alternative C as new roads would be constructed, causing increased OHV access along new roads and subsequent impacts to solitude and dispersed campers. However, these impacts would be less under Alternative C than under Alternative B. Traffic on these roads would be heaviest during construction activities and lessen considerably during production. Access for recreational users would be expanded from the creation of new access roads under Alternative C; however, the presence of increased noise and dust from increased traffic and the presence of new oil and gas facilities would balance any perceived positive impacts from increased access for OHV users and dispersed recreationists. This increased access would be less under Alternative C than under Alternative B. However, increased roads for OHV use also could create conflicts with private landowners as it potentially could result in accidental or intentional trespass or property damage. This would be incrementally less under Alternative C compared to Alternative B due to fewer miles of new access roads. See Section 4.13, Transportation, for a more detailed discussion of transportation impacts.

Construction activities under Alternative C potentially would impact historical settings and viewsheds for visitors of historic trails. These impacts would be similar to but less than under Alternative B because road construction and the disturbance footprint would be less and all segments of historic trails would be considered avoidance areas. Alternative C would result in potential impacts to visitors of historic trails from the impacts of increased traffic and construction of new aboveground facilities on both the setting and viewshed of historical trails. Consideration of historical trails as avoidance areas as well as implementation of BMPs for reducing visual impacts, including using intervening topography to hide Project elements from trails and trail-associated sites, would serve to reduce the visual impact and protect the viewshed and historical setting. See Section 4.2, Cultural Resources, for a more detailed discussion of impacts to historic trails and measures to reduce these impacts.

Under Alternative C, there would be impacts to the recreational setting for fishing, boating, and other aquatic activities, although to a lesser degree than under Alternative B. The quality of recreational activities on the North Platte River could be reduced by traffic and flaring noise, increased sedimentation from surface disturbance and erosion, potential fuel or lubricant spills, and by impairment of the aesthetic value of the visual setting due to construction of new aboveground facilities.

Facilities under Alternative C would be sited on BLM-, USFS-, and county-administered lands to conform to recreational planning goals and objectives. As with Alternative B, impacts from Alternative C would be minimized through adherence to requirements outlined in the CFO RMP and TBNG LRMP as well as to BLM and USFS regulatory requirements outlined in the Gold Book (USDOI-USDA 2007). Further stipulations pertaining to cultural, visual, and wildlife resources are detailed in Sections 4.2, 4.15, and 4.18, respectively.

4.10.3.2 Mitigation and Mitigation Effectiveness

No additional mitigation measures, including compensatory mitigation, have been identified for Alternative C.

4.10.3.3 Residual Impacts

Residual impacts are defined as unavoidable adverse impacts to a resource that remain after implementation of mitigation has been applied. No additional mitigation measures are proposed and would be implemented; however, impacts to recreation would include the presence of construction activities and Project facilities that would compromise the quality and opportunities for camping, hiking, fishing, hunting, visitation to historic trails, and water-based activities (Section 4.10.3.1).

4.10.4 Relationship between Local Short-term Uses of the Human Environment and Maintenance and Enhancement of Long-term Productivity

The relationship between local short-term uses of the human environment and maintenance and enhancement of long-term productivity is the disclosure regarding whether the short-term use of a resources associated with a project affects the long-term sustainability of that resource. The recreational setting would be impaired in the short-term as well as visual aesthetics; however, the recreational setting would be restored in the long-term after the area has been reclaimed. While the reclamation of arid lands could take several decades, these actions potentially would reduce the long-term impacts to public land for big game forage and associated recreational opportunities, specifically under Alternative C which would result in reclamation of a great portion of the CCPA relative to Alternative B.

4.10.5 Irreversible/Irretrievable Commitment of Resources

Irreversible/irretrievable impacts are subsets of unavoidable adverse/residual impacts. Irreversible impacts are those that cannot ever be restored; they would be lost forever. Irretrievable impacts are those for which the resource value would be irretrievably lost until restoration of that resource takes place. The loss and/or incremental reduction of hiking, hunting, and other dispersed recreational opportunities experiences would be an irretrievable loss, but not irreversible as recreational opportunities would return after reclamation. The loss and/or incremental reduction of visual aesthetics from the construction of aboveground facilities would be an irretrievable loss, but not irreversible as the visual aesthetics could return after final reclamation is completed. Additionally, it is anticipated that increased acreage would be reclaimed to pre-existing land uses under Alternative C relative to Alternative B as interim reclamation would be required on lands overlying federal mineral estate.

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4.11 Socioeconomics and Environmental Justice

The analysis area for direct, indirect, and induced impacts to socioeconomics and environmental justice includes Converse, Campbell, and Natrona counties, focusing on the community of Douglas and to a lesser degree on Glenrock in Converse County, Casper and other nearby communities in Natrona County, and Wright and Gillette in Campbell County. This area encompasses the CCPA, the current and likely location of the majority of the Project-related offices, oil and gas service and construction contractors that would support the Project, and where most of the workforce would reside. Public sector revenues (i.e., the state share of federal mineral royalties, state severance tax, sales and use taxes, and ad valorem tax revenues from state mandated education levies) that would be generated by the Project to the State of Wyoming also have been assessed.

Oil and gas development could have a variety of effects on social and economic conditions. The assessment considers the following types of effects:

- **Employment**—effects on jobs in the oil industry, businesses that support that industry, and indirect effects on other sectors of the economy, including changes in industry, employee spending, and other industrial sectors that could be indirectly affected by development such as ranching and outdoor recreation.
- **Personal Income**—effects on income of direct, indirect, and induced businesses and their employees; on other sectors of the economy such as tourism; and on landowners, mineral owners, and royalty interests.
- **Population**—effects on resident and temporary populations in nearby communities.
- **Housing**—demand for and effects on availability of temporary and long-term housing.
- **Community Infrastructure and Services**—demands on public, quasi-public, and private facilities and services.
- **Public Schools**—changes in district enrollment and the likelihood that those changes necessitate changes in facilities and/or staffing.
- **Fiscal Conditions**—changes in local and state taxes, federal mineral royalty revenues, and government expenditures.
- **Social Conditions**—effects on community stability and cohesion, quality of life, attitudes, opinions, lifestyles, and changes in crime and other social indicators.
- **Environmental Justice**—disproportionately high and adverse effects on minority, low-income, and Native American populations and resources of Native American concern.

The alternatives considered have the potential to affect these social and economic conditions, which are described in Section 3.11. All alternatives would increase the number of jobs and labor income in certain sectors of the local economy as well as population growth and resultant increased demand for housing and community infrastructure and services. Following completion of the Project construction, job and income declines as well as population out-migration would occur absent other new large-scale economic expansion projects or initiatives in the region. Each alternative potentially would affect agriculture (primarily ranching), outdoor recreation, and other sectors of the economy that also are closely linked to land use and access in the analysis area. Beneficial and adverse effects on community infrastructure, local government services, and community social conditions likely would occur under all alternatives.

The methodology for analyses for socioeconomic impacts included projections of direct, indirect, and induced employment by the proposed development, future oil and natural gas recovery, the market value of the resources produced, future population immigration, and housing needs. These impacts were stimulated using the IMPLAN economic model, which is a widely accepted commercial economic model that has data sets for every county and state in the nation based on economic data from the U.S. Bureau of Economic Analysis, U.S. Bureau of Labor Statistics, and the U.S. Census.

Projected direct employment estimates were the primary input used with the IMPLAN economic model, calibrated using data for Converse and Natrona counties to derive Project changes in total employment that would drive changes in other economic and demographic variables. The modeling approach involved a series of mathematical computations to derive quantitative estimates of key parameters that represent the incremental economic and demographic effects of the Project in the analysis area. In turn, the magnitude, timing, duration, and geographic distribution of the changes were used to inform other dimensions of the socioeconomic assessment. The primary variables driving the modeling included:

- The number, timing, and location of new wells to be drilled.
- Additional in-field infrastructure proposed to support the development and future recovery and production of crude oil and other liquids and natural gas.
- The distribution of mineral estate interests between federal, state, and private categories
- The anticipated labor requirements required to build and operate the Project, including transporting the liquid and gas resources to bulk transfer, refining or transmission pipeline facilities.
- The anticipated per well quantities of crude (liquids) and natural gas to be produced, both over time and cumulatively.
- Assumptions regarding future markets prices for crude oil and natural gas.
- Royalty and tax rates on future production.
- The availability of local labor to meet future labor demand.
- The anticipated residency status and household size characteristics of workers who relocate to meet labor demands in energy development industries and other sectors of the economy where job opportunities are stimulated by the energy development.
- Housing preferences of workers relocating to the area.

See the Socioeconomic Technical Supplement (**Appendix C**) for additional details regarding the assumptions.

The overall methodology used for analysis of impacts to socioeconomics and environmental justice included:

- Estimated direct employment over time associated with the additional development was based on information provided by the OG and the assumed level of drilling.
- Projected direct employment included estimated temporary construction employment associated with ancillary facilities. This activity was assumed to occur over the first 8 years of project development, which was the time period used to assure adequate field treatment and processing capacity would exist across the entire CCPA to accommodate new well development.
- The assessment included an assumption of an additional 400 construction workers per year during the first four years of the Project to account for workers associated with new residential, commercial, industrial, and public sector infrastructure development.
- Secondary indirect and induced employment effects were projected using IMPLAN multipliers for the region.

- Population effects were based on assumptions regarding worker household/demographic profiles, local labor force availability, and anticipated residency patterns of in-migrating workers.
- ***A qualitative a***ssessment of demands on key facilities and services ***was*** based on current levels of service, capacity, and available information regarding identified needs/shortfalls (Section 3.11.8, Public Infrastructure and Services).
- Social effects were addressed qualitatively based on reviews of local print media, public scoping comments, and interviews with local officials and landowners.
- For all action alternatives, the effects of increased drilling, field development, and production activities were considered. For example, while Alternatives B and C were based on annual average drilling of 500 wells, Alternative A was based on drilling approximately 110 wells per year, which is reasonably comparable to the rate that occurred in 2013 and 2014 prior to the dramatic curtailment of activity due to falling oil prices in 2015.

Socioeconomics and environmental justice effects of land use decisions are managed according to the management goals and objectives from the BLM ROD for the CFO RMP (BLM 2007b) and the USFS TBNG LRMP (USFS 2001). Local land use and comprehensive plans also are to be considered when assessing proposed development projects. The Converse County Land Use Plan was adopted by the Converse County Commissioners in 2015 (Converse County 2015a).

Assumptions used in the analysis of socioeconomics and environmental justice effects included:

- Typical well production data provided by the OG assumed average aggregate production of 1.16 billion cubic feet of gas and 274,000 barrels of crude over the life of a well. A 99 percent success rate for new wells was assumed for this analysis.
- The drilling levels assumed for all alternatives would result in a renewed influx of oil and gas workers. The communities in the analysis area have recent experience with elevated levels of development and the effects that accompanied that development. As a result, some of these communit*y*-initiated efforts to address many of the socioeconomic effects associated with that pace of development. However, the recent drop in oil prices triggered a dramatic slowdown in the pace of development that in turn resulted in an outmigration of non-resident oil and gas workers from the region.
- The induced and indirect employment associated with drilling, field-development, and production activities would parallel the advances and declines in direct employment for each alternative. Under the action alternatives, employment and income associated with drilling and field development is assumed to occur over 10 years and then cease. Production-related employment would continue, but would again diminish as production would decrease, previously drilled wells would cease production, and wells would be plugged and abandoned.

This assessment also was shaped by several considerations that are not specifically related to the alternatives but could affect overall socioeconomic conditions in the analysis area. These considerations include: future oil and gas commodity prices; cyclical expansion and contraction in the oil and gas industry; uncertainty and volatility as related to the pace of development; indirect effects on other uses in the CCPA, including recreation*,* agriculture (primarily ranching/grazing), ***and property values***; and indirect effects on non-market values. The potential implications of each of these considerations for socioeconomic effects are discussed below.

<u>Future oil and gas commodity prices</u>: Continued production from most existing wells is incumbent on prices sufficient to cover production and the fixed costs of maintaining the lease and well. Energy market conditions, the commodity prices of crude oil in particular, were substantially higher in 2013 and 2014 (when the OG requested the BLM initiate this EIS) than they were in early 2016, demonstrating the volatility of energy markets. Crude oil prices were between $70 and $100 per barrel from early 2011

through late 2014. The subsequent sharp decline in crude prices, with prices averaging less than $50 per barrel in 2015, dramatically curtailed drilling activity in Converse County.

The strong correlation between commodity prices and the number of active rigs suggests that a substantial rise in crude oil prices would be necessary to support drilling at levels contemplated by the action alternatives. Higher prices would support the accelerated level of development and also yield higher revenues to the public sector, particularly to the state and local governments. Recent energy price forecasts from the U.S. Energy Information Administration anticipate crude oil prices to be around $65 per barrel in 2017 and increase to $79 per barrel by 2025. Natural gas prices are forecast to climb from $3.80 per million British thermal units (Btu) to $5.46 per million Btu during the same period (U.S. Energy Information Administration 2015). Therefore, the range of future prices for the fiscal revenue projections assumed for this analysis was $65 to $100 per barrel for crude and $***3.5***0 to $***5.5***0 per mcf for natural gas (commodity prices for natural gas are net of a $0.50/mcf gas processing allowance). Variation in oil and natural gas prices over time also would affect tax and royalty revenues generated on the value of production; higher prices translating to higher revenues, and lower prices leading to lower revenues. ***In fact, prices would vary over time, and not necessarily be limited to the ranges defined above*. *Variation in oil and natural gas prices over time also would affect tax and royalty revenues generated on the value of production; higher prices translating to higher revenues, and lower prices leading to lower revenues.***

***Although higher prices would support accelerated level of development and yield higher revenues to the public sector, particularly to the state and local governments, it is unclear what crude and natural gas prices would be needed to support development at the levels assumed under Alternatives B and C. In addition to prices, future development levels would also reflect the availability of capital, industry development capacity in terms of the availability of rigs, labor and other factors, and the potential returns available from competing opportunities -- an analysis of which again are beyond the scope of this programmatic assessment*.**

Cyclical expansion and contraction in the oil and gas industry: Oil and gas development in a local region is often characterized by cycles of expansion and contraction as it moves from exploration, through early development, to full-scale commercial development and long-term production, until the resource plays out. The expansion phase involves an increased number of direct jobs and income in the oil and gas exploration, development, production, and transportation industries as well as increases in indirect and induced jobs and income. For the action alternatives, the 10-year drilling and exploration phase would be accompanied by substantial increases in both temporary and long-term population and associated demand for temporary and long-term housing and community infrastructure and services. For Alternative A, expansionary effects would be much smaller than for the action ***alternatives and*** would extend over approximately 15 years before the economic contractions would begin.

The economic contraction phase would be characterized by reductions in employment, out-migration of workers and families, and lowered demand for housing, community infrastructure, and local government services. The contraction phase for each alternative also would be characterized by reductions in annual oil and gas-related federal, state, and local government tax and royalty revenues. Other socioeconomic effects that often accompany the economic contractions include reductions in private sector business revenues, business closures, personnel lay-offs, declining real estate prices, rising vacancy rates, and other changes in social and economic conditions. The severity of such effects would depend in part on the economic vitality and diversity of other segments of the economy at that time. This characterization of socioeconomic effects for this assessment is a function of the assumption of a steady pace of new well development; however, some variability would be expected over time, which would temper these expansions and contractions. Historically, local oil and gas development and expansion cycles have been shorter in duration than the 10-year cycle assumed for this analysis.

Uncertainty and volatility as related to the pace of development: ***A sustained level of new well development over a specific period was assumed for analysis. However, compared to many industries, the oil and gas industry is able to expand and contract development activities relatively quickly, which creates the boom and bust scenarios that have been part of the history of oil and gas development. A well-defined and steady pace of development might be attractive to local governments, many local businesses, real estate investors, and services providers for purposes of community and fiscal planning; however, the actual pace of drilling would be variable and unpredictable because development decisions are dependent on variable factors such as oil and gas demand, pricing, regulatory approvals, rig and manpower availability, adequate infrastructure for product transport, weather, the overall investment and development strategies of individual energy companies, and the availability of capital. Moreover, t***he oil and natural gas reserves in the CCPA are part of a much larger array of oil and gas resources extending from North Dakota to ***Texas***. Development across the region is affected by the same market price conditions as those in the CCPA; therefore, periods of expansion and decline in the CCPA generally would coincide with similar patterns occurring elsewhere in the region. Commodity prices that support development in the CCPA likely also would support accelerated activity on projects in Converse, Campbell, and other nearby counties, which would increase competition for labor, equipment, housing and services. ***Thus, the assessment of direct and indirect socioeconomic impacts of each alternative must consider the regional context for oil and gas development when assessing labor availability, population effects, demand for housing and community infrastructure and services, and the social effects of development.***

Volatility in the pace of development can result in boom and bust cycles, which in turn have effects in the local communities, local governments and facilities and services that translate into implications for local communities planning for or affected by such development. In general, a more rapid pace of development would exacerbate many of the social and economic effects on communities (e.g., higher demand for temporary and conventional housing, greater increases in housing costs, more immigration and labor shortages, and demands on law enforcement and other public facilities). In cases where existing capacity has been absorbed (e.g., a pace of 600 wells per year) could result in a greater than a 20 percent increase in temporary housing demand, which would increase the likelihood of undesirable housing situations. Conversely, slower development drilling rates could ease many of these effects by decreasing growth and the associated housing, services, and infrastructure demand.

Variability in development rates and the impacts on local social and economic conditions have been evident locally in recent years when global oil prices rose to historic levels and then declined precipitously. This decline resulted in major contractions in drilling and development levels, and all three counties in the analysis area experienced economic slowdowns in 2015. Among the types of effects that accompanied the slowdowns were sharp reductions in sales and use tax revenues, reductions in business revenues and business closures, lower occupancy rates for temporary lodging, longer listing times and lower prices for housing, and slowdowns or cancellation of new commercial, residential and public development. It is likely that some employers scaled back staffing, through layoffs, attrition, or reducing the working schedule of employees. The severity and types of effects are influenced by the magnitudes and duration of the changes in drilling and development. The effects also were affected by the level of development that had occurred and the quantity and value of production that would continue even as new development stops or slows because on-going production would support local employment and the local tax base over time.

Although the local bust cycle resulted in social and economic disruption and dislocation for local communities, it also provided a possible upside as new infrastructure that was put in place, or was being put in place, to accommodate the previous boom would be available to accommodate increased demands when and if drilling and development resumes.

Another ***source*** of uncertainty in the region pertains to the current challenges facing the coal industry, which in large part are tied to low natural gas prices and rising public concern regarding the contributions of coal-fired electrical generation to climate change. The prospect of lower production and sales as well as the challenges in expanding the export market could lead Wyoming's coal producers to pursue voluntary retirements, leave vacancies unfilled, and conduct staff layoffs as a part of cost-saving measures and to bring production in line with demand. Such actions could increase local labor availability and ease pressures on housing availability and affordability. At the same time, declining production would reduce major sources of state and local government revenues tied to the value of coal production.

<u>Indirect effects on other uses in the CCPA, including recreation and ranching/grazing</u>: All alternatives potentially could displace other uses and users of land within the CCPA; temporarily in some instances and for longer periods in others. The existing and ongoing drilling and field-development activity already has altered the recreational setting in portions of the CCPA, reducing or displacing some recreational use (primarily hunting). Although dispersed public recreation within the CCPA occurs on 10 percent of the CCPA that is public land, some hunting and outfitting occurs on private lands through recreational leases or individual landowner approvals. The development of additional wells and well pads would increase the potential for conflict with recreational activities and could further reduce or displace recreational use of the area. In all cases, a reduction in hunting would be anticipated for safety and aesthetic reasons within portions of the CCPA where oil and gas activity is present. Over the long term, as development and production activities cease and reclamation occurs, recreational users may return to the area. Shifts in the geographic distribution of hunting and other recreational activity, or reductions in the level of such activity, would have corresponding economic implications.

As described in Section 4.9, grazing lands, patterns, and practices could be affected by oil and gas development activity, fugitive dust, damage to rangeland improvements, livestock stress and mortality, disturbance, infestation of invasive plant species, and reductions in forage availability. Within the CCPA, 76 percent of the land used for grazing is privately held. Private surface owners are compensated for use of their land through surface use and damage agreements. As noted in Section 3.11.11, Social Conditions and Trends, payments associated with these agreements provide additional income for ranchers. Additionally, some private landowners have negotiated surface agreements that include such conditions as speed limits on private roads, dust control, limitations on times of use, and fines for livestock and wildlife mortality. On federal grazing allotments, the types of effects noted above could result in reductions in authorized grazing use. Permittees with grazing privileges are not compensated for use of surface areas within their allotments by oil and gas companies or reductions in authorized grazing levels. All of the effects on grazing lands, patterns, and practices could result in reductions in farm income for grazing permittees. The mitigation measures for range resources outlined in Section 4.9 are designed to reduce impacts on permittees with grazing allotments on federal lands.

<u>Effects of oil and gas development on property values:</u> Among public concerns associated with oil and gas development is the potential effect of such development on property values. Concerns have been heightened in recent years in response to the increases in horizontal drilling and well stimulation employing hydraulic fracturing and by proximity to accidents such as the well blowout in April 2012 and a well pad fire in September 2015, both of which occurred within the CCPA. Some property owners in rural residential areas, where properties and homes are often valued for their rural, scenic, and quiet character, are concerned that their properties may be particularly vulnerable to adverse property values when development of well pads and ancillary facilities nearby change that character. Development in split-estate situations, where surface and subsurface mineral estates are owned by different parties, are another area of concern.

Due to the size of the CCPA, complexity of land ownership and management in the area, and the programmatic nature of this analysis, an assessment of the potential effects on property values

is beyond the scope of this EIS. Some general findings drawn from studies that have examined different facets of property value effects from development include the following.

- ***When determined to exist, adverse effects on property values tend to diminish as distance between a property and one or more active wells or related facilities increases.***
- ***Increases in natural resource development, as measured by employment, often create upward pressures on real estate market values in nearby communities. Similarly, values can go down if a bust cycle occurs, although this is not directly linked to such development.***
- ***Property values can be enhanced for properties where the surface owner also owns oil and gas mineral rights.***
- ***The effects can vary based on the stage of development. Active drilling, road construction, and ancillary facility development can have adverse short-term effects that may diminish over time as the activity moves into production and the volume of traffic and noise decreases.***
- ***For rural properties in areas where hydraulic fracturing occurs, effects on property values may hinge on an individual property's reliance on groundwater. Properties served by a rural water system may be less affected by oil and gas development.***
- ***Linkages between oil and gas development and effects on property values may be more indirect (e.g., the effect of increased traffic, noise, and the amount of light at night).***
- ***The taxes associated with oil and gas development may fund community infrastructure and services that collectively enhance general property values in nearby communities.***

While these findings do not provide a basis for overall assessment of the potential net effects in the CCPA, they provide some perspectives that could be relevant to the current situation. The area where development would occur is primarily rural, agriculture is the predominant land use, and some surface owners within the interior of the CCPA also own mineral rights. Direct effects on agricultural land use within the CCPA would be relatively limited, and surface use agreements would offset some or all of the economic losses for affected landowners. Real estate market values in Douglas, Glenrock, and other nearby communities likely would increase in the short-term, allowing some owners and investors to profit. However, the value of some private properties could be adversely affected indirectly by traffic, noise, light or other factors, and some owners could experience diminishing value over time.

<u>Indirect effects on non-market values</u>: As noted in Section 3.11.12, Non-Market Values, environmental amenities including air and water quality, wildlife and wildlife habitat, scenic vistas, cultural and historical features, and areas that provide opportunities for solitude are valued by many local residents and non-residents alike. These amenities add to the quality of life for residents, promote local tourism and recreation, and are some of the factors that could attract new residents and businesses to an area. Many people value these amenities for their very existence and desire their continued availability for future generations.

Portions of the CCPA have been affected by past development, which has adversely affected some outdoor amenities including wildlife and wildlife habitat, scenic vistas, and areas that provide opportunities for solitude. All alternatives would continue to affect these amenities; however, the action alternatives would intensify development in some currently developed areas of the CCPA and result in development in currently undeveloped areas.

In addition to the effects of development, disturbance, and activity on environmental amenities, the proliferation of litter along roads that often accompany development activity adversely affects scenic and wildlife amenities. Such effects could arise under all alternatives but likely would intensify under the action alternatives given the increased activity and extended duration of the drilling and field-development phase.

4.11.1 Impacts on Socioeconomics from Alternative A – No Action

Under Alternative A, there were approximately 1,520 existing oil and gas wells in the CCPA, and an additional 1,663 new wells would be drilled as disclosed under NEPA (Section 2.3.2). These new wells would include 599 wells on fee and state lands and minerals for which federal approval is not required, as well as 1,064 wells on federal minerals that have been disclosed under separate NEPA actions. For this assessment, it was assumed that future development under Alternative A would occur at an average pace of 110 wells per year*, **drilled by an average of 10 to 12 rigs***. Based on the average production assumptions outlined above, future annual production under Alternative A, including the residual from existing wells, would peak at approximately 100.8 billion cubic feet of gas and 24.3 million barrels of crude in 2028. New wells developed under Alternative A would account for approximately 85 percent of that production. After peaking, production would begin an extended period of decline (**Figure 4.11-1**). Total future production under Alternative A, including the residual production from existing wells, would be an estimated 2.4 trillion cubic feet (tcf) of gas and 533 million barrels of oil.

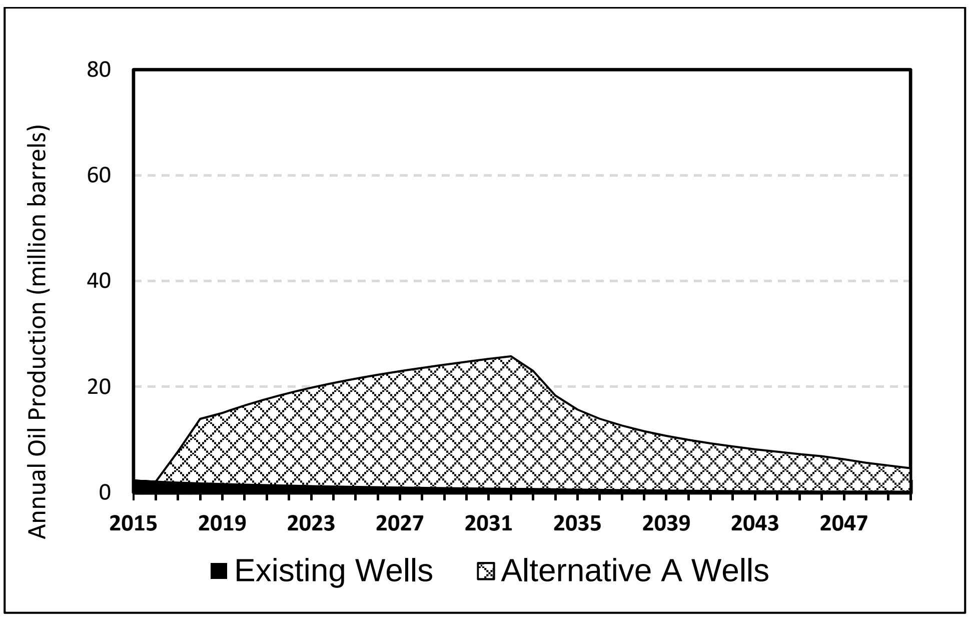
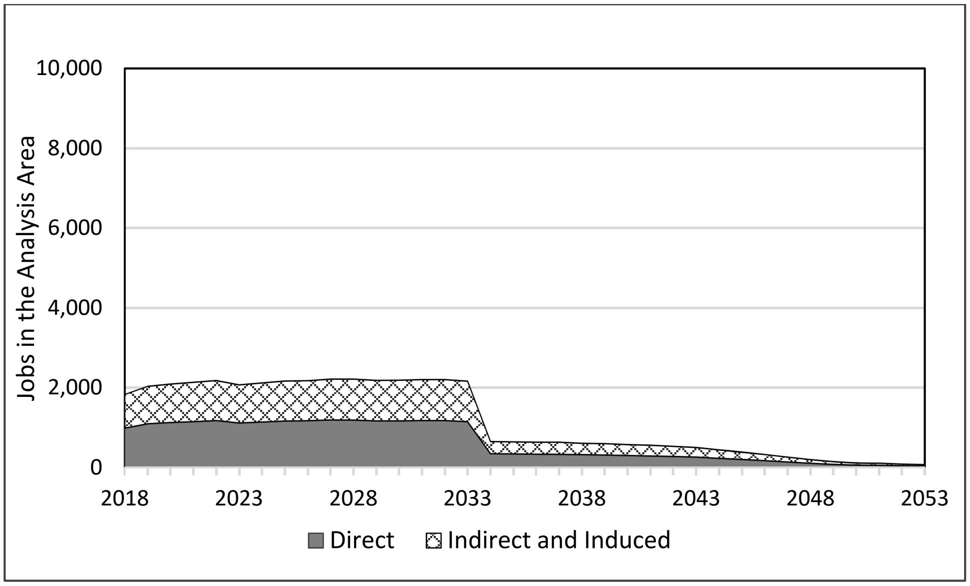


Figure 4.11-1 Estimated Annual Oil Production under Alternative A

<u>Employment</u>

Development under Alternative A would provide added economic stimulus in the regional economy as drilling and field development in the three-county analysis area would continue for approximately 15 years. Substantial field infrastructure development also would occur under Alternative A. Employment related to drilling and completion would drop off dramatically thereafter, and employment related to production and transportation would trend downward for 20 or more years, depending on the economic viability of continued production. The reduction of direct on-site and off-site employment during drilling and field-development, along with the fewer production and trucking jobs would ripple through the economy, reducing the number of indirect and induced jobs supported by activity in the CCPA (**Figure 4.11-2**). Under Alternative A, a peak of approximately 2,*4*00 jobs would be supported in the three-county area. Those jobs would not all represent new jobs as many of them would be associated with oil and gas firms currently active in the region that would be maintaining existing activities to keep their workers employed and avoid layoffs. Following the completion of development, the number of jobs supported by ongoing production initially would fall to 650 jobs, and then continue to decline over time as production also declined ***(see Section 2.0 of Appendix C for more information regarding projected employment)***.



Note: Includes jobs associated with existing production.

Figure 4.11-2 Employment in Analysis Area Supported by Development under Alternative A

Under conditions that existed in late 2015 and early 2016, the majority of the indirect and induced jobs, as well as many of the direct jobs supported by Alternative A, could be filled by displaced and unemployed workers from the regional labor force. Given the uncertainty in the coal industry, the numbers of available workers in the three-county area could increase in the future. Many coal industry workers have heavy equipment operation and maintenance skills that could be transferred to the oil and gas industry.

Personal Income

Implementation of Alternative A would contribute to higher ***average wages and*** personal income in the region. Total personal income would rise due to increases in the number of jobs, particularly in the higher-paying energy-sectors; reductions in regional unemployment and under-employment; and the upward pressure on wages and salaries. Some of the gains in personal income could be offset by higher consumer prices. The positive effects on income related to development under Alternative A would moderate and eventually diminish following the completion of the well-development phase.

Effects on income would include short- and long-term effects on farm income due to changes in land use associated with oil and gas development. Such changes would include reductions in authorized grazing on federal lands (Section 4.9***) and short-term or long-term loss of private crop or grazing lands. Reductions in federally permitted grazing of as many as 211 AUMs per year (Section 4.9) would result in a net reduction of 3,434 federally permitted AUMs over 20 years under Alternative A. The total economic loss for such reductions to local ranchers would be $58,241 over the 20-year period, an average of $2,912 per year. The average annual loss is equivalent to less than 0.05 percent of the total farm income of Converse County ranchers in 2012 (Table 3.11-4). Based on a***

net economic value of $16.96 per AUM for cattle (Wyoming Department of Revenue, Property Tax Division 2015) and annual fee of $1.69 per federally permitted AUM (BLM 2015), federal grazing fees would be reduced by $5,803 over the 20-year period. The federal fee is revised annually and is $1.41 per AUM for 2018. In some instances, ranchers or tenant operators of private lands affected by energy development may result in other indirect effects (Section 4.9.1), require changes in operating practices and increased operating costs. The reductions in AUMs, along with the associated effects on ranch income for the affected ranchers would continue long-term, decreasing in magnitude as reclamation occurs.

Federally permitted AUMs are those that take into account the federal surface acreage only and do not account for AUMs that may occur on private surface. The BLM and USFS do not have the authority to regulate grazing on private surface. Specific terms of individual agreements are subject to negotiation between the landowner and the oil and gas operator. In general, such agreements shall pay the owner a sum of money or other compensation for loss of production and income, loss of land value and loss of value of improvements caused by oil and gas operations (W.S. 30-5-405). The negotiated surface use and damage payments may offset the economic losses from grazing reductions for affected landowners. Tenants who lease grazing or cropland on private surface and would be affected by oil and gas development would not receive compensation under a surface use agreement. The number of tenants that would be affected and the magnitude of any resulting economic effects is unknown.

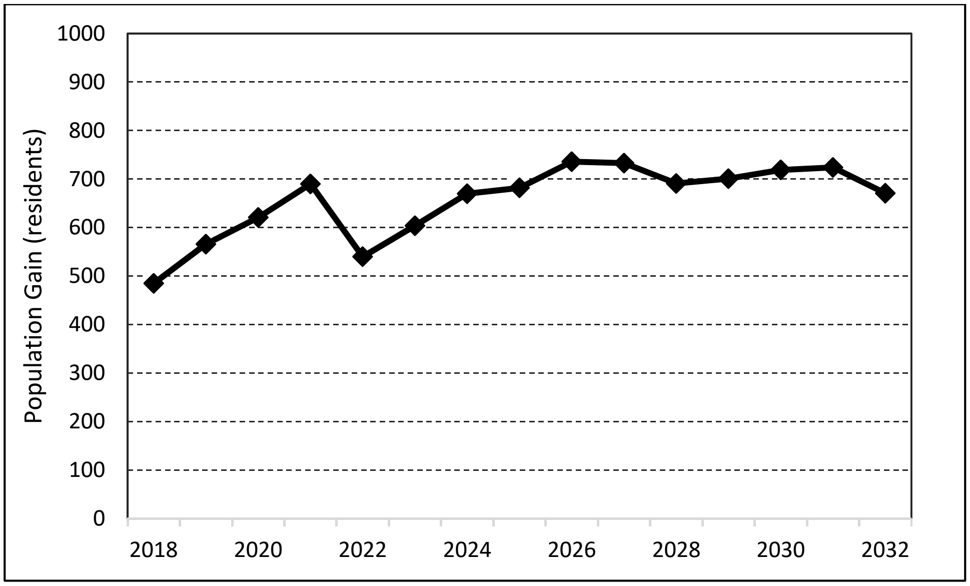
The mitigation measures for range resources outlined in Section 4.9 are designed to reduce impacts on permittees with grazing allotments on federal lands.

Population

Future development under Alternative A would provide a long-term economic stimulus to the local economies of Converse, Natrona, and Campbell counties. Local labor, including workers employed with existing firms, could be expected to fill many but not all of the jobs supported by development under Alternative A. Based on labor market conditions and established capacity of construction and oil and gas firms in the region, it was assumed that existing residents of the thee-county area would staff 1,500 direct, indirect, and induced jobs related to Alternative A. This would include residents whose employment is already related to development in the CCPA. Jobs not filled by existing residents would trigger in-migration and population growth for the region, resulting in a peak gain of ***922*** residents in 20***31*** (year ***14*** of ***development under Alternative A***) (**Figure 4.11-3**). Local workers would include those who are unemployed, under employed, some who are employed in the coal mining industry and facing unemployment as a result of weaker markets for Wyoming coal, or workers who commute to jobs in other locations while waiting for the local oil and gas development industry to rebound.

Short-term surges in temporary population could accompany the construction of the ancillary facilities. That population would account for much of the gain shown from 2019 to 2021 in **Figure 4.11-3** as well as the decline in the following year when the pace of construction would slow. The operations workforce associated with these facilities would be relatively small and result in little long-term population gain in the analysis area.

At the peak, the incremental population impacts associated with Alternative A would represent approximately 0.***7*** percent of the combined 2013 resident population of the combined three-county analysis area. The maximum gain in Converse County would be less than ***2.***0 percent of the county's estimated 2013 population.



Note: Represents population for all 3 counties and includes population associated with existing production.

Figure 4.11-3 Net Population Change Associated with Alternative A

The scale of population growth related to Alternative A within the analysis area would be limited in comparison to the existing population base. The majority of the incremental population growth from the alternative would be expected to reside in the Casper and Douglas areas due to housing availability (particularly temporary housing), oil field service company locations, and proximity to work sites; however, some workers likely would locate in Gillette, Glenrock, and Wright because these communities have sufficient housing availability to accommodate the incremental growth. Due to the limited scale population gains and housing needs associated with Alternative A, substantial growth in other communities (e.g., Glendo, Wheatland, Midwest, and Lusk) would not be likely, although a small number of oil field workers may choose to live in these and other locations, and some existing residents of those and other communities may secure work in the CCPA and commute from their current place of residence. **Figure 4.11-4** presents an approximate distribution of the estimated 737 new residents that would be expected in the peak year as a result of development under Alternative A.

Fluctuations in drilling rates in response to changing market conditions would affect the numbers of temporary field services and transportation workers associated with the oil and gas industry who reside in a community. The availability of temporary lodging could change quickly from limited vacancies to offering discount rates to travelers. The corresponding effects on indirect and induced workers would be less immediate and pronounced, as employers react and adjust more slowly to the economic downturns.

Under Alternative A, net population migration would occur in response to a resumption of drilling activity involving approximately 10 rigs. Net out-migration likely would follow the cessation of drilling 15 years later, although nearly 600 jobs would continue in conjunction with continuing production and transportation needs. The extent of the out-migration would depend on economic conditions at the time, which would influence individual tendencies to remain and seek other employment, remain and retire, or to migrate.

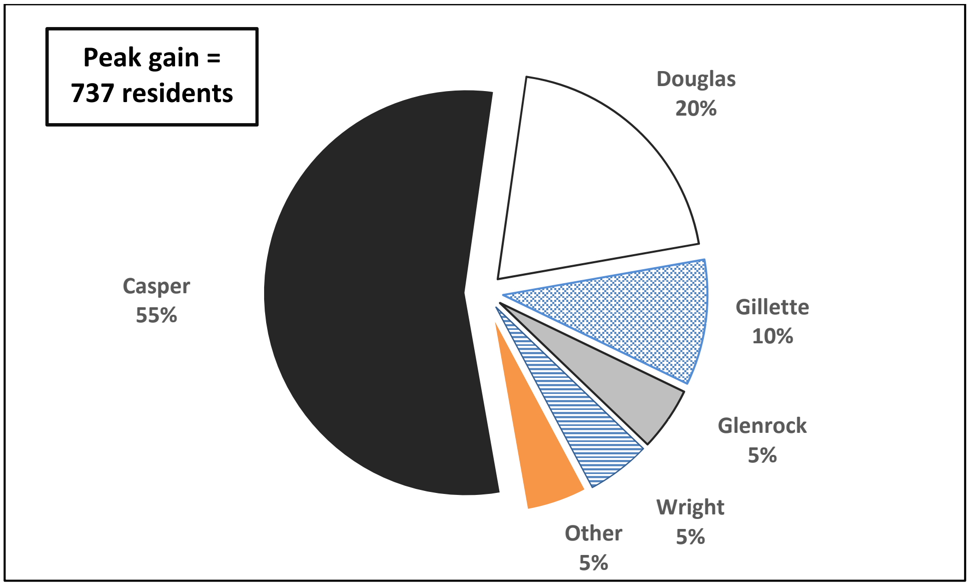


Figure 4.11-4 Distribution of New Residents Associated with Development under Alternative A

<u>Housing</u>

Many of the direct jobs and most of the indirect and induced jobs associated with Alternative A ***would be filled by residents of Converse, Natrona, and Campbell counties*** whose employment is already related to development in the CCPA. On average, annual drilling and field development activity under this alternative would be lower than that which occurred in 2013 and 2014. As a result, incremental housing needs to accommodate growth under Alternative A would peak at a total of ***601*** units in ***2031, more than a decade in the future***. ***The peak incremental need would***, includ***e projected*** demand for 2***73*** temporary accommodations, 2***74*** rental units, and ***54*** homes for purchase. This relatively low need could be accommodated by existing housing resources in the three-county ***analysis*** area. ***The loss of approximately 1,600 jobs following the 15-year development period and the resultant out-migration of workers and families likely would result in vacancies across all housing types, depending on the level of other economic activity occurring at the time. Prices of both rentals and housing sales likely would decline; however, the impacts would be spread across the three-county area.***

<u>Community Infrastructure and Services</u>

New drilling and field development activity associated with Alternative A would continue as disclosed under ***existing*** NEPA ***documents***, although at a somewhat slower pace than occurred during the 2013/2014 period. Continued drilling and field development at reduced levels in the CCPA likely would result in demands on law enforcement, fire suppression, and emergency response similar to the levels experienced during the 2013/2014 period. Demand for road maintenance and weed and pest control would increase as the number of wells, access roads, pipelines, and other ancillary facilities would increase. Workers filling many of the direct and most of the indirect and induced jobs likely would be drawn from the local workforce; therefore, the estimated incremental population increase due to Alternative A would peak at ***922*** persons in the three-county area in 20***31***. That total would represent approximately 0.***7*** percent of the combined 2013 three-county population. Consequently, incremental demand for public infrastructure and services for counties, communities, and healthcare and social service providers related to Alternative A likely would be negligible. ***As development declined and workers migrated from the area in search of employment, Alternative A-related demands on local government infrastructure and services also would decline. The out-migration would be spread***

across communities in the three-county area, and local governments likely would not expand infrastructure and services to accommodate the Alternative A-related population; therefore, few contractions in public infrastructure or services would be anticipated.

Public Schools

Increases in school enrollment related to Alternative A would follow the trends in resident population; enrollment would increase over time as resident populations would increase, but then decline as drilling activity is completed and production levels fall. Between 2010 and 2013, public school enrollment across the three-county analysis area averaged between 15.5 percent (Natrona County) and 18.5 percent (Campbell County) of the resident population. The overall average for the 4 school districts in those counties was approximately 16.7 percent.

Assuming continuation of the relationships between resident population and school enrollment and the estimated population gains associated with Alternative A, excluding single-status workers, estimated public school enrollments would increase by as many as 135 students by 2025 (**Table 4.11-1**). The incremental increases in student enrollment likely would be concentrated in the elementary grades during the early years of development, shifting to the secondary grades over time. Approximately half of the total increment likely would occur in Natrona County School District #1.

Table 4.11-1 Estimated School Enrollment for Selected Years from Alternative A

School District	Incremental Enrollment in Public Schools[1]			
	2018	**2021**	**2025**	**2028**
Natrona County #1	48 to 58	47 to 56	57 to 68	55 to 66
Converse County #1	16 to 20	16 to 19	19 to 23	19 to 23
Converse County #2	4 or 5	4 or 5	5 or 6	5 or 6
Campbell County #1	18 to 22	18 to 21	22 to 26	21 to 25
Other Nearby Districts[2]	9 to 11	9 to 11	11 to 13	10 to 13
Combined Enrollments	**95 to 116**	**94 to 112**	**113 to 135**	**111 to 133**

1 Estimated public school enrollment based on a range of 15.5 percent to 18.5 percent of the additional resident population, excluding temporary single-status workers.

2 Includes districts serving Johnson, Crook, Weston, Niobrara, and Platte counties. Assignments to individual districts were not made as part of the assessment; however, impacts to any district would be expected to be limited.

The estimated changes in school enrollments under Alternative A may require a few additional staff but would not require facility construction by any of the affected districts. Affected school districts could experience increases in operating expenditures and revenues. ***Enrollment in the four affected school districts likely would decline after development ceases.***

Fiscal Conditions

Under Alternative A, 1,663 new wells would be drilled over 15 years, and residual production would occur from existing producing wells in the CCPA. Initially production values would reflect the increases in production associated with new wells. Cessation of new development would be followed by a steady decline in production volumes, with corresponding effects on the taxable value of production and associated value-based public sector tax revenues.

Total estimated incremental market value of production from existing and new wells under Alternative A through the life of the field would range from $3***4.7*** billion to $***53.5*** billion. ***The estimated market value of future production under Alternative A is net of a 2 percent allowance for gas used in***

processing, or flared or vented as part of field development and operations. Flaring or venting typically occur when transmission capacity is unavailable and also to increase safety. Operators try to minimize flaring and venting as it represents foregone revenue. The 2 percent allowance is not a projection of anticipated loss, but an allowance included to recognize that 100 percent of the gas production would not be marketed. The 2 percent allowance equates to a net reduction of approximately 0.39 percent in total estimated sales over the life of the field. Under Alternative A, peak annual market value of production would occur in 203***1*** at between $1.***81*** billion and $2.***80*** billion. The rapidity of both the growth and decline of the annual value for the range of energy prices is shown in **Figure 4.11-5**.

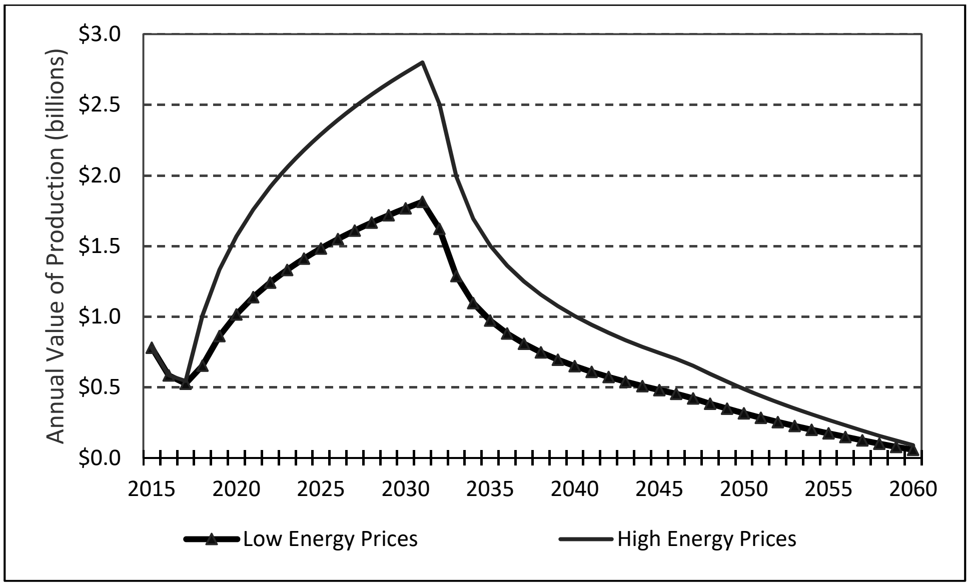


Figure 4.11-5 Estimated Annual *Market Value of* Oil and Gas Production under Alternative A

Royalties and taxes levied on the value of production would be substantial over the life of the resource within the CCPA. State severance taxes, federal and state royalties, and local ad valorem taxes would be the primary categories of such revenues. (Note: Additional descriptions of these revenue sources are presented as part of the impacts of Alternative B under Section 4.11.2 ***and Appendix C***.) Total estimated revenues from the defined sources based on anticipated production under Alternative A and the assumed range of oil and gas prices would be between $6.***5*** billion and $9.***9*** billion over the life of the Project-related production (**Table 4.11-2**). Federal mineral royalties would be the single largest source of revenues, ranging between $***2.8*** billion and $4.***3*** billion. Approximately 49 percent of the federal mineral royalties would be disbursed to the State of Wyoming, assuming continuation of the current federal regulations. Severance taxes would account for the second largest source of revenues, slightly surpassing ad valorem taxes on production. Additional ad valorem taxes (not included in the estimates shown in **Table 4.11-2**) also would be levied on the taxable value of well improvements as well as field production and processing equipment.

The counties, municipalities, school districts and many special service districts in the study area would likely see future increases in their respective ad valorem tax bases and ad valorem tax revenues under Alternative A. The increases would result indirectly from rising real estate values for existing property and the assessed values associated with new residential and commercial development. Such effects would be most likely to occur in Converse County due to larger existing base of residential and commercial development in Natrona and Campbell counties. The increases would occur over several years and may abate as development is completed. However,

some of the increase could persist long-term due to the overall expansion of the residential and commercial development. The indirect effects on ad valorem taxes are not estimated due to uncertainties regarding the timing, location and typical values associated with the future development.

An estimated 29 percent of the mineral estate in the CCPA is privately owned. Royalties on production would accrue as income to the owners of those interests, which may be different from the surface owners. Under Alternative A, such royalty income would be an estimated $0.5 to $0.7 billion (2015 dollars) over the life of the new wells. The mineral royalties paid to owners of the fee interests are not included Table 4.11-2.

Table 4.11-2 Estimated Taxes and Public-sector Royalties on Oil and Gas Production from Alternative A

	Estimated Revenues (2015 dollars)			
Tax / Royalty	**Years 1 to 10**	**Years 11 to 20**	**Years 21 to 30**	**Total for Life of Project (40+ yrs)**
Low Energy Prices				
Severance tax	***$586,213,000***	***$772,443,000***	***$300,526,000***	***$1,856,140,000***
Federal mineral royalties	***$876,580,000***	***$1,155,055,000***	***$485,735,000***	***$2,775,537,000***
State mineral royalties	***$95,876,000***	***$126,334,000***	***$53,127,000***	***$303,574,000***
Ad valorem tax, counties[1]	***$87,199,300***	***$140,394,500***	***$60,959,600***	***$323,155,900***
Ad valorem tax, schools[1]	***$326,997,200***	***$526,479,300***	***$228,598,400***	***$1,211,834,000***
Combined Total - Low	***$1,900,820,500***	***$2,628,153,800***	***$1,091,234,000***	***$6,251,535,900***
High Energy Prices				
Severance tax	***$896,928,000***	***$1,190,745,000***	***$463,421,000***	***$2,855,309,000***
Federal mineral royalties	***$1,343,713,000***	***$1,783,888,000***	***$750,425,000***	***$4,277,617,000***
State mineral royalties	***$146,969,000***	***$195,113,000***	***$82,078,000***	***$467,864,000***
Ad valorem tax, counties[1]	***$133,362,600***	***$216,377,100***	***$93,681,400***	***$496,551,900***
Ad valorem tax, schools[1]	***$497,330,800***	***$785,718,600***	***$349,353,500***	***$1,851,724,400***
Combined Total - High	***$3,018,303,400***	***$4,171,841,700***	***$1,738,958,900***	***$9,949,066,300***

[1] Allocations assume locally generated taxes are retained by the school districts and not subject to transfer to the state under the "recapture" provisions of the Wyoming School Finance Act.

Future expenditures for materials, supplies, equipment, and some construction and drilling services associated with new well development and production would be subject to state and local sales and use tax. The state imposes a 4.0 percent general sales and use tax on such purchases. Converse County and Natrona County both levy an additional 1.0 percent sales tax (general purpose). Converse County enacted an additional 1.0 percent special purpose tax in 2013. Approved to be levied for up to 10 years, the special purpose tax was automatically eliminated in late 2015 when the maximum allowable revenue authorized to be generated by the tax had been collected. Revenues generated by oil and gas development during the latter part of 2013 through 2014 played an important role in the rapid retirement of that special purpose tax.

Investments in new centralized gas-processing facilities or transmission pipelines also are taxable. Information provided by the OG estimates typical investment of between $7 million and $14 million per production well with investment of another $1 billion in field development and processing infrastructure. Therefore, the total future investment for the 1,663 new wells under Alternative A would be between

$13 billion and $24 billion. Detailed projections of the sales and use taxes are not supported by the available data. However, order of magnitude estimates conservatively assuming that 40 percent of the total investment would be subject to taxation would yield estimated sales and use tax revenues of between $***260*** and $***480*** million through completion of development (**Table 4.11-3**).

Table 4.11-3 Estimated Range of Sales and Use Tax Revenues on Capital Investment for Alternative A

	Capital Investment (2015 dollars)	
	Low	**High**
Total Investment	$13.0 billion	$24.0 billion
Taxable Total (40 percent of total)[1]	$5.2 billion	$9.6 billion
Projected Sales and Use Tax (***5.0*** percent average rate)[2]		
State of Wyoming ***(funds retained by the State)***[3]	$***144*** million	$***266*** million
Local counties and municipalities[4]	$***116*** million	$***214*** million
Total Estimated Sales and Use Taxes *Collected*	**$*260* million**	**$*480* million**

[1] Assumption based on 100 percent of estimated expenditures on tangible products and 30 percent of non-labor expenditures on drilling services, rig rentals, and completion services.

[2] Based on assumption of ***100*** percent of taxable purchases subject to 5 percent sales ***and use*** tax rates ***(i.e., 4 percent State plus 1 percent local general purposes optional sales and use tax rate).***

[3] ***Note that 69.31 percent of the State's 4 percent tax is retained by the State, and 30.69 percent is distributed to counties and municipalities.***

[4] ***Includes local general purpose tax revenues and 30.69 percent of the state's 4.0 percent tax revenues to local governments.***

Based on the current revenue distribution formulas, approximately ***55*** percent of the total would accrue to the State of Wyoming and ***45*** percent (i.e., between $***116*** and $***217*** million) would accrue to county and municipal governments. The single largest share of the local government revenues would accrue to Converse County; however, nearly half of the ***local government share of the State's allocation to local governments*** would be distributed to counties and municipalities outside the three-county area. ***Additional local sales and use tax revenues would result during periods when local specific purpose option taxes are being levied. Such taxes are subject to approval of local voters and have been levied in Converse County to fund major capital projects in recent years.***

These estimates do not include sales and use taxes derived from investments that would be made by oil field service and transportation companies intended to support this and other projects in the area. The ***estimates*** also do not include additional taxable expenditures that would occur over the life of the field (e.g., in conjunction with ongoing production, well maintenance, and repairs).

Future development under Alternative A would support additional consumer expenditures in the regional economy by temporary and long-term workers associated with drilling, completion, production and reclamation. All sectors of the economy would stand to gain from the boost in consumer sales, with the most pronounced effects on the retail trade, food and beverage, and lodging and entertainment sectors. Such consumer expenditures would increase over time, as production and transportation employment would increase, augmenting the incremental expenditures associated with the development phase. The incremental expenditures would drop sharply after the development phase is completed. All three counties and the local municipalities would benefit from sales and use tax receipts derived from those consumer expenditures. Based on the anticipated work force residency patterns, locations of oil and gas company and service firms, and the comparative sizes of the trade and service sectors in the various communities, the bulk of the consumer related sales and use tax revenues would accrue in the Casper and Douglas communities.

The three Counties and the local municipalities would likely also see increases in other revenues, such as fees, fines, and some intergovernmental revenues such as motor vehicle and fuel taxes. Portions of the increases would be tied to increases in local activity, with population growth factoring into some intergovernmental distributions of state-shared revenue.

Alternative A-related local government tax revenues from the above sources would decline substantially as development ceases. Ad valorem tax revenues on production and facilities would continue but at reduced rates as production declines and facilities are depreciated. The lower level of production-related and consumer purchases would similarly reduce sales and use tax revenues. Federal mineral royalty distributions also would decline.

Social Conditions and Trends

Assuming oil and gas commodity price levels are sufficient to support ***continued*** resumption of drilling in the CCPA, the deployment of 10 ***to 12*** drilling rigs between 2018 and 2033 under Alternative A would result in economic gains for many residents and public revenues for local governments of the three-county analysis area and the State of Wyoming. This level of development would provide employment opportunities, increased income, and a higher material standard of living for many residents, without resulting in as large of a workforce or as severe of housing competition as occurred in the 2013/2014 period, depending on the level of regional oil and gas development occurring at the time. Communities within the three-county analysis area likely would be able to accommodate the modest influx of workers and additional population associated with such development with existing infrastructure and services, although some increases in staffing for road and bridge, weed and pest control, and law enforcement may be needed in Converse County to accommodate the continued development activity. The reduction in employment and population that would accompany the completion of the 15-year development phase likely would not result in substantial excess infrastructure and service capacity for any community within the three-county analysis area. ***Similarly, population out-migration would be spread across communities in the three-county analysis area.***

As with any increase in population, increases in traffic congestion and accidents, crime, and social problems such as substance abuse would be anticipated; however, the pace of development associated with Alternative A likely would not result in substantial changes in community character or social conditions within any affected community in the three-county analysis area. As described in Section 3.11.11, conflicts could arise when oil and gas facilities are located within proximity to areas valued for their historic, cultural, scenic, or recreation amenities, and in or near rural residential areas. See Section 4.2 (Cultural Resources), Section 4.15 (Visual Resources), and Section 4.10 (Recreation) for more detailed discussion of impacts to these resources.

Environmental Justice

As noted in Section 3.11.13, Environmental Justice, no concentrations of minority, low-income, or Native American populations have been identified in the socioeconomic and environmental justice analysis area that would be directly affected by the proposed action or alternatives. Consequently, no disproportionately high and adverse human health or environmental effects on minority, low-income, or Native American populations would be anticipated under Alternative A, and employment opportunities related to Alternative A in the three-county area could raise incomes for many low-income residents.

As discussed in Section 4.2.1.3, direct and indirect impacts to land and resources of Native American concern under Alternative A would include those that displace, destroy, or otherwise physically disturb ***these types of resources*** or would result in disturbance of sacredness by physical destruction of, or visual, auditory, and/or olfactory intrusions into, special areas and landscapes; changes to resource availability resulting from construction or other alteration of faunal and floral habitats and migration patterns; and interruption of access to important locations due to changes in roads and/or use. An estimated total of 31 cultural resource components of possible concern to Tribes could be affected by Alternative A (**Table 4.2-5**). The priority for treating resources of Native American concern would be both direct and indirect avoidance. If avoidance is not possible, mitigation plans would be developed and implemented in consultation with the BLM/USFS, SHPO, and affected tribes prior to conducting any surface disturbing activities. Avoidance or minimization of impacts on resources of Native American concern and the implementation of tribally approved mitigation plans as required by existing stipulations in the BLM Casper RMP (BLM 2007b) would avoid disproportionately high and adverse impacts on resources of Native American concern under Alternative A.

4.11.2 Impacts on Socioeconomics from Alternative B – Proposed Action

Under Alternative B, up to 5,000 new oil and gas wells would be drilled in the CCPA over the course of 10 years. The pace and timing of oil and gas development would be two key variables affecting socioeconomic conditions in communities near development. For purposes of this analysis, a consistent level of drilling ***of 500 wells per year by an average of 50 rigs*** was assumed for Alternative B. The actual pace and timing of development in the CCPA over time would depend on a variety of factors including oil and gas demand, pricing, regulatory approvals, rig and manpower availability, weather, and corporate strategies. Given the cyclical nature of oil and gas development and the regional nature of the oil and gas industry, surges and declines in development could result in higher or lower levels of drilling than those contemplated by this assessment. Consequently, actual incidence of socioeconomic effects described in the following sections could be lower or higher in any given year then those portrayed in this assessment, which assumes drilling and completion of 500 wells per year.

The uncertainties associated with oil and gas development often are related to fluctuations in energy commodity prices. Although a range of energy prices was used to examine the effects of different prices on future public sector revenues, the potential effects of such differences on the pace of development were not examined for this analysis.

Implementation of Alternative B would result in consistently increasing production over the 10 years of drilling, with estimated annual production peaking at 356 million cubic feet of gas and 94.3 million barrels of crude. Thereafter, production would decline over an extended period. Total production for Alternative B over the life of the field would be estimated at 5.79 tcf of gas and 1.37 billion barrels of crude.

<u>Employment</u>

A key driver of the socioeconomic impacts of Alternative B would be the estimated direct employment associated with the proposed oil and gas development, extending from pre-development approval and permitting through drilling, completion, production, and into reclamation. The labor-intensive drilling and completion phase for new wells is the initial focus of the assessment of foreseeable short-term effects on migration, population, housing demand, and public facilities and services. Over time, the level of field operations and production employment related to development of Alternative B would rise due to the need to service additional wells and haul increasing volumes of produced water and oil.

Direct employment estimates for Alternative B were developed based on information provided by the OG, and obtained from the U.S. Bureau of Economic Analysis, Census Bureau, and Wyoming Department of Employment. The estimates are assumed to be a reasonable reflection of the current state of practice for development, drilling, and production based on experience in the CCPA.

The OG provided information regarding the timing/phasing of development activities, duration of activities, and approximate numbers of employees, including both company and contractor employees, for a typical well in the CCPA.

Direct on-site employment at an individual well site would vary over time, ranging from a single field biologist doing pre-development site clearance to 30 or more drilling and well-service employees during drilling and completion operations. Some activities would be of relatively short duration (a matter of hours), while others could continue "round-the-clock" for weeks. Interim reclamation would occur at each site, employing a few workers for several days. Additionally, Project engineers and managers, state and federal regulatory and resource management staff, and others occasionally would visit an individual well site; however, these additional personnel were not included in the OG's summary of on-site employees. Allowances for these workers were captured in adjustments for off-site direct employees and estimated as part of induced employment. Based on information provided by the OG for Alternative B, **Table 4.11-4** provides a summary of the typical on-site worker requirements, duration of activity, and total person-days that would be associated with a 4-bore multi-well pad. ***Section 2 of Appendix C provides additional detail regarding the employment projections for Alternative B*.**

Table 4.11-4 Direct On-site Labor Effort to Complete a 4-bore Multi-well Pad

Development Phase	Typical Number of Persons on Site	*Typical Activity Duration (days)*	*Estimated Total Person-days on Site to Complete Well*
Location staking/surveying	4	***3***	***12***
Cultural/biological clearance	2	***1***	***2***
Location construction, including access and electricity	6	***16***	***96***
Rig mobilization/setup	11 to 20	***5***	***81***
Drilling	24 to 30	***110***	***3,935***[1]
Completion	9 to 21	***30***	***714***
Rig demobilization/move	11 to 20	***5***	***81***
Tank battery and wellhead/ production equipment setup	5 to 30	***40***	***995***
Interim reclamation	2	***1***	***2***
Engineers and other staff	1	***19***	***44***
Total	**1 to 30**	***243***	***5,962***

[1] ***The estimated total person-days on site reported for drilling includes the effects of a having substantially more than the typical employees on site on some days.***

Source: OG. 2014. Information provided to AECOM.

Oil and gas operators historically have been successful in refining development and production technologies and processes, which has reduced workforce requirements on a per well basis as they gain experience in a play. It is reasonable to assume that future technology and process refinements would occur, reducing workforce requirements. While development and production technologies and processes likely would improve and per/well workforce requirements likely would decrease during the 10-year development period, the timing and extent of workforce reductions are unknown. Therefore, the workforce forecasts contained in this analysis reflect current practices and may overestimate employment in the latter years of the 10-year development period.

The on-site labor requirements provided in **Table 4.11-4** were the basis for calculating the estimated direct on-site employment during field development based on the concept of work teams or crews, with a work team or crew responsible for each of the major development activities. Individual members of a crew may work together or independently, may be company employees or contractors, and may complete some of their work off-site. Given the varying durations of the key activities, the completion of an average of 500 new wells per year under Alternative B could involve an average of more than

100 separate work crews within the field on any given day, approximately 44 of which would be drilling crews directly associated with operating rigs. This estimated number of work crews was calculated based on the typical sequence of activities (**Table 4.11-4**), typical duration of each activity (with no overlap between activities), potential seasonal restrictions on activity due to weather, and allowances for 6 and 7 days per week for some activities.

Levels of on-site employment within the CCPA fluctuate over time due to factors including the numerous tasks involved in drilling, completing, and bringing a well into production; the specialized nature of crews involved in completing those tasks; the differing number of individuals associated with the various crews; and varying durations for distinct tasks and work schedules of different crews (some 5-day/40-hour weeks, some round-the-clock for extended periods of time). Over a typical 1-year period, on-site employment within the CCPA would average approximately 2,300 workers in conjunction with new well development and completions, with an estimated range of approximately 1,600 to 3,000 daily on-site workers. The variation primarily would result from differences in the number of rigs actively drilling and the number of completions occurring across the field. On-site employment would tend to be higher on weekdays than on weekends; however, weekend employment still would be considerable due to the on-going nature of many jobs and the schedule requirements for many tasks. Some seasonal variability in development activity and employment could occur due to weather, but employment would remain relatively high under Alternative B. ***The average number of days and number of person-days to drill and complete a well (see Table C-2 in Appendix C) are assumed to remain constant over the entire development period. The recent experience in the Bakken and elsewhere has been for significant improvements in efficiency as operators develop a better understanding of the geology and drilling conditions, and technology evolves. To the extent that this would occur in the CCPA, such improvements would result in reductions in the direct employment requirements to drill and complete any given number of wells, and subsequently, lower the development-related population and associated impacts on housing, public facilities and service, and other dimensions of the local socioeconomic environment.***

The round-the-clock drilling and sequential nature of some activities on a 7-day-per-week basis also would require additional employees in order to sustain work crews and give allowances for scheduled times off, illness, injury, turnover, and labor market inefficiencies. The workforce estimates for the development phase also must include allowances for administrative, management, maintenance, clerical, and other employees working locally for the company and contractors to support the on-site workers. An example of such direct-support jobs would be the mechanics based in Casper who maintain oilfield service trucks. A 40 percent allowance for the above jobs and workers was assumed, based on an analysis of data from the U.S. Bureau of Labor Statistics and industrial economic censuses (Census 2012; U.S. Bureau of Labor Statistics 2015b). The net adjustments for administrative and support personnel would raise the total direct employment associated with development under Alternative B by ***an average of*** approximately ***990*** workers ***over the 10-year development period. Substantially fewer administrative and support personnel would be required during the extended period of production***.

In addition to the employment associated with drilling, field development, and production, the construction of ancillary facilities to support oil and gas development under Alternative B would support additional employment opportunities within the three-county analysis area. The timing, location, and ultimate configuration of these facilities are not currently known, but their development would result in additional short-term construction and secondary employment during the period in which they were constructed. Most of these facilities would be constructed over a matter of months using a mix of local and non-local construction workers. The central processing/stabilization plants could require a year or more to construct, with a workforce ranging up to several hundred workers at peak.

Direct on-site employment also would occur in conjunction with long-term production and field operations. The primary activities associated with operations would be the ongoing monitoring, maintenance, and servicing of the wells, occasional well workovers, and the hauling of produced water and oil. Some producers may develop piping systems to handle produced water, which would reduce the number of employees required. However, the extent of such systems is currently unknown, so an all truck haul scenario was assumed for analysis. The number of jobs for each of these three categories would increase over time as the cumulative number of producing wells increases. The numbers of well service employees were estimated from information provided by the OG and the numbers of transportation workers were a function of the estimated water and oil production. As with the development employment, the estimates of employment during production included allowances to account for 7-day-per-week staffing and for management and support employees. The number of production and transportation workers would increase from nearly 400 in the first year of development to a peak of ***nearly 1,600*** workers in the final year of new well development. Thereafter, the number of such workers would decline as production and the amount of produced water declines.

Total estimated direct employment during production would increase over time, ***to 5,032 in Year 4 of the Project, declining the following year as construction of some larger ancillary facilities is completed*** (**Figure 4.11-6**). The peak would coincide with the development of the 500 new wells, ***increased transportation of high volumes of*** water and oil production, ***and construction of the last non-linear ancillary facilities*.**

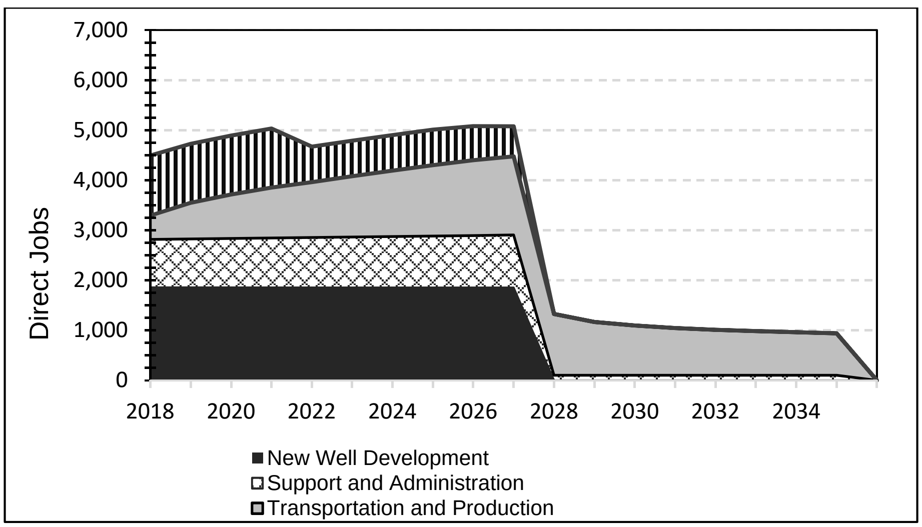


Figure 4.11-6 On-site and Off-site Direct Employment from Alternative B

Economic activity associated with Alternative B would result in additional economic growth in the three-county region. The incremental employment growth (i.e., employment above and beyond the existing employment in the CCPA plus that due to Alternative A) would increase over time as production would increase the demands for operations and transportation of water and oil.

Estimated employment gains of ***8,508*** jobs in the region would result from ***the drilling and completion of 500 wells, again assuming no improvements in technology or other efficiencies that would reduce the direct workforce requirements*.** This ***total*** includes ***4,089*** direct jobs and ***4,419*** indirect and induced jobs supported by the increased economic stimulus associated with new well development; construction of ancillary facilities, ***new residential and commercial development*,** and infrastructure; purchases by the operators, suppliers, and vendors; consumer purchases by employees; and increased expenditures by local public entities. ***Total project-related employment would rise to 9,485 jobs in Year 4, followed by a*** short-term dip in direct employment would occur as construction of major ancillary facilities is completed. ***The incremental employment in the three-county area under Alternative B would peak at 9,556 in Year 9 of development*** (**Figure 4.11-7**)*.* ***That total would*** include *5****,076*** direct and ***4,480*** indirect and induced jobs. Over the 10-year period of development, each direct job would support approximately 0.***80*** to 0.9***8*** induced and indirect jobs in the three-county area.

The strong gains in employment would affect local labor-market conditions. Local labor force participation rates would rise and local labor unemployment decline, perhaps below 2.0 percent**.** ***Such rates have been experienced in the Bakken region of North Dakota and elsewhere in Wyoming during periods of rapid energy development*****.** ***Shortages of available labor would result in substantial labor-force in-migration.***

Note that the estimated effects on indirect and induced jobs may not fully capture the effects on state and local government and other public-sector employment. The underestimation arise***s*** due to the manner in which the IMPLAN model addresses the local employment effects of changes in public sector revenues. Given the recent shares of state and local government employment to total employment in the three-county region and the scale of anticipated population gains and service needs, ***the*** underestimation ***would*** likely be relatively small ***in magnitude*** and would not substantively affect the assessment of other socioeconomic impacts.

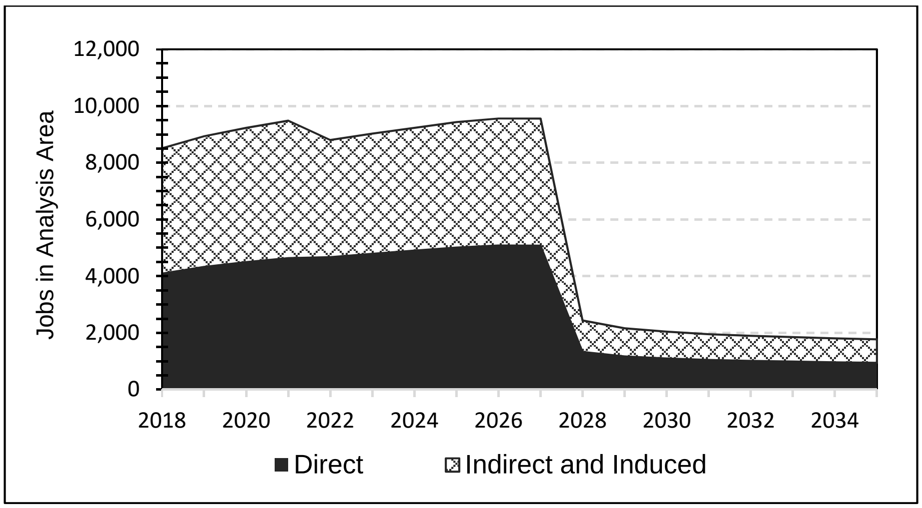


Figure 4.11-7 Estimated Incremental Employment in Analysis Area for Alternative B

At peak production, the combined total local employment in the three-county area would increase under Alternative B by approximately eight percent compared to total 2013 employment. Although the work site locations for Alternative B drilling and other field development would be in Converse County, substantial job gains, including direct jobs as well as indirect and induced jobs, would be based in Natrona County. All sectors of the local economies would be expected to see job gains as a result of development under Alternative B. Beyond the direct impacts in the energy sector (including the oil and gas industry) and transportation, the largest gains in private sector jobs would occur in retail and wholesale trade, construction, accommodations, and food service. Local government employment also would increase given implementation of Alternative B.

Although ***some*** decline in tourism and outdoor recreation in Converse County ***might*** be anticipated with implementation of Alternative B, given the anticipated absorption of much of the temporary accommodations by oil and gas workers, possible reductions in access to private lands, and changes in the outdoor recreation experience related to the proposed oil and gas development, most businesses that service tourism and recreation visitors (e.g., lodging, dining, convenience retail) also would serve oil and gas employees; therefore, they likely would not experience a net loss of business. On the contrary, development contemplated under Alternative B would support a more consistent level of activity for those businesses than that provided by tourism and outdoor recreation visitors, which tend to be more seasonal. Businesses that rely heavily or exclusively on tourism or outdoor recreation visitors, such as hunting outfitters and taxidermists, could experience declines in business and lower income during the 10-year development period. Long-term effects on hunting and outdoor recreation could persist following the development period due to the change in the recreational setting associated with the increased level of industrialization and continuing production activities in the CCPA. See Section 4.10 for detail regarding impacts on recreation, including hunting.

Completion of field-development would trigger substantial reductions in ***direct, indirect, and induced*** employment; net reductions of ***more than 7,000*** jobs are likely in the analysis area within 2 years. Further declines would be expected as oil and produced water volumes decline.

Year-to-year variability in the pace of drilling likely would result in some corresponding fluctuations in the number of drilling and field-development jobs with higher rates translating into more employees and lower rates of drilling requiring fewer employees. Levels of off-site direct employment likely would be slightly less sensitive to fluctuations in drilling employment, but sustained differences in the annual number of wells drilled eventually would be accompanied by commensurate changes in off-site employment. Differences in the annual rate of drilling and development would translate into slight differences in the number of incremental employees hired during production and operations, but such employment tends to be more responsive to the long-term levels of production than to current drilling rates.

Labor-market conditions in the CCPA were tight in 2014 due to past and ongoing energy and mineral resource development. Unemployment rates were very low, labor-force participation among residents was high, and temporary, non-resident workers filled many jobs. Since then, declining energy prices slowed the pace of development to very low levels, triggering layoffs. Labor-market conditions eased, increasing worker availability and out-migration of some non-resident workers. The higher rate of development associated with Alternative B would result in a return to the active exploration and development conditions that existed in 2013 and 2014, including ***potentially record*** low unemployment as available local labor would be absorbed and an influx of workers, many of whom would be single-status.

Some local employers would likely see an increase in staff turnover and a need to fill more job vacancies as some existing employees accept higher paying project-related jobs. Some affected employers could have trouble recruiting and retaining employees to meet future staffing levels to maintain services, especially during the initial development phase. The difficulties would arise due to the high wages and salaries typically available in the oil and gas industries, and the limited availability of affordable housing, rising cost of living, and limited child care options. Employers could respond by increasing wages and salaries, offering more hours to part-time workers, having proprietors and managers work additional hours, modifying the hours of operation, and other adjustments in operations.

Labor-market conditions would again change upon completion of development, and labor demand would weaken relative to available supply. Local unemployment would rise, labor-force participation would decline, and labor-force out-migration likely would occur.

Personal Income

Total and average per-capita personal income would increase under Alternative B due to increases in the number of jobs, particularly in the relatively higher-paying energy-sector. More energy sector jobs would contribute to rising per-capita incomes, which also would receive a boost from the upward pressure on all wages and salaries from the tight labor markets. ***Based on recent experiences in Sublette and Converse Counties, average weekly wages would rise substantially under Alternative B. The increases in average wages would be broad-based, but likely to accrue disproportionately to many of those workers employed in the energy and related industry, whether they are current residents or workers drawn by the industry.*** Higher incomes also could be realized by individuals who gain full-time employment but were previously employed part-time. ***Individuals on fixed incomes, and workers employed by employers unable to keep pace with the broad-based wage escalation would not see their incomes keep pace with the rises in overall average weekly wages*. *Investors and landlords of residential and commercial property likely would realize increases in property income.***

As discussed in Section 3.11.5, during the increase in energy development activity between 2012 and 2014, the cost of living in Converse County increased compared to the Wyoming statewide average*. *Similar effects likely would occur under Alternative B. Consequently, some of the gains in personal income likely would be offset by higher housing ***costs*** and ***higher costs of food, clothing, transportation and other consumer goods and services*** (i.e., higher cost of living). Individuals on fixed income, those who otherwise do not realize income gains, ***and those whose gains do not keep pace with the increases in the cost of living*** could experience diminishment of their economic wellbeing. The positive effects on income related to Alternative B would eventually diminish over time, particularly following the completion of the well-development phase. ***The effects on the cost of living, particularly in Converse County, also likely would moderate and become more comparable or below the statewide average.***

Effects on income would include short and long-term effects on agricultural income due to changes in land use associated with oil and gas development. Such changes would include reductions in authorized grazing of as many as ***1,084 federally permitted*** AUMs (Section 4.9), ***short-term or long-term loss of production from some private crop or grazing lands, and other indirect effects including changes in operating practices and increased operating costs. A net reduction of 17,815 federally permitted AUMs would occur over 20 years under Alternative B. The economic value of such reductions to local ranchers would be $328,865 over 20 years under this alternative; an average of $16,643 per year. The average annual loss, before any offsets provided by surface use and damage agreements, would be equivalent to less than 0.02 percent of the total farm income of Converse County ranchers in 2012. Based on a net economic value of $16.96 per AUM for cattle (Wyoming Department of Revenue, Property Tax Division 2015) and annual fee of $1.69 per federally permitted AUM (BLM 2015), federal grazing fees would be reduced by $25,119 over the 20-year period. The rate is revised annually and was $1.41 per AUM for 2018. The reductions in federally permitted AUMs, along with the associated effects on ranch income for the affected ranchers would continue long-term, decreasing in magnitude as reclamation occurs. The surface use and damage payments would offset the economic losses from grazing reductions for affected landowners*. *The reductions in AUMs on federal surface along with the associated effects on ranch income for the affected ranchers would continue long-term, decreasing in magnitude as reclamation occurs. Tenants who lease grazing or cropland on non-federal surface and who would be affected by oil and gas development would not receive compensation under a surface use agreement. The number of tenants that would be affected and the magnitude of any resulting economic effects is unknown.***

The mitigation measures for range resources outlined in Section 4.9 would reduce impacts on permittees with grazing allotments on federal lands.

Population

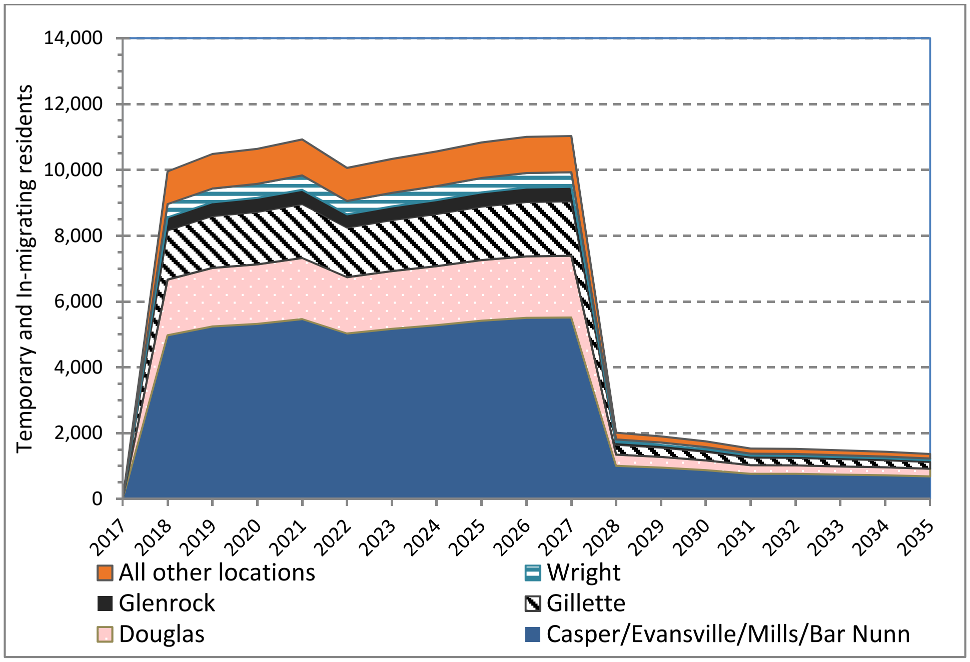
Implementation of Alternative B would provide long-term economic stimulus to the three-county analysis area. Local labor availability to fill the jobs supported by the economic expansion could be limited due to the effects of outmigration associated with recent cutbacks in the energy industry and by the absorption of available workers to meet the labor demand associated with the development of previously approved wells.

Under Alternative B, substantial net labor migration of temporary workers would occur, particularly for workers with the specialized skills needed in the oil field. The rapid increase in demand for transportation and support workers, as well as individuals to fill the indirect and induced jobs created also would trigger in-migration.

Driven by migration, population growth due to Alternative B is projected to increase over time ***by more than 10,900*** additional residents by Year 4 (**Figure 4.11-8**). ***An estimated 5,462*** additional residents would reside in Natrona County***, and 2,294*** additional residents ***would reside*** in Converse County*.* Campbell County and communities and unincorporated areas in nearby counties ***would see combined population growth of 3,168 residents in Year 4 under Alternative B***.

During the drilling and field development phase of an oil and gas play, the majority of employment is associated with oil and gas service companies. While some of these firms may be dedicated to a single operation or location, many serve multiple operators and locations across a broader region. As shown by **Table 3.11-3**, during the third quarter of 2013, over 51 percent of the oil and gas extraction companies in the three-county analysis area were located in Natrona County, approximately 40 percent were located in Campbell County, and approximately 9 percent were located in Converse County. Additionally, approximately 41 percent of the companies that supported mining activities (including oil and gas) during that same timeframe were located in Natrona County, approximately 45 percent were located in Campbell County (although the majority of these likely served the coal mining industry), and approximately 14 percent were located in Converse County.

Many employees of the companies that support oil and gas extraction report to their employer's offices or yards and transport company vehicles and equipment to the job site, which may be in Converse County one day, in Campbell County the next day or week, and elsewhere in Wyoming the following week. Under Alternative B, some oil and gas service companies likely would locate field offices and yards in Converse County. However, in central and eastern Wyoming, Casper has been the regional oil and gas service center for nearly a century. For this reason, it is assumed that the largest share of incremental population associated with direct and indirect oil and gas service industry employees related to Alternative B would reside in the Casper area. Campbell County also would experience population growth associated with expansion of existing oil and gas service firms in the Gillette area. The Casper area also is a regional commercial and service center and has the largest stock of both temporary and conventional housing; therefore, it also is assumed that the largest share of induced workers would reside in the Casper area.



NOTE: Includes temporary and in-migrating populations. Excludes 250 to 500 oil field workers assumed to be housed in rig camps and other temporary workforce housing in Converse County.

Figure 4.11-8 Estimated Population Changes due to Alternative B

The majority of the incremental population change in Converse County from Alternative B likely would reside in Douglas and Glenrock. In Natrona County, most of the incremental population likely would live in the Casper area, including Bar Nunn, Evansville, and Mills (**Table 4.11-5**). In Campbell County, most of the incremental population would live in Gillette and Wright. The remaining incremental population likely would be distributed across other communities and unincorporated portions of the three-county area and to communities outside the analysis area. The net increase in population would be comparable to the net increase in employment, reflecting a combination of a high level of single-status workers, two-worker households, workers holding multiple jobs among the immigrating households, and an increasing number of temporary non-resident and commuting workers.

Table 4.11-5 Incremental Population Changes from Alternative B

Community	2014 Population	Incremental Population			
		2018	2021	2027	2028
Casper/Evansville/Mills/Bar Nunn	69,342	***4,975***	***5,462***	***5,513***	***1,004***
Douglas	6,423	***1,691***	***1,857***	***1,874***	***342***
Gillette	31,971	***1,493***	***1,638***	***1,654***	***301***
Glenrock	2,583	***399***	***437***	***442***	***81***
Wright	1,847	***399***	***437***	***442***	***81***
Rolling Hills	439	***50***	***54***	***54***	***10***
Other Communities	NA	***946***	***1,039***	***1,029***	***192***
Total	**112,605[1]**	***9,953***	***10,924***	***11,027***	***2,011***

[1] Total not including Other Communities.

The incremental population effects of current residents changing jobs are unclear. Some incremental population increases would result if vacant positions result in a higher number of openings than are provided for in the labor force assumptions described above. At the same time, there would be little net difference in population effects from having an in-migrating worker fill the job vacated by the current resident as compared to that same worker filling a newly created job opening.

The peak incremental population impacts associated with Alternative B would represent approximately ***8*** percent of the 2014 resident population of the combined affected communities in the three-county analysis area. The estimated peak population impact in Douglas would represent a ***26*** percent increase, over the 2014 estimated population.

The estimated population impacts would include a large number of temporary single-status workers who would be employed by the operators and their contractors. These workers would place demands on temporary and rental housing, increase demand on local facilities and services, increase market demand for private-sector businesses, and generate public-sector revenues; however, they would result in less indirect demands on facilities, services, and conventional housing than do migrating households. Following the completion of new well development, the number of non-resident workers would decline substantially.

Short-term surges in temporary construction workforces would occur in conjunction with the construction of the ancillary facilities as described in the employment section. The production and operations workforce associated with these facilities would be relatively small and result in small long-term changes in population within the analysis area.

Population declines of more than 9,000 residents would follow the completion of development in the CCPA, depending on the level of other economic activity occurring at the time. Most of the loss would occur in Natrona County, but the highest percentage of loss relative to population would occur in Douglas, Glenrock, and Wright.

Housing

Workers relocating on a temporary or long-term basis in conjunction with Alternative B would generate demand for a variety of housing types. Although some rig hands, oil and gas service workers, and pipeline and ancillary facility construction workers could occupy rental housing and apartments if available, given the limited availability of such housing, m***any*** workers likely would occupy temporary housing such as hotels, motels, RVs, rig and construction worker camps, and other temporary living facilities, especially during the early years of the 10-year development period. Experience in southern Wyoming, North Dakota's Bakken region, and other large-scale oil and gas plays has shown that during periods of intensive oil and gas development, many workers would relocate to an area temporarily for a period of weeks or months, returning to their home communities between work shifts or assignments. Most of these workers would relocate in single status (i.e., without other household members). Workers with long-term assignments such as managers, administrative, and technical personnel likely would seek rental accommodations in conventional housing, mobile homes, and apartments, while others would purchase homes or mobile homes. Most workers in sectors supporting indirect and induced jobs, including those in health care, education, government positions, retail trade, and consumer services likely would seek rental housing, mobile homes, and apartments or would purchase homes. However, the ability to procure affordable housing for many workers in the indirect and induced job categories could be hampered by the relatively lower wages as compared to those in the energy development industries.

Most communities in the three-county region and some outside the region likely would experience an influx of workers and population associated with Alternative B. Availability of housing, proximity to worksites, housing costs, employment opportunities for spouses, and access to community amenities

including shopping and schools are among the factors that would influence residential location decisions. For oil and gas drilling and service workers, proximity to employer offices/yards, proximity to worksites, and the ability to procure short-term housing would be key factors in residential location decisions. A portion of housing demand in the early years of development under Alternative B would be associated with private sector housing construction workers and employees of oil and gas drilling, service, and pipeline/ancillary facility construction companies. Workers unable to find suitable and affordable housing within the analysis area would commute to/from more distant communities, particularly in the early years of the development period when housing availability would be tight, and housing costs would escalate rapidly. If the housing availability closer to the CCPA improves over time, non-resident workers with ongoing job sites within the CCPA could locate closer to save travel time and travel costs.

Based on community size, distance from the CCPA, ***availability of*** temporary and conventional housing resources, the location of oil and gas service company offices and yards, and other factors, it was assumed for analysis that 50 percent of non-local employees not living in temporary workforce housing would reside in the Casper metropolitan area, 17 percent in Douglas, 15 percent in Gillette, 4 percent each in Wright and Glenrock and the remaining 10 percent in other locations both within and outside the three-county area. **Figure 4.11-9** displays annual housing demand***, including temporary accommodations, apartments, and owner-occupied housing*** through 2032 for Alternative B.

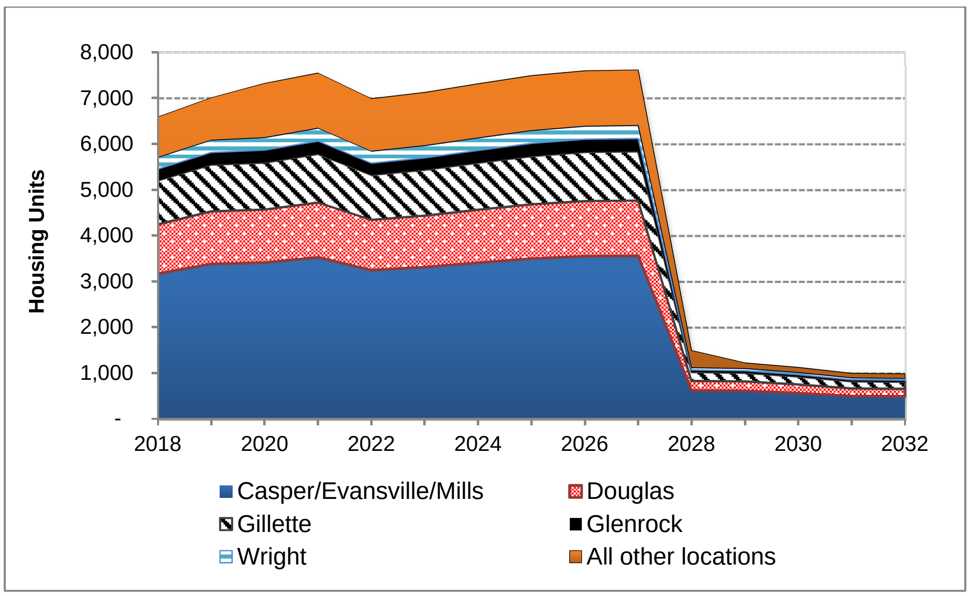


Figure 4.11-9 Estimated Housing Demand by Location for Alternative B

Table 4.11-6 provides housing demand by location for years 2018, ***2021***, ***2027***, 202***8***, and 2032. During the first year of development, Alternative B housing demand would total ***6,590*** units***, the majority of which would be for temporary accommodations and rental units***. Total housing demand would ***rise to 7,548 units*** in 202***1***, the ***fourth*** year of development. Projected project-related demand would ***decline by approximately 600 units following completion of construction of larger ancillary facilities and residential, commercial, and industrial development spurred by development under Alternative B, and then climb to a peak of 7,614 units in the final year of development. Alternative B-related housing demand would be approximately*** total units in 2032, 5 years after the 10-year development period ends. Periodic spikes in temporary housing demand would occur after development during well workovers, and major maintenance of ancillary facilities.

Table 4.11-6 Estimated Housing Demand by Location for Alternative B

Community	Demand (housing units)				
	2018	***2021***	***2027***	***2028***	***2032***
Casper/Evansville/Mills	***3,169***	***3,524***	***3,557***	***620***	***491***
Douglas	***1,077***	***1,198***	***1,209***	***211***	***167***
Gillette	***951***	***1,057***	***1,067***	***186***	***147***
Glenrock	***254***	***282***	***285***	***50***	***39***
Wright	***254***	***282***	***285***	***50***	***39***
All other locations (including company-provided temporary worker housing)	***885***	***1,205***	***1,211***	***374***	***99***
TOTAL	***6,590***	***7,548***	***7,614***	***1,491***	***982***

Figure 4.11-10 displays estimated housing demand by type of housing for Alternative B based on the foregoing workforce and population estimates. These housing need estimates reflect the following assumptions:

- It *i*s assumed that as many as 500 single-status workers would be housed in temporary workforce housing (e.g., rig camps or commercial dormitory style housing facilities, commonly referred to as man camps). This assumption was based on the construction of additional workforce facilities in the CCPA under Alternative B and recent practices elsewhere in Wyoming and in the Bakken area of North Dakota where some drilling contractors and service companies provide or contract for in-field housing. Such facilities typically are of modular design and construction and scalable in terms of capacity. ***Larger workforce housing facilities are generally self-contained, providing sleeping, dining, and recreation facilities and on-site security.*** The facilities typically are removed from the site when the need has eased, or more conventional housing capacity is complete. One such facility, ***originally*** built to service workers in the Bakken region, was designed to be converted from smaller efficiency apartments to larger, more family-oriented apartments ***to meet long-term production related needs*** (Oil Patch Dispatch 2012).
- The locations of these facilities likely would be in Converse County.
- The housing demand in Casper, Douglas, and Gillette is estimated to be 40 percent in motels, hotels, and RV parks; 50 percent in rental housing; and 10 percent in purchased conventional and mobile homes.
- Housing demand in other communities in Converse, Campbell, and Natrona counties and communities outside the analysis area (including Glendo, Lusk, and Wheatland) would be 78 percent temporary accommodations, 20 percent rental units, and 2 percent owner-occupied homes.

As shown in **Figure 4.11-10**, the majority of estimated housing demand during the first year of development under Alternative B would be for hotel/motel rooms and RV pads or for rental units (approximately 40 to 45 percent of demand for each category). ***Total*** estimated housing need ***to meet demand*** in the fourth year of development ***would exceed 7,500*** housing units***, including temporary construction worker housing***. The vast majority of demand would be for hotel/motel rooms, RV pads, and rental units. ***Oil and gas c***ommodity prices adequate to support the level of development for Alternative B likely would stimulate other oil and gas development in Converse and Campbell counties, and elsewhere in the region, which would create temporary housing demand from other sources.

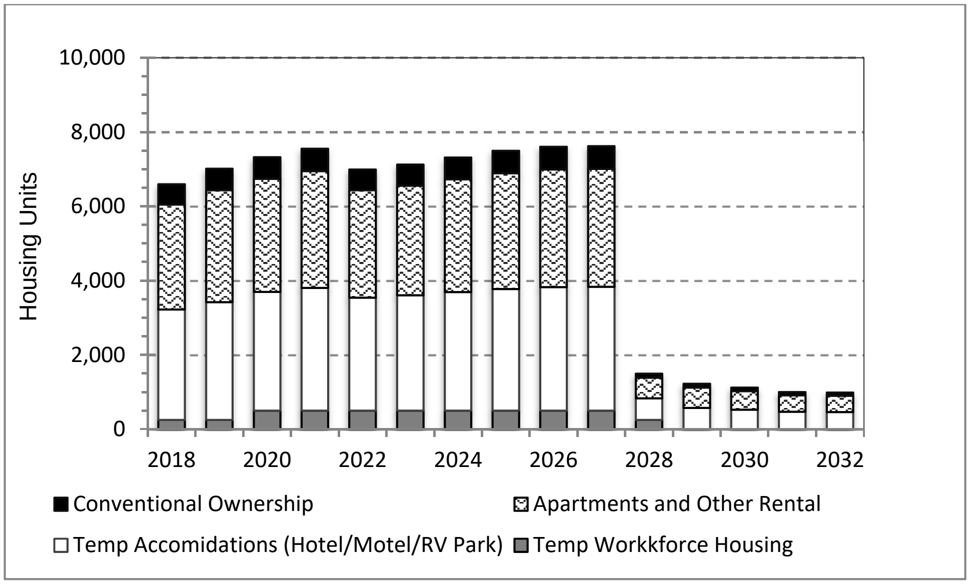


Figure 4.11-10 Housing Demand by Type for Alternative B

The major communities in the three-county analysis area collectively have adequate hotels, motels, and RV parks to accommodate the temporary housing demand from Alternative B during the peak year of development, not including workers assumed to be housed in temporary workforce housing. However, accommodating peak demand in Douglas, Glenrock, and Wright would leave little availability to satisfy competing demands from travelers, tourists, and special events.

The residency distributions outlined in **Figure 4.11-9** and **Table 4.11-6** reflect the population distribution over the course of the 10-year development period, assuming the availability of adequate housing resources to accommodate the demand. A critical factor affecting residency distribution would be the ***future*** availability of rental and conventional housing in the Douglas market. Housing shortages in the Douglas market ***at the outset of the assumed level of development with Alternative B*** likely would "push" more population to Casper and Gillette given the greater availability of temporary and conventional housing in those communities. ***Over time, the expansion of the housing stock in Douglas would result in population residency more in line with that projected above. In rapid growth situations such as that which would happen with Alternative B, particularly one in which uncertainty and year-to-year variation in the actual pace of development could occur, local communities and residential and commercial builders face challenges in forecasting demand and avoiding over-building.***

Recent experience in other large-scale energy development regions has shown that housing shortages could result in unconventional housing arrangements, particularly in the early stages of development. Where allowed by local ordinances, local homeowners rent rooms to energy workers or allow RVs in backyards and driveways. Workers camp on public and private lands and have higher than desirable numbers of occupants in rental units. Strategies used in the past to accommodate peak temporary housing demand in Converse County (e.g., opening fairgrounds for campers) may not be sustainable over the long term. Many of these situations abate over time as additional ***new conventional*** housing ***(i.e., apartments, mobile home spaces, and housing for purchase) is built and*** becomes available; however, residential development typically requires a long lead-time to implement, particularly when considered in comparison to the relatively quick response capacity of the oil and gas industry, either in gearing up for drilling and development or scaling back when commodity prices fall. The overall vision for the 7 Trails development, which was recently annexed into the City of Douglas, envisions development of 1,800 dwelling units over the next 25 years or longer, along with commercial space, and space for school and other community infrastructure (Wagonhound 2015). To the extent that some of the envisioned residential development would occur in a timeframe and price range consistent with the needs of Alternative B, 7 Trails could accommodate a portion of the estimated demand for rental units and homes for purchase for Douglas.

Rental housing in the three-county analysis area was almost fully absorbed during the fall of 2014 when there were 18 rigs drilling in Converse County, 13 in Campbell County, and substantial oil and gas infrastructure development was occurring in both counties. Most of the incremental rental housing demand for Alternative B would need to be filled by the construction of new units. However, developers and lenders may be reluctant to build a large volume of rental units on speculation given the number of units required, the relatively short duration of demand (10 years), and the experience of the recent oil price collapse. The high level of short duration demand could result in higher reliance on mobile homes and modular home construction as opposed to more conventional stick-built construction.

In summary, the shortage of rental housing in the three-county analysis area associated with Alternative B-related demand would result in a variety of effects. These could include:

- ***More workers living in temporary accommodations (hotels, motels, and RV parks).***
- ***More workers seeking temporary accommodations in the Casper area and Gillette, and in communities outside the three-county analysis area.***
- ***Increased housing costs for renters. Based on the recent experience in Sublette County, average rents in Converse County would likely increase dramatically; potentially to the $1,000 - $1,200 per month range for apartments and potentially above $1,600 per month for houses (see 3.11.7 and Appendix C for more details).***
- ***Increased home sales prices. Average sales prices of homes sold in Converse County would increase dramatically in the near term to $300,000 or more, depending on how quickly and strongly the residential construction sector responds.***
- ***Oil and gas service companies developing more temporary living facilities near worksites.***
- ***Workers residing in unconventional living situations.***
- ***Workforce shortages for oil and gas companies, which could affect the pace of development, and for local governments, companies that provide goods and services to oil and gas companies and consumers.***

Recent experience in other large-scale energy development regions has shown that housing shortages could result in unconventional housing arrangements, particularly in the early stages of development. Where allowed by local ordinances, local homeowners rent rooms to energy workers or allow RVs in backyards and driveways. Workers camp on public and private lands and have higher than desirable numbers of occupants in rental units. Strategies used in the past to accommodate peak temporary housing demand in Converse County (e.g., opening fairgrounds for campers) may not be sustainable over the long term. Many of these situations abate over time as additional new conventional housing (i.e., apartments, mobile home spaces, and housing for purchase) is built and becomes available; however, residential development typically requires a long lead-time to implement, particularly when considered in comparison to the relatively quick response capacity of the oil and gas industry, either in gearing up for drilling and development or scaling back when commodity prices fall. Over time, as new residential

development is completed average monthly rents and average home sales prices stabilize and the decrease as housing shortages ease.

Long lead-times and funding required for infrastructure development could hamper new development in some locations. Given these factors and the recent pace of housing construction in the three-county analysis area, the regional housing construction industry likely would not meet estimated demand in a timely fashion. Relying on residential construction contractors from other areas also could be problematic as construction workers would compete with oil and gas workers for housing and could be attracted to higher paying jobs in the energy industry. Coupled with the likely reluctance of developers and lenders to engage in speculative housing projects, this could lead to an inadequate housing supply to accommodate the estimated population increase anticipated for Alternative B.

Over time, demands due to Alternative B could stimulate construction of additional temporary accommodations by the private sector. However, severe housing shortages and escalating housing costs could create pressures on wages and salaries in the early years of development, which would increase labor costs to employers and potentially affect the ability of the operators to hire and retain sufficient labor to sustain the proposed development rate. A shortage of rental housing also would complicate the ability to attract and retain nonlocal workers in industries where indirect and induced employment would be stimulated, including construction, health care, local government, and education. The retail and hospitality industries also could experience hiring difficulties related to housing availability.

As noted above, the coal mining industry in the region is facing major uncertainties and changing market conditions. Depending on the future course of adjustments to those conditions, the availability of housing could change in Douglas, Wright, and Gillette. Weak prices and declining demand for Wyoming coal triggered layoffs in the mining industry, with the prospect of further layoffs in the future. As a result of these layoffs, local labor could fill a larger share of the jobs, which could reduce population in-migration for Alternative B or result in population out-migration and increase housing availability.

At the end of the 10-year drilling and field development period, housing demand related to Alternative B would decline substantially as employment needs decrease by more than 6,000 jobs over a 2-year period, triggering corresponding out-migration of population from the three-county area. Depending on the housing demands from other sectors of the local economy at that time, the sharp drop in demand could result in declining occupancy and nightly rates for lodging establishments, higher vacancy rates and lower rents for apartments and conventional housing, and lower resale prices and increases in the average time on the market to sell conventional housing. The recent experience in Sublette and Converse Counties, suggests dramatic declines, in the range of 25 to 40 percent in the average sales prices of homes and monthly rents when development under Alternative B is completed or the pace of development slows unexpectedly due to falling prices, or the completion of the proposed drilling program.

<u>Community Infrastructure and Services</u>

Large-scale oil and gas development associated with Alternative B would affect public infrastructure and services on two levels. Increases in industrial activity within the CCPA and increases in traffic to and within the CCPA would correspondingly increase the demand for law enforcement, emergency management and response, road maintenance, and weed and pest control services. Population increases in affected communities would generate corresponding increases in demand for the full range of community infrastructure and local government services. ***Workers who stay in workforce housing are often assigned to extended multi-day or multi-week work-shifts and commonly return to their permanent places of residence when they are off shift. They thus would place some temporary***

demands on local facilities and services but at lower levels than workers who reside in the community.

County and municipal governments would receive certain revenues from the Project, which could offset the costs of the additional services required to meet the demand. However, production and property tax revenues from the Project would lag development-related demand by 1 to 2 years. Municipal revenues generated directly by the Project would be limited to sales and use tax revenues, although portions of the severance tax and federal mineral royalty revenues ultimately would be distributed to municipalities.

Figure 4.11-8 and **Table 4.11-5** display the incremental population forecasts by community associated with Alternative B. Under Alternative B, Converse County and the special districts and volunteer organizations that provide services within the CCPA, as well as the counties and communities that host Project-related workers and population, would incur additional staff, equipment, and operating costs as services would expand to respond to the rapidly increasing demand. Recruiting and retaining staff would be challenging in a rapidly expanding economy, particularly under the housing shortages described in the preceding section. Although the revenues generated by Alternative B would be substantial, the bulk of those revenues would not be available until sometime after service providers begin to experience development-related demand. Sales and use tax revenue distributions would lag expenditures by a matter of months, and receipt of production and property tax revenues would lag by 1 or 2 years. Consequently, developing the service capacity to respond to the greatly increased demand would be challenging for the counties, municipalities, special districts, and volunteer organizations that provide services and infrastructure in the three-county analysis area. ***Additionally, local governments may be reluctant to finance major infrastructure or service expansions given the 10-year time frame for development and the uncertainty and volatility associated with oil and gas development.***

Converse County and the two municipal governments likely would experience difficulty recruiting and retaining employees to meet future staffing levels to maintain services, especially during the initial development phase. The difficulties would arise due to the high wages and salaries typically available in the oil and gas industries, and the limited availability of affordable housing, rising cost of living, and limited child care options. Those challenges might ease over time, particularly if additional housing is developed and as production levels increase; the latter offering more stable, long-term employment opportunities.

At the end of the 10-year drilling and field development period, employment needs for Alternative B would decrease by ***more than 7,000*** jobs over a 2-year period, resulting in a corresponding out-migration of population from the three-county area. Local governments that expanded their infrastructure and services would face excess capacities and declining oil and gas revenues to fund facilities and services. Although reductions in staff levels could occur, substantial facility operating and maintenance costs would continue.

Law Enforcement

Law enforcement agencies would be affected by increases in population, traffic, and demographic changes in service populations under Alternative B. As shown in **Table 3.11-*23***, the three counties in the analysis area staff municipal police and county sheriff departments from 1.0 to 3.8 total officers per 1,000 population. To maintain the current officer to population ratios, counties and municipalities would need to add a total of approximately ***11*** officers in Converse County, ***17*** officers in Natrona County, and ***5*** officers in Campbell County under the peak population forecast for 2021 (**Table 4.11-7**). Additional non-certified personnel likely would be needed for all counties and communities. The estimate for Converse County does not explicitly include allowances for additional Sheriff Office deputies that may be needed for increased traffic enforcement and other duties within the CCPA. Additionally, the peak population estimates do not include estimates for other locations residing in unincorporated areas of all three counties and communities outside the socioeconomic assessment area. This other population (estimated at ***947*** persons in the peak year for Alternative B) would be dispersed across a large geographic area and a number of communities; therefore, the incremental population in any one area would be small and likely would result in negligible demand for law enforcement or other services.

Table 4.11-7 Estimated Peak Demand for Law Enforcement Officers from Alternative B

County/Agency	2013 Officers per 1,000 Residents	Peak (2021) Population Increase	Estimated Additional Officers
Converse County			
Sheriff	2.3	***2,294***	***6***
Douglas	2.2	***1,857***	***4***
Glenrock	2.7	***437***	**1**
Natrona County			
Sheriff	1.2	***5,462***	***7***
Casper/Evansville/ Mills	1.8[1]	***5,462***	***10***
Campbell County			
Sheriff[2]	1	***2,075***	**2**
Gillette	1.7	***1,638***	***3***

1 Average does not include Bar Nunn, which is included in the Sheriff Office numbers.

2 Includes demand for officers in Wright.

In addition to the recruiting challenges referenced above, providing a vehicle and equipment for new recruits would be costly, and officer training both at the law enforcement academy and on the job could require 6 months or more. Given recent fluctuations in energy prices, counties and municipalities may be hesitant to make substantial investments in law enforcement agencies in advance of development; therefore, law enforcement agencies likely would be strained in the early years of development.

The existing Converse County detention facility is over capacity, and the county periodically houses some detainees outside of the county at substantial expense. A new detention facility ***is located in the recently completed Converse County Joint Justice Center in Douglas. T***he capacity of that facility or ***its ability to accommodate Alternative B-related demand*** are not known at the time of this analysis. The Natrona County detention facility was operating at between 52 to 63 percent of capacity in 2014, and the Campbell County detention facility was operating at 53 percent of capacity on average and 62 percent at peak occupancy. At peak, the population increment associated with Alternative B would add an estimated ***8*** percent and ***6*** percent of the total 2014 population, respectively for the two counties. Therefore, detention facilities in Campbell and Natrona counties likely would be able to accommodate the increase in population associated with Alternative B with existing capacity. All three counties likely would need to hire additional detention staff to accommodate the increased population.

Emergency Response (Fire and Emergency Medical)

As noted in Section 3.11.8, Public Infrastructure and Services, Converse County fire protection agencies are exclusively staffed by volunteers. The substantial increase in drilling and field development in the CCPA coupled with the relatively large and rapid population growth anticipated under Alternative B likely would result in an increase in fires and accidents. The Douglas and Glenrock fire departments would respond to structure fires and accidents within the CCPA and along access routes leading to the area, placing additional strains on those agencies and potentially resulting in long response times given the location of fire stations relative to more remote areas of the CCPA. Recruiting, training, and equipping volunteers would be a challenge for the all-volunteer agencies, as would the ability to fund increased equipment needs. Although volunteer agencies typically do not try to extinguish oil and gas fires on well pads and at ancillary facilities, additional training and equipment likely would be required to prepare these agencies for containment of oil and gas-related fires as well as oil and hazardous material spills and accidents along roads.

The Douglas Volunteer Fire Department, which is the lead responder for structure fires in Douglas and Converse County, has identified a future need for satellite fire stations on the east and west sides of Douglas. These satellite stations likely would be needed sooner under Alternative B.

The Converse County Rural Fire Control Association, which responds to grass and wildland fires in the rural parts of the county, could be required to respond to an increased number of wildland fires given the increased industrial activity and traffic. The Association is staffed by volunteers who live in these rural areas. Although the county’s rural population likely would not substantially increase under Alternative B, increased calls to respond to wildland fires along access roads within the CCPA could strain the existing volunteer workforce.

Municipal fire suppression agencies in Campbell and Natrona counties would experience increased demand for service stemming from population increases related to Alternative B and the increases in oil and gas-related traffic on roads providing access to the CCPA. Given that many direct oil and gas workers would be in the area temporarily and working at remote sites, recruiting additional volunteers could be challenging.

Ambulance services from the Memorial Hospital of Converse County likely would experience a substantial increase in calls for service within the CCPA, along access roads leading to the CCPA, and in municipalities. Responding to this increase in demand likely would require additional staff and equipment. As with fire suppression agencies in Campbell and Natrona counties, demand for ambulance services in these counties under Alternative B would be associated with population growth and increased traffic along access roads to the CCPA. Additionally, the development of temporary workforce housing facilities in rural areas of Converse County could result in additional demands on ambulance and other emergency response services.

While additional first responders and equipment would be required for many emergency response agencies in the socioeconomic assessment area to serve the population increase associated with Alternative B without a reduction in service levels, the range of services provided by each agency, and the widely different service areas, capacities, and volunteer/staffing policies preclude generalized forecasts of incremental staff and equipment demand.

Water Supply and Treatment

Although all regional and municipal water systems would have nominal capacity to accommodate the population growth forecast by the Wyoming Economic Analysis Division (**Table 3.11-*14***), demand under Alternative B could exceed the effective delivery capacity of some municipal and regional systems during periods of peak demand. ***Although effects on each community’s water system are quantified based on incremental Alternative B-related population for that community, approximately 40 percent of that demand would be from workers residing in temporary housing (hotels, motels and RV parks), which typically use substantially less water than conventional housing. Moreover, it is assumed that most demand for temporary housing would be satisfied by existing units, which are currently served by municipal water systems and would only represent a marginal increase in water demand, based on increased occupancy. Additionally, as described in Section 3.11.8.4, most of the communities at risk for system capacity exceedances during periods of peak demand have options for reducing demand (e.g., by reducing water sales to oil and gas service companies and implementing watering restrictions). It also would be likely that communities at risk of exceeding their system capacities would consider those risks when permitting new residential development.***

The Douglas municipal water system has a maximum water delivery capacity of 5.6 million gallons per day; however, seasonal restrictions on groundwater well and treatment plant limitations result in a reliable system delivery capacity of 3.8 million gallons per day during certain times of the year. The average daily demand of 1.7 mgd is approximately 45 percent of reliable system capacity, which would allow the system to accommodate the roughly ***29*** percent increase in average daily demand associated with the population growth related to Alternative B. However, seasonal production constraints on the groundwater well and limitations on the treatment plant could result in exceedance of the reliable system capacity during peak periods of demand, which reached 3.6 mgd in 2012. Curtailing sales of water to oil and gas customers could provide an extra margin of water supply until planned system expansions and improvements (Section 3.11.8, Public Infrastructure and Services) are in place. Depending on the location, timing, and amount of new development, additional water transmission and storage infrastructure could be required to accommodate new development. It is common for developers to share in the costs of such infrastructure, either by being directly responsible for building the facilities, or through tap or impact fees. The City's schedule for implementing the planned improvement program was not known at the time of this analysis.

Although Glenrock would have adequate water supply and storage capacity to accommodate the population growth related to Alternative B. Additional water conveyance pipeline capacity from the town's water sources to the storage and treatment facilities would be needed when the town reaches a population of 3,000. The estimated peak incremental population forecast for the town under Alternative B (i.e., in 2021) would be ***442***. When this peak population is added to the 2014 population of 2,583, the total population would be ***3,025***, which would ***exceed*** the level where additional conveyance capacity would be needed.

The Central Wyoming Regional Water System that serves Casper and nearby municipalities also would have adequate system capacity to accommodate the population growth related to Alternative B. The Casper water system had a delivery capacity of 39 mgd in 2013, and peak water use during that year was 29.2.mgd or approximately 75 percent of capacity. The forecast Alternative B peak (2021) population increment of ***5,513***, or approximately ***9*** percent of the 2013 ***service area*** population, would be within existing system capacity. However, during periods of peak flow on the North Platte River when well fields may be shut down, system delivery capacity might not be adequate to meet demand. In the past water restrictions have been put in place during periods of peak demand.

System expansions and improvements to the Gillette water system, which are planned to be completed in 2016, are intended to provide capacity to serve a population of 57,000. The peak (2021) Alternative B population forecast for the Gillette area would be ***1,654***. When added to the current service population of 37,000 it still would be substantially below the 57,000-***resident*** capacity threshold.

The Wright water system serves over 2,500 residents and has plans to develop wells and water storage capacity to serve a population of 5,000, which would provide adequate capacity to serve the incremental peak year (2021) population growth of ***442*** residents associated with Alternative B. The target date for completion of these facilities was not known at the time of this assessment.

The wastewater treatment system in Douglas has a capacity of 1.5 mgd and a 2014 peak use of 0.8 mgd. The remaining 47 percent of treatment capacity should be able to accommodate the peak year Alternative B population forecast, which is approximately ***29*** percent of the 2014 Douglas population.

The Glenrock wastewater treatment system currently treats wastewater for approximately 2,500 residents. Recently completed upgrades to the lagoon system were designed to accommodate a population of 3,300. Consequently*,* the incremental Alternative B peak year population forecast for Glenrock of ***442*** residents would be within the existing Glenrock wastewater treatment system capacity.

The Sam Hobbs Regional Wastewater Treatment Facility serves Casper and the surrounding communities. It has a capacity of 10 mgd and recent average use has been at approximately 70 percent or 7 mgd. Peak year Alternative B population growth for Casper and the surrounding communities would represent approximately ***8*** percent of the service area population of approximately 67,000, which could be accommodated with existing wastewater treatment capacity. The addition of the population associated with Alternative B may accelerate demand for system upgrades required to meet USEPA standards.

The Gillette Wastewater treatment system has capacity to serve 35,000 residents and currently serves approximately 30,000. ***Thus****,* the system could accommodate the incremental peak year population growth of ***1,654*** forecast for Alterative B.

The Wright wastewater treatment system has capacity to serve a population of 5,000 and currently serves a population of just over 2,500. The incremental Alternative B peak year population growth of ***442*** forecast for Wright could be accommodated with the existing wastewater treatment capacity.

Solid Waste Disposal

The Casper Regional Landfill (serving the Casper area, Douglas, and Glenrock) serves communities with a total population of approximately 95,000. In addition to the currently operational cell, the landfill has land for 5 additional cells. Each cell has an estimated life span of approximately 50 years at current fill rates. The Alternative B peak year population growth forecasted for Converse and Natrona counties of ***7,883*** (approximately ***8*** percent of the current service ***area*** population) could be accommodated by existing landfill capacity, although the additional population would accelerate the fill rate.

In 2014, the Campbell County Landfill (serving all municipalities in Campbell County) had an estimated life span of 45 years at current fill rates. Consequently, the landfill would be able to accommodate the forecast Alternative B peak year population growth of ***2,096*** (approximately 4 percent of 2014 ***service area*** population) with existing landfill capacity, although the fill rate would be slightly accelerated.

Converse County Road and Bridge Department

County roads would provide access for drilling and servicing wells; for construction and operating infrastructure; and for transporting oil, water, supplies, and workers to the CCPA under Alternative B. As noted in Section 3.11.8, most Converse County roads were designed for agricultural use. The volumes of traffic, particularly heavy truck traffic, associated with Alternative B would require reconstruction of the affected roads to industrial standards and require frequent maintenance during heavy periods of development. The Converse County Road and Bridge Department would require additional staff and equipment and would incur substantial costs associated with road reconstruction and maintenance.

Some funding for road reconstruction would be obtained from road use agreements negotiated for roads leading to high traffic development areas such as oil loadouts and produced water disposal sites. Through these agreements, the operator would be responsible for funding or improving some roads, performing maintenance activities to county standards, and returning roads to original condition upon completion of development. Reconstruction of other roads and general maintenance activities would be funded through county funds and revenues. The county would ***begin receiving incremental sales and use tax revenues as the pace of development increases but would*** not receive production-related revenues until 1 or 2 years after wells begin producing; therefore, Converse County ***may*** need to seek other revenue sources to fund road maintenance and improvement within the CCPA during the early years of the 10-year development period

Like other local government agencies and private sector companies*,* the Road and Bridge department could experience difficulty recruiting and retaining staff due to the high demand for truck drivers and equipment operators, the higher wages paid by the energy industry, and the competition for housing during the 10-year development period for Alternative B.

Health Care

Based on average daily census for each hospital during 2014 (Section 3.11.8.8, Health Care), hospitals within the three-county analysis area likely would have adequate physical capacity to accommodate the population growth associated with Alternative B.

The 25-bed Memorial Hospital of Converse County had an average daily census of 9.5 during 2014. Although the ***17*** percent increase in population associated with the Alternative B peak year population forecast for Converse County would increase the average daily census to ***over 12*** on a statistical basis, the traffic to and industrial activity in the CCPA associated with Alternative B could drive inpatient use substantially higher but likely would not exceed the 25-bed capacity.

The 200-bed Wyoming Medical Center in Casper had an average daily census of 90.5 in 2014. The Alternative B peak year ***7*** percent increase in Natrona County population would not exceed the Medical Center's inpatient capacity, although patient visits could be substantially higher than the population increment because of the regional nature of the hospital's service area.

The 90-bed Memorial Hospital of Campbell County had an average daily census of 25 patients. The incremental Alternative B peak year population increase of ***4*** percent would not exceed the hospitals inpatient capacity.

Recruiting and retaining physicians and staff could be difficult for all hospitals and health care facilities. Given the rapid increase in employment and population associated with Alternative B, hospitals, clinics, and physician's offices likely would experience substantial increases in demand for services prior to their having adequate staff and resources to accommodate that demand.

The substantial increase in industrial activity and traffic would be accompanied by an increase in accidents, potentially straining hospital emergency rooms. Moreover, a large percentage of the drilling and field development workforce likely would be comprised of temporary workers who would not have relationships with local physicians. Consequently, substantial increases in emergency room and urgent care facility visits would be likely. While employees of major drilling and service companies likely would have health insurance, hospitals and health care providers in other large-scale energy development communities have reported increases in uncollected debt.

Social Services

Based on the experience during the 2013/2014 period, caseloads in the Public Assistance Program within the Department of Family Services in the three-county area likely would not increase substantially during the 10-year development period for Alternative B due to the large increase in employment opportunities. Public Assistance caseloads could increase as employment would decline following the end of the development phase.

Although the number of other Social Services (Child Support Enforcement, Juvenile Services, and Protective Services) likely would increase given the substantial increase in population associated with Alternative B, increases in some programs, such as Juvenile Services and Protective Services, likely would be less during the early years of development given the large percentage of single-status workers. Other programs such as Child Support Enforcement may increase. Similarly, the instances of cases involving substance abuse likely would increase during this period.

Public Schools

Increases in school enrollment related to Alternative B would follow the trends in resident population; overall enrollment would increase over time in response to employment increases, but then would decline as drilling activity is completed and production levels begin to fall. Population change associated with Alternative B primarily would affect four school districts: Converse County School Districts #1 and #2, Natrona County School District #1, and Campbell County School District #1. Between 2010 and 2013, public school enrollment across the three-county analysis area averaged approximately 16.7 percent.

Based on a continuation of the relationship between school enrollment and the estimated population gains associated with Alternative B, excluding single-status workers, estimated public school enrollments in the region would increase by as many as ***1,526*** students in 2021 (**Table 4.11-8**). ***The peak enrollment impact with Alternative B would occur in 2027 when as many as an additional 1,533 students would attend school in affected districts.*** That total would be equivalent to ***5.1*** percent of the combined regional fall enrollment in 2014/2015. The incremental increases in student enrollment likely would be ***more heavily*** concentrated in the kindergarten and elementary grades (i.e., during the early years of development) and shift into the secondary grades over time.

Table 4.11-8 Estimated School Enrollment for Selected Years from Alternative B

School District	2014/2015 Fall Enrollment	Incremental Enrollment in Public Schools[1]			
		2018	2021	*2027*	2028
Natrona County #1	13,059	***568 to 678***	***639 to 763***	***642 to 766***	***120 to 144***
Converse County #1	1,795	***193 to 231***	***217 to 259***	***218 to 261***	***41 to 49***
Converse County #2	665	***51 to 61***	***57 to 69***	***58 to 69***	***11 to 13***
Campbell County #1	9,134	***216 to 258***	***243 to 290***	***244 to 291***	***46 to 55***
Other Nearby Districts[2]	5,676	***108 to 129***	***121 to 145***	***122 to 146***	***23 to 27***
Combined Enrollments	**30,329**	***1,136 to 1,357***	***1,277 to 1,526***	***1,284 to 1,533***	***241 to 288***

1 Estimated public school enrollment based on a range of 15.5 percent to 18.5 percent of the additional resident population, excluding temporary single-status workers.

2 Includes districts serving Johnson, Crook, Weston, Niobrara, and Platte counties. Assignments to individual districts were not made as part of the assessment; however, impacts to any district would be expected to be limited.

The largest incremental enrollment increases related to Alternative B (in numerical terms) would occur in Natrona County School District #1 with as many as ***678*** additional students in 2018; equivalent to ***5.2*** percent of the 2014/2015 district-wide fall employment. Incremental enrollment could increase by as many as ***85*** students in the ensuing 3 years***. The incremental enrollment would decline to*** approximately ***144*** students following the completion of development. Incremental enrollment related to Alternative B in Converse County School District #1, enrollment in Douglas schools would increase by as many as ***231*** students in the first year of development, which would represent a ***12.9*** percent increase over the 2014/2015 fall enrollment. Estimated peak incremental enrollment would be as high as ***261***. In the other districts (Converse County School District #2 ***in Glenrock***, Campbell County School District #1, and other nearby districts), combined peak enrollment would be as many as ***506*** students in 2021; the largest relative impacting being nearly a ***10.4*** percent increase in Converse County School District #2 compared to the 2014/2015 fall enrollments.

In all cases, the magnitude and duration of the estimated enrollment increase likely would be insufficient to necessitate and support construction of additional schools. Rather, some class sizes would increase, and districts may need to ***open*** one or more ***additional*** elementary classrooms, along with the necessary staff, in order to maintain the state-mandated, district-wide 16-to-1 student-teacher ratios in kindergarten through third grade. Depending on the existing school capacities at the time, the districts could find it necessary to use modular classrooms, revise enrollment boundaries for existing schools, or reconfigure the range of grades served in its existing schools in order to avoid overcrowding or accomplish other education objectives. For those districts that require ***adding modular classrooms or opening additional*** classroom***s in existing buildings***, it would be a challenge to anticipate enrollment increases soon enough to seek and obtain approval for new school facilities from the Wyoming School Facilities Commission.

Although Wyoming teacher salaries are relatively high compared to most other jobs in the state (Wyoming Department of Workforce Services 2016b), the two school districts serving Converse County likely would experience difficulty in recruiting and retaining teachers due to the limited availability of affordable housing, increases in cost of living, and limited child care options in Glenrock and Douglas. Those districts also could have trouble recruiting and retaining custodians, school-bus drivers, and administrative staff given the anticipated workforce competition during the early years of development. ***Based on the estimated enrollment increases, Natrona County School District #1 would face the largest recruiting need.***

As discussed in Section 3.11.9, the Wyoming School Foundation Program was established to provide guaranteed levels of funding to all school districts in the state, with funding based on the number of students and classrooms as well as other factors such as adjustments for small schools, transportation, special programs, and the cost of living. Consequently, school districts affected by increases in enrollment from Alternative B should be eligible to receive financial resources to fund the required increases for teachers and operating costs should locally generated sources not be adequate. However, adjustments for increases in enrollments and cost of living often lag actual enrollment increases by a year. The districts also would experience increased costs to provide for special needs of incoming students including programs for transient students, students with special needs, and additional teachers to serve students needing classes for English as a Second Language.

Under Alternative B, enrollment would decrease substantially at the end of the ten-year development period. School districts likely would not have built new schools in order to accommodate development related growth, but likely would have added instructional and support staff. School district revenues would decline after development ceases, either from a reduction in production-related revenues or Wyoming School Foundation distributions. Staff reductions would be likely in most districts.

<u>Fiscal Conditions</u>

Future oil and natural gas production estimates provide the foundation for estimating mineral development revenue from Alternative B. Projected production was derived using typical well-production data provided by the OG and the number of new wells associated with Alternative B. Total estimated incremental market value of production from new wells under Alternative B through the life of the field, based on the natural gas and oil price ranges outlined in the discussion of commodity prices in the introduction to this section and estimated commodity production, would range from $***104.4*** billion to $***161.3*** billion. Peak annual market value of production would occur in 2026 at between $7.0 billion and $10.8 billion. ***The estimated market value of future production under Alternative B is net of a minus 2 percent allowance for gas used in processing, or gas that is flared or vented as part of field development and operations. Flaring or venting typically occurs when transmission capacity is unavailable and also to increase safety. Operators minimize flaring and venting as it represents foregone revenue. The 2 percent allowance is not a projection of anticipated loss, but an allowance included to recognize that not all gas produced would be marketed. The 2 percent allowance equates to a net reduction of about 0.39 percent in total projected sales over the life of the field.*** The rapidity of both the growth and decline of the annual value is shown in **Figure 4.11-11**.

See Appendix C for additional information regarding the estimated production value, the tax and royalty revenues, and distribution of those revenues.

The value of oil and gas sales under Alternative B would reflect the trends in annual production, increasing over time as long as the anticipated level of new development occurs, but would decline steadily after new development ceases. As shown on **Figure 4.11-11**, the incremental annual sales from Alternative B would exceed $2 billion within 2 to 3 years after development commences and remain above that mark until between 2035 (under low energy prices) and 2044 (under high energy prices). Production and the value of sales would decline rapidly after full-field development occurs (i.e., Year 10) and would decrease by approximately 70 percent in the subsequent decade. Higher rates of drilling (e.g., that might result from higher commodity prices) would result in increases in production-related revenues for local governments, and those revenues would lag increases in demand for local government infrastructure and services. Conversely, slower drilling rates would decrease production-related revenues for local and state governments.

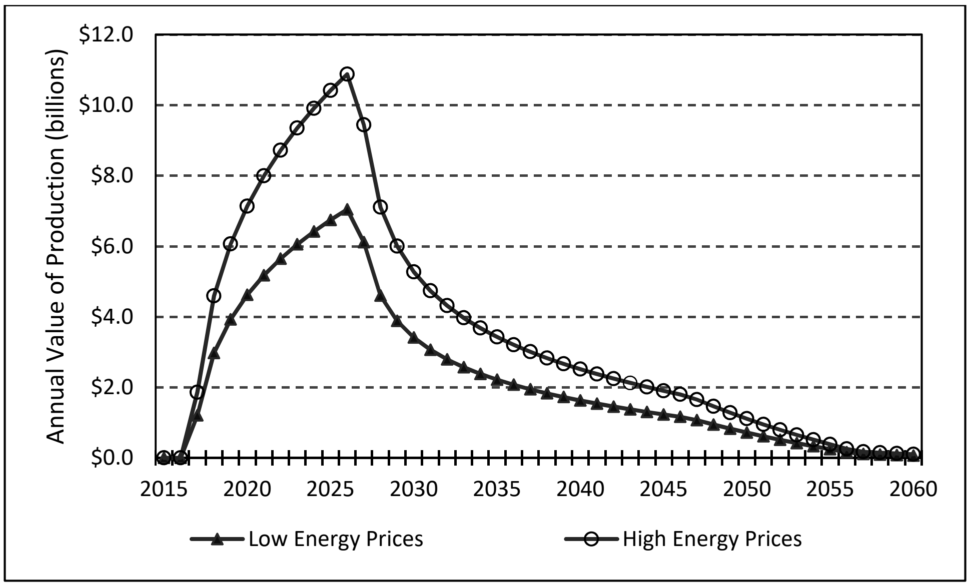


Figure 4.11-11 Estimated Annual *Market Value of* Oil and Gas *Production* under Alternative B

Royalties and taxes levied on the ***estimated market*** value of production would be substantial over the life of the field. State severance taxes, federal and state royalties, and local ad valorem taxes would be the primary categories of such revenues. Sales and use taxes, which are more a function of the capital investment in development, also would be substantial. The production-based revenues for each of these categories are ***discussed in the following sub-sections and summarized*** in **Table 4.11-9**.

Severance Taxes

The State of Wyoming levies a severance tax on all minerals produced in the state. Current severance tax rates are 6.0 percent on oil and natural gas. Severance tax rates would be applied to the taxable value at the point where the production process is complete. Processing adds value to oil and gas; therefore, the effective tax rate would be lower than the nominal rate. In 2007, the Wyoming Legislative Services Office estimated the effective rates at 5.46 percent for oil and 4.86 percent for natural gas. Applying these rates to the estimated range of production values for Alternative B would yield severance taxes of between $***2.6***6 billion and $***4.11*** billion over the first decade of production and between

$***1.78*** and $***2.73*** billion over the second decade of production (**Table 4.11-9**). Over the life of the field, estimated severance taxes would be between $5.***59*** billion and $***8.62*** billion.

Severance tax receipts collected by the state are allocated to the Permanent Wyoming Mineral Trust Fund and to the Severance Tax Distribution Account. Further distributions to numerous other funds are made from the ***Severance Tax Distribution Account. The total of such distributions is*** subject to a legislatively established aggregate cap of $155 million ***per year*. *A total of 18.36 percent of such distributions are allocated to cities and towns and counties, funds to aid cities, towns and counties with capital construction projects, and to counties to help maintain county roads***. Revenue in excess of the annual cap is distributed one-third to the state's general fund and two-thirds to the budget reserve account. ***Additional information regarding the severance tax distribution is provided in Appendix C.***

Historic levels of mineral production and commodity prices have consistently generated sufficient severance tax revenue to exceed the cap ***on distributions from the Severance Tax Distribution Fund*** such that ***overages accrue*** to the ***State's G***eneral ***F***und and ***B***udget ***R***eserve ***A***ccount. The resulting distribution (which was used in this analysis) would be 41.7 percent to the Permanent Wyoming Mineral Trust Fund, 19.4 percent to the General Fund and 38.9 percent to the Budget Reserve Account. . Under the assumed allocations and pricing assumptions, ***the distributions of state severance taxes under*** Alternative B would ***be*** between $2.***3*** billion and $3.***6*** billion to the Permanent Wyoming Mineral Trust Fund, between $1.***1*** billion and $1.***7*** billion to the state's General Fund, and between $2.***2*** and $3.***3*** billion to the Budget Reserve Account. ***Although the severance taxes generated under Alternative B would comprise a substantial portion of foreseeable statewide severance tax receipts, no specific allocations of severance taxes generated under Alternative B would be made to the affected counties and communities in the CCPA because the $155 million cap has consistently been met based on other taxable production in the state.***

Table 4.11-9 Estimated Public-sector Taxes and Royalties on Oil and Gas Production from Alternative B

Tax / Royalty	Total Estimated Revenues (2015 dollars)			
	Years 1–10	Years 11–20	Years 21–30	Total for Life of Project (40+ yrs)
LOW ENERGY PRICES[1]				
Severance tax[2]	***$2,664,605,000***	***$1,771,681,000***	***$750,672,000***	***$5,588,011,000***
Federal mineral royalties	***$3,984,456,000***	***$2,649,242,000***	***$1,215,702,000***	***$8,355,905,000***
State mineral royalties	***$435,800,000***	***$289,761,000***	***$132,967,000***	***$913,927,000***
Ad valorem tax, Converse County[3]	***$396,372,200***	***$354,643,100***	***$151,587,700***	***$973,239,600***
Ad valorem tax, Converse County school districts[4]	***$1,483,092,400***	***$1,451,488,600***	***$567,190,600***	***$3,641,538,000***
Combined Total – Low	***$8,964,325,600***	***$6,516,815,700***	***$2,818,119,300***	***$19,472,620,600***
HIGH ENERGY PRICES[1]				
Severance tax[2]	***$4,106,455,000***	***$2,731,633,000***	***$1,157,594,000***	***$8,615,798,000***
Federal mineral royalties	***$6,151,994,000***	***$4,092,334,000***	***$2,266,950,000***	***$12,907,564,000***
State mineral royalties	***$672,874,000***	***$447,599,000***	***$205,430,000***	***$1,411,765,000***
Ad valorem tax, Converse County[3]	***$611,310,500***	***$546,281,100***	***$232,692,800***	***$1,498,872,000***

Table 4.11-9 Estimated Public-sector Taxes and Royalties on Oil and Gas Production from Alternative B

Tax / Royalty	Total Estimated Revenues (2015 dollars)			
	Years 1–10	Years 11–20	Years 21–30	Total for Life of Project (40+ yrs)
Ad valorem tax, Converse County school districts[4]	***$2,292,415,000***	***$2,048,554,300***	***$872,598,000***	***$5,620,770,100***
Combined Total - High	***$13,835,048,500***	***$9,866,401,400***	***$4,735,264,800***	***$30,054,769,100***

[1] ***These revenues are net of the effects on mineral royalties, severance taxes and ad valorem taxes of a minus 2 percent allowance of annual gas production for use in processing, or gas that is vented or flared.***

[2] ***Severance taxes would be allocated to the Permanent Wyoming Mineral Trust Fund, the state's general fund and the state's budget reserve account. See Appendix C for more detail.***

[3] Revenues based on 12.00 countywide mill levy for general government purposes.

[4] Revenues for Converse County School District #1 are based on combined local and school foundation levy of 45 mills. Revenues for Converse County School District #2 are based on a combined levy of 44.50 mills. Allocations assume locally generated taxes are retained by the school districts and not subject to transfer to the state under the "recapture" provisions of the Wyoming School Finance Act.

Federal Mineral Royalties

Federal mineral royalties, based on a rate of 12.5 percent, would be derived on the value of production from the federal mineral estate, which encompasses approximately 64 percent of the total oil and gas mineral estate in the CCPA. Total estimated federal mineral royalties of between $8.***4*** billion and $12.***9*** billion would be generated from Alternative B over the life of the field, based on the assumed commodity pricing assumptions outlined above. The current allocation of federal mineral royalties approved by Congress and the President is 51 percent of the revenue to the federal government and 49 percent to the state; therefore, between $4.***3*** billion and $6.***6*** billion would accrue to the Federal Treasury and between $4.1 billion and $6.3 billion in disbursements to the State of Wyoming under Alternative B.

The state's share of federal mineral royalties would be allocated according to a tiered allocation formula. The state first would deduct 1 percent for administration. Thereafter, the next $200 million in annual receipts would be distributed among seven different funds (e.g., a county highways fund, the University of Wyoming, a pool to be distributed among the state's incorporated cities and towns, and a school capital construction account). ***A total of 13.375 percent of such distributions are allocated to cities and towns, funds to aid cities, towns and counties with capital construction projects, and to counties to help maintain county roads.*** Federal mineral royalties in excess of $200 million would be distributed one-third to the School Foundation Program and two-thirds to the state Budget Reserve Account. ***Additional information regarding the state's distribution of its share of federal mineral royalties is provided in Appendix C.***

Estimated allocations of the federal mineral royalty distributions to the state would be between $1.36 billion and $2.***11*** billion to support public schools and between $2.7***3*** billion and $4.***22*** billion to the state's Budget Reserve Account (**Table 4.11-10**). ***Although the state's share of federal mineral royalties generated under Alternative B would comprise a substantial portion of the state's foreseeable receipts, no specific allocations of the federal mineral royalties generated under Alternative B would be made to the affected counties and communities in the CCPA because the $200 million cap has consistently been met based on other taxable production in the state.***

Table 4.11-10 Estimated Allocations of Wyoming's Share of Federal Mineral Royalties under Alternative B

	Allocation (2015 dollars)			
	Year 1–10	**Year 11–20**	**Year 21–30**	**Total for Life of Project (40+ yrs)**
Low Commodity Prices				
Wyoming School Foundation	***$650,144,000***	***$432,277,000***	***$239,421,000***	***$1,363,433,000***
State budget reserve	***$1,302,240,000***	***$865,852,000***	***$479,561,000***	***$2,730,960,000***
Total State Share - Low	***$1,952,384,000***	***$1,298,129,000***	***$718,982,000***	***$4,094,393,000***
High Commodity Prices				
Wyoming School Foundation	***$1,003,821,000***	***$667,746,000***	***$369,899,000***	***$2,106,127,000***
State budget reserve	***$2,010,656,000***	***$1,337,498,000***	***$740,908,000***	***$4,218,579,000***
Total State Share – High	***$3,014,477,000***	***$2,005,244,000***	***$1,110,807,000***	***$6,324,706,000***

State Royalties

Like the federal government, the State of Wyoming collects mineral royalties on production from the state mineral estate. The state's interest in the mineral estate in the CCPA is estimated at 7 percent; therefore, assuming a 12.5-percent royalty rate, estimated royalties would be between $2***57*** and $***404*** million over the life of the field. State mineral royalties would accrue to the Wyoming Office of State Lands and Investments, which by statute are to benefit public schools and other designated state institutions, such as the Wyoming State Hospital.

Private Mineral Estate Royalties

An estimated 29 percent of the mineral estate in the CCPA is privately owned. Royalties on production from private mineral interests would accrue as income to those owners (which may be different from the surface owners). Over the life of the field, such royalty income is estimated at between $1.4***4*** and $2.2***6*** billion.

Gross Products and Local Ad Valorem Taxes

The gross products tax is based on the value of the minerals produced in the previous year. The taxable value is determined by the state, but the tax is levied and collected by local taxing jurisdictions based on the applicable tax levy; therefore, the tax is akin to local ad valorem property taxes. Based on the location of the wells and mineral resources, the taxing districts most directly affected by Alternative B would include Converse County, Converse County School District #1 and Converse County School District #2. The countywide Converse County Soil Conservation District and Converse County Weed and Pest District would realize additional revenues from the increases in mineral related valuation. Portions of the ad valorem taxes levied by the two school districts may be subject to the recapture provisions of the Wyoming School Finance Act if the value of future production generates revenues in excess of the guaranteed foundation program amount. Converse County School District #1 was subject to the recapture provisions in 2014. Any such recaptured revenues would be transferred to the state and subsequently used for education funding elsewhere in the state.

Revenues from a mandatory statewide mill property tax levy to support public schools via the Wyoming School Foundation program would be collected on Project-related valuation, with the proceeds being transferred to the state.

Assuming current mill levies over the life of the project, estimated gross products tax revenue from Alternative B would total between $4.***61*** billion and $7.***11*** billion (**Table 4.11-11**). Of that total, 21.1 percent would accrue to Converse County, 54.8 percent to Converse County School District #1, 13.5 percent to Converse County School District #2, and 10.5 percent to the Wyoming School Foundation Program.

Table 4.11-11 Estimated Gross Products and Ad Valorem Taxes to Local Counties and School Districts under Alternative B

	Allocations (2015 dollars)[1,2]			
County/School District	**Years 1–10**	**Years 11–20**	**Years 21–30**	**Total for Life of Project (40+ years)**
Low Commodity Prices				
Converse County	***$396,372,200***	***$354,643,100***	***$151,587,700***	***$973,239,600***
Converse County #1	***$1,030,583,800***	***$922,086,300***	***$468,613,900***	***$2,530,462,100***
Converse County #2	***$254,342,400***	***$227,566,100***	***$97,270,100***	***$624,505,600***
Wyoming School Foundation	***$198,166,000***	***$177,304,000***	***$75,786,000***	***$486,571,000***
Combined Total - Low	***$1,879,464,400***	***$1,681,599,500***	***$793,257,700***	***$4,614,778,300***
High Commodity Prices				
Converse County	***$611,310,500***	***$546,281,100***	***$232,692,800***	***$1,498,872,000***
Converse County #1	***$1,589,432,100***	***$1,420,353,200***	***$720,056,100***	***$3,897,127,400***
Converse County #2	***$392,263,400***	***$350,536,100***	***$149,313,500***	***$961,790,700***
Wyoming School Foundation	***$305,625,000***	***$273,113,000***	***$116,335,000***	***$749,361,000***
Combined Total – High	***$2,898,631,000***	***$2,590,283,400***	***$1,218,397,400***	***$7,107,151,100***

[1] Allocations to the school districts represent the revenues that would be generated by the local district levies. If such revenues were to exceed the guaranteed level of funding under the Wyoming School Finance Act, some of those revenues could be subject to transfer to the state under that Act's recapture provisions. Recaptured revenues are used to support education funding elsewhere in the state.

[2] Based on 2015 tax rates.

In addition to the gross products tax on production, the counties, school districts, and some local taxing districts (e.g., special service districts and communities) would levy ad valorem taxes on the production equipment, pipelines, and other real improvements associated with the Project as well as residential, commercial, and industrial development generated by the Project. Local communities would realize additional ad valorem tax revenues from new real-estate development supported by the Project and the indirect effects o***n*** market values of existing real estate ***driven by tight housing markets and market demand for existing retail, commercial, and industrial properties*****.** Values of developable land, and most residential, commercial, and industrial property rises during boom times but may decline when demand eases. The effects on existing property values would not necessarily be the same across all locations or types of properties as changes occur to the condition/quality of the land, adjacent land use, traffic congestion on nearby road access, and many other factors that influence value. ***The indirect effects on ad valorem taxes under Alternative B are not estimated due to uncertainties regarding the timing, location and typical values associated with the future development.***

The affected local taxing districts in Converse County would include Converse County Conservation District; Converse County Weed and Pest District; the City of Douglas, and the towns of Glenrock, Rolling Hills and Lost Springs. Taxing jurisdiction in Natrona and Campbell counties also could realize effects on their ad valorem tax base due to construction and indirect effects on property values due to development under Alternative B. Project-related ad valorem tax revenues accruing to these districts were not estimated for this analysis.

Sales and Use Taxes

Information provided by the OG for typical development costs per well and future investment in field development and processing infrastructure yielded an estimated total future investment of between $40 billion and $72 billion under Alternative B. Assuming that 40 percent of the total investment would be subject to taxation (intended to be conservative), estimated sales and use tax revenues would be between $***800*** million and $***1,440*** million through the 10-year schedule of development (**Table 4.11-12**).

Table 4.11-12 Estimated Range of Sales and Use Tax Revenues on Capital Investment for Alternative B

	Capital Investment (2015 dollars)	
	Low	**High**
Total Investment	$40.0 billion	$72.0 billion
Taxable Total (40 **percent** of total)[1]	$16.0 billion	$28.8 billion
Projected Sales and Use Tax (***5.0*** **percent** average rate)[2]		
State of Wyoming ***(funds retained by the State)***[3]	$***444*** million	$***798*** million
Local counties and ***municipalities***[4]	$***356*** million	$***642*** million
Total Estimated Sales and Use Tax*es Collected*	**$*800* million**	**$*1,440* million**

[1] Assumption based on 100 percent of estimated expenditures on tangible products and 30 percent of non-labor expenditures on drilling services, rig rentals, and completion services.

[2] Based on assumption of ***100*** percent of taxable purchases subject to 5 percent sales ***and use*** tax rates ***(i.e., 4 percent State plus 1 percent local general purpose optional sales and use tax rate).***

[3] ***Note that 69.31*** percent of the state's 4 percent tax is retained by the state, and 30***.69*** percent is distributed to counties and municipalities.

[4] ***Includes local general purpose taxes and 30.69 percent of the State's 4.0 percent tax revenues to local governments.***

Based on the current ***state and local sales and use tax rates and the state's*** revenue distribution formulas, approximately ***55*** percent of the total would accrue to the State of Wyoming and ***45*** percent (i.e., between $***356*** and $***642*** million) would accrue to county and municipal governments. The single largest share of the latter would accrue to Converse County; however, nearly half of the local government ***share of the state's allocation to local governments*** would be distributed to local governments outside the three-county area. ***Additional local sales and use tax revenues would result during periods when local specific purpose option taxes are being levied. Such taxes are subject to approval of local voters and have been levied in Converse County to fund major capital projects in recent years.*** In contrast to ad valorem tax revenues that lag behind production, sales tax revenues would accrue more or less concurrently with development; therefore, sales tax revenue would be critical to helping local governments respond to the demands on facilities and services.

The above estimates do not include sales and use taxes derived from ***ongoing expenditures and capital facility*** investments that would be made by oil field service and transportation companies intended to support this and other projects in the area. Neither do they include additional taxable expenditures that would occur over the life of the field (e.g., in conjunction with ongoing production, well maintenance, and repairs).

Development under Alternative B would stimulate higher consumer expenditures in the regional economy and three-county analysis area. Counties and local municipalities would gain revenue from sales and use tax receipts derived from such expenditures. All sectors of the economy would increase, with the most pronounced effects on the retail trade, food and beverage, and lodging and entertainment sectors. Lodging and food and beverage sales likely would see particularly large increases due to the many single-status workers that would live in temporary accommodations during the development phase. Alternative B consumer expenditures would increase over time as production and transportation employment would increase, augmenting the incremental expenditures associated with the development phase. The incremental consumer expenditures and taxable sales would drop sharply after the development phase is completed.

Revenue Summary

The combined total public-sector and private royalty revenues from the identified sources would be between $***21.7*** and $***33.8*** billion over the life of the field (**Table 4.11-13**). Th***ese*** estimate***s*** include only the estimated sales and use taxes associated with the initial capital investment; it does not include sales taxes associated with consumer expenditures and production.

Table 4.11-13 Estimated Total Taxes and Royalties on Oil and Gas Production from Alternative B

Commodity Price *Scenario*	Estimated Revenues (nominal dollars)			
	Years 1–10[1]	Years 11–20[1]	Years 21–30	Total from Life of Project (40+ years)
Low[2]	***$10,370,763,600***	***$6,972,525,700***	***$3,035,455,300***	***$21,711,079,600***
High[2]	***$16,228,022,500***	***$10,582,517,400***	***$5,076,792,800***	***$33,755,202,100***

[1] Only sales and use tax revenues levied on the initial capital investment are included. Those revenues would accrue in years 1–10 under Alternative B.

[2] ***These revenues are net of the effects on mineral royalties, severance taxes and ad valorem taxes of a 2 percent allowance for produced gas that is used in processing or is vented or flared.***

The three Counties and the local municipalities would likely also see increases in other revenues, such as fees, fines, and some intergovernmental revenues such as motor vehicle and fuel taxes. Portions of the increases would be tied to increases in local activity, with population growth factoring into some intergovernmental distributions of state-shared revenue. Estimates of these other revenues were not prepared because they would be dependent on many factors that are outside the scope of this programmatic analysis.

As shown on **Figure 4.11-12**, federal mineral royalties totaling between $8.***4*** and $12.***9*** billion would account for the single largest share of the total (***40***.0 percent); however, nearly one-half of that total would be disbursed to the State of Wyoming. The state would garner between $***6.5*** billion and $***100*** billion in severance taxes and state mineral royalties. Converse County would realize a total of $***973*** million to $1.***50*** billion in gross products and ad valorem taxes and the two school districts and Wyoming State Foundation program would collectively receive between $3.6***4*** billion and $5.***61*** billion in tax revenues. Sales and use taxes levied on the capital investment program would account for approximately 4 percent of the total. It should be noted that only sales and use taxes levied on the initial capital investment have been included in this calculation. Taxes derived from increases in consumer purchases, investments by oil field service companies, purchases associated with ongoing production and maintenance, or future residential and commercial development supported by Alternative B were not estimated; therefore, they have not been included. Such revenues would increase total public sector revenue and the share of revenues contributed by sales and use taxes.

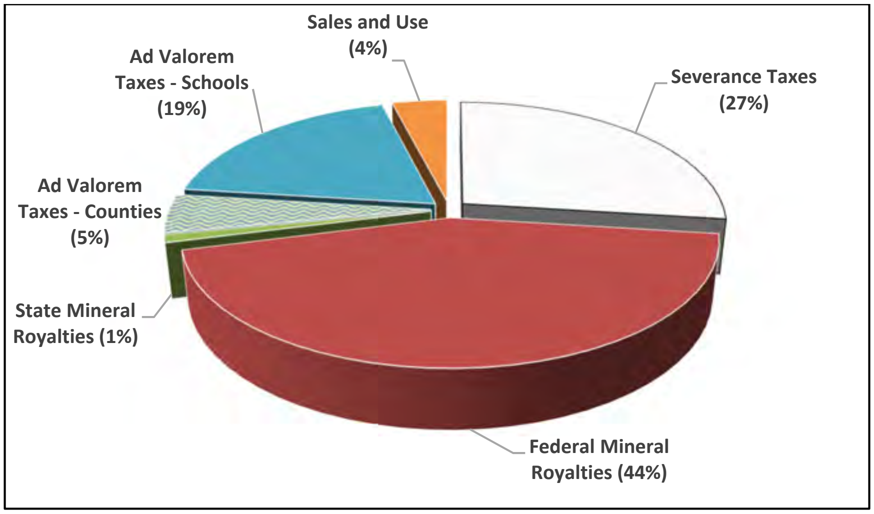


Figure 4.11-12 Distribution of Public-sector Taxes and Royalties from Alternative B

Local Public Sector Expenditures

Although the revenues generated to the public sector by Alternative B would be substantial over time, local governments would correspondingly be required to make substantial expenditures to respond to demand from development activities and from the population increases associated with Alternative B. The amount, timing, and priorities of expenditures that county and municipal governments would make in response to development are not known at this time and would depend in part on the concurrent level of development throughout the analysis area.

In relative terms, Converse County, the City of Douglas, and the Town of Glenrock likely would experience the largest increase in future expenditures due to Alternative B. For Converse County, increased law enforcement, road and bridge, and general administrative expenditures initially would account for the bulk of the increases. For the City of Douglas and the Town of Glenrock, the initial priorities would include increased budgets for police and public works.

Local governments commonly have had to respond to service demand from energy development prior to receiving substantial revenues from that development. In the case of major infrastructure investments, local governments assume substantial risk that the development will continue and generate adequate revenue to pay for the investment. This phenomenon has been referred to as the “tax lead-time problem” (Colorado Geological Survey 1974), but might be more appropriately called the “tax lag-time problem” in that the receipt of adequate tax revenues lag the point in time at which local governments incur cost to serve development and growth.

Another issue alluded to elsewhere in this assessment is the “jurisdictional mismatch problem,” in which development-related tax revenues do not accrue in sufficient amounts to the local governments affected by development-related impacts. In Wyoming, ad valorem taxes on oil and gas production and facilities typically do not accrue to municipalities where most of the population-related impacts occur. Municipalities would need to rely on development-related sales and use taxes, which often are inadequate to fund expenditures to serve development and could diminish relatively rapidly when development slows.

These historical challenges have accompanied energy and other forms of natural-resource development in Wyoming and much of the west. As previously noted, most local governments in the analysis area have expanded infrastructure during past periods of energy development, so the affected communities would have some capacity for growth in infrastructure demand. Additionally, production-related revenues from existing wells within the CCPA would provide revenue streams for counties, school districts, the Wyoming School Foundation Fund, and some special districts as future development occurs.

Under Alternative B, revenues to the State of Wyoming and affected local governments from all project-related sources would decline substantially as development is completed and production levels decline over time. For local governments, declining revenues would coincide with reduced demand for public infrastructure and services, likely resulting in some staff reductions and changes in service delivery.

Social Conditions and Trends

Implementation of Alternative B would result in substantial economic and fiscal gains for the three affected counties and the State of Wyoming. The increase in economic activity and employment opportunities would improve the standard of living and quality of life for many local residents and non-local workers. Many local businesses would profit from the increase in spending by companies and employees. Converse County and the entities that would receive tax revenues from development ultimately would be able to expand and improve facilities and services, which could again positively affect the quality of life of many county residents. However, given the magnitude and pace of development associated with Alternative B, workforce and housing shortages and competition would be likely. Some business and local governments would have difficulty attracting and retaining employees, which likely would drive up wages for all employers. An increase in wages would be beneficial for employees but could strain employers and increase the cost of living. As housing costs escalate, low and fixed income residents could be priced out of the housing market, and incoming workers would have difficulty finding housing.

The rapidly increasing demand for community infrastructure and services would pose substantial challenges for local governments. If 50 rigs could be deployed and 500 wells drilled in the first year of development under Alternative B, the overall population in the three-county analysis area would increase ***8*** percent over 2014 levels (**Table 4.11-5**), with the greatest increases occurring in Douglas (***26*** percent), Wright (***21*** percent), and Glenrock (***15*** percent). These levels of ***rapid*** growth would result in service delivery challenges, particularly in Converse County, its communities, and Wright.

As noted in the discussion regarding fiscal effects, the substantial tax revenues that would accompany development could help fund the required infrastructure and services expansions, but those revenues tend to lag the development-related increase in demand. Therefore, local governments likely would experience a decline in delivery of public service during the early years of development. Additionally, the jurisdictions affected by the demand may not realize offsetting increases in revenue from the development. For example, municipalities outside of Converse County that host Project workers would not receive direct revenues from the development, although they would receive some sales tax revenue from worker spending as well as some state-shared revenues such as severance taxes.

Based on the experience of Converse County and its communities during the 2013/2014 period as well as the experience of other communities with large-scale oil and gas development (Jacquet 2009), increases in crime and social problems (e.g., alcohol and drug-related offenses, traffic offenses, disturbances, assaults, and domestic conflicts) would accompany the implementation of Alternative B. Although some increases in crime and social problems would be anticipated to accompany any increase in population, some researchers have attributed increased levels of crime and social problems during large-scale energy development to the demographics (largely single-status working age males) and temporary and transient nature of the development workforce. Other research has concluded that incidences of crime may not increase on a per capita basis during periods of rapid energy development (BBC Research and Consulting 2013). However, substantial increases in traffic offenses and accidents, crime, and social problems would be likely, especially in Converse County given the population increases anticipated with Alternative B as well as the number of workers who would be working in the county but living in Natrona and Campbell counties and elsewhere.

Development under Alternative B would result in continued changes to the rural setting within the CCPA. Although the CCPA currently contains a fair amount of energy and other development (including uranium mines, oil and gas wells and ancillary facilities, commercial scale wind farms, highways, railroads, and power lines), many portions still retain their rural character. Development in areas valued for their scenic or recreation amenities and in or near rural residential areas likely would result in continuation and intensification of the dissatisfaction and conflict described in Section 3.11.11, Social Conditions and Trends.

Impacts related to Alternative B to historic, cultural, and recreational resources and the degradation of views in and near many parts of the CCPA (as described in Sections 4.2.2, 4.10.2, and 4.15.4) would generate dissatisfaction for residents, visitors, and others that value these resources and landscapes. Such dissatisfaction could result in a reduction in visitation and use of these resources, with corresponding economic effects on the local tourism/recreation economy as well as a reduction on the non-market value of affected resources (Section 3.11.12). Moreover, historic, cultural, and recreational resources and the rural setting are environmental amenities that contribute to the quality of life for residents of the CCPA and nearby communities. Impacts on these amenities would be considered by some residents as diminishing their quality of life.

Some residents might be affected by a loss of access to private lands for hunting and changes in the outdoor experience due to the oil and gas development in the CCPA. Affected hunters and other recreational participants could shift their activity to other locations or reduce their level of participation. Such impacts would be considered as diminishing their quality of life.

Health, safety, and environmental concerns of residents, workers, and recreational users of the area may be heightened by the increased potential for traffic and industrial accidents, injuries and fatalities associated with such accidents, hazardous material spills, and air emissions associated with expanded oil and gas operations in the area. Increases in local traffic volumes also could contribute to added congestion, traffic delays, and vehicle operating and maintenance costs. ***Section 4.13 identifies Converse County roads anticipated to be affected under Alternative B. Short-term delays on these roads could be anticipated during reconstruction, and during rig moves and the well completion mobilizations. Affected County roads would require more frequent maintenance but would be reconstructed to a higher standard to accommodate the increased traffic and heavy trucks. An increase in accidents on affected County roads also would be likely, and the high volumes of heavy truck traffic would cause safety concerns for county residents and visitors that travel them. Section 4.13.2.2 describes transportation mitigation measures designed to ensure that affected roads are not degraded, minimize traffic delays, and minimize roadway public health and safety issues.***

For rural residents of the CCPA whose residences are near development areas, health, safety, and environmental concerns have been heightened due to a well blowout in April 2012 and a well pad fire in September 2015.

Rapid growth, particularly in Douglas, Glenrock, Wright, and Rolling Hills, could be perceived favorably by some residents, business owners, and community leaders as it would present opportunities for economic and community development. Others likely would be dissatisfied with the large number of newcomers, particularly temporary and transient workers who would be present in commercial and recreational settings. These changes in community character likely would abate during the later years of development as more long-term residents would arrive and housing, commercial, and community infrastructure would respond to demand.

As development is completed and employment and population in the three-county analysis areas declines, unemployment levels, housing vacancies, and business contractions would be likely. These effects would be most noticed in communities where population gains were largest relative to their size, such as Douglas, Glenrock, and Wright. For some residents, the loss of economic activity and the lower material standard of living would be viewed as negative. For others, the return to more stable community conditions with fewer temporary and transient workers and lower levels of traffic would be viewed as positive.

Environmental Justice

As noted in Section 3.11.13, Environmental Justice, the percentage of minority and low-income populations living within and near the CCPA is below the statewide and national percentages for those populations. No concentrations of racial, low-income, or Native American populations have been identified in or near the CCPA. Consequently, no disproportionately high and adverse human health or environmental effects on an identified environmental justice population would be anticipated under Alternative B.

The increased employment opportunities associated with Alternative B in the three-county area could be beneficial to many low-income residents. Conversely, the anticipated increase in cost of living associated with Alternative B, particularly increases in housing costs, likely would be adverse for some low- and fixed-income residents. These cost of living effects would be broadly distributed across all affected communities and affect many residents, regardless of income status; therefore, impacts would not constitute an environmental justice impact under the provisions of EO 12898.

According to Section 4.2.2.3, the types of impacts to resources of Native American concern under Alternative B would be the same as discussed under Alternative A. Additional surface disturbance would occur under Alternative B; therefore, direct and indirect impacts to resources of Native American concern, and particularly landscapes under Alternative B would be more extensive than those under Alternative A.

As reported in Section 4.2.2, an estimated 164 cultural resource components of possible concern to tribes could be affected by Alternative B. In addition to the impact avoidance, minimization, and mitigation measures described for Alternative A, and cultural resource mitigation measures CR-1, through CR-3 (Section 4.2.2.4), adherence to mitigation measure CR-4 would involve tribal monitoring of sediment-disturbing activities during construction in areas most likely to contain resources of Native American Concern under Alternative B.

Avoidance or minimization of impacts on resources of Native American concern and the implementation of Tribally approved mitigation plans coupled with the above referenced Alternative B-specific mitigation measures and tribal monitoring of disturbance activities would avoid disproportionately high and adverse impacts on resources of Native American concern under Alternative B.

Several Tribes have commented that increased development activity in the project area could impact water and air quality on reservations that are downstream and downwind from this project area.

4.11.2.1 Mitigation and Mitigation Effectiveness

Most unavoidable adverse socioeconomic impacts of Alternative B would be associated with the rapid and/or temporary influx of new workers, the need to provide housing and community services and facilities for the additional workforce and their families, the reductions in employment and population that would occur at the end of the development period, and the declines in public revenues that would occur at the end of the Project. ***These impacts primarily would fall on nearby communities and local government institutions outside BLM-managed lands. While some socioeconomic mitigation***

strategies are within the BLM's control, most mitigation strategies would require action by other government entities—typically cities, counties, and State agencies (BLM 2008).

Implementation of the following mitigation measure would aid in reducing adverse socioeconomic effects and enhance the beneficial effects:

SOC-1 The OG will meet at least annually with the BLM and representatives of the state and local governments to discuss near-term and mid-term development plans. Additional coordination meetings also will be conducted if situations/conditions arise that will substantially accelerate or retard development in the CCPA.

Mitigation measure SOC-1 would aid local governments in their efforts to plan the needed infrastructure and services to accommodate the increased Project-related workforce and populations.

Additionally, CEQ regulations require that…* "*All relevant, reasonable mitigation measures that could improve the project are to be identified, even if they are outside the jurisdiction of the lead agency or the cooperating agencies, and thus would not be committed as part of the RODs of these agencies*" *(CEQ 1981).

The scale and the uncertainty associated with the pace of drilling of the proposed development relative to adjacent communities would result in substantial challenges for local governments as they develop and implement plans to accommodate the growth related to development under Alternative B. Converse County, a cooperating Agency for this EIS, has proposed a Prospective Petroleum Industry Development and Response Reporting Program. The program is foreseen as a cooperative program between the OG, local governments, and the BLM and USFS. The program, intended to reduce adverse and enhance beneficial socioeconomic effects, would collect and report Project-related development and community/local government impact data on a semiannual basis.

Although details of the program would be determined by the program's participants, topics to be monitored could include the following:

- ***Current and rolling 5-year estimates of the number of producing wells and well pads, wells to be drilled, and off-pad facilities (pipelines processing plants, etc.);***
- ***Current and estimated numbers and residency patterns of Project-related employment in affected counties and communities;***
- ***Demographic characteristics of the workforce (e.g., percent single-status employees and those accompanied by households);***
- ***Community housing conditions (i.e., occupancy and vacancy rates by housing type and housing costs);***
- ***Comparison of estimated housing supply and Project-related demand;***
- ***Forecasts of housing construction by community;***
- ***Effects on county roads;***
- ***Identification of current and estimated community/local government infrastructure and service constraints and issues; and***
- ***Identification of community/local government infrastructure and service development plans by jurisdiction.***

As proposed, the OG and affected local governments would each provide relevant information that would be aggregated and reported by a third party. The resulting information could be used by the OG and the affected local governments to develop coordinated responses to housing, community infrastructure and service, and social impacts generated by the proposed development.

Although the BLM does not have authority to require the proposed monitoring program as mitigation for socioeconomic impacts, the agency is allowed to "provide information and other assistance, sanction local activities, encourage community and project proponent agreements, and cooperate with responsible officials to the fullest extent feasible" (BLM 2008).

Following public review of the SDEIS the OG submitted the following commitment to hold annual meetings with Converse County commissioners:

> ***Members of the Operator Group commit to meet individually with a delegation of Converse County commissioners every year they are developing in the Project area for up to 10 years after issuance of the ROD for the Project. This meeting will occur between October and December of a given year, which will generally coincide with the finalization of individual operator's budgets for the upcoming year. At this meeting, the operator will describe to the county commissioners its anticipated level of activity, such as the number of drill rigs and/or completions activities that the operator will operate within the Project Area during the upcoming year, and construction of large planned facilities (such as compressor stations, major pipelines, and communication towers). The operator and county commissioners will discuss potential impacts of this anticipated development on roads and other infrastructure. As condition of this meeting, the county commissioners commit to keep sensitive information (such as rig and completions activities) received from an individual operator confidential and should recognize that information provided about anticipated activities is always subject to change.***

This additional committed measure would assist the Converse County commissioners in planning for the increased level of development activity under Alternative B.

4.11.2.2 Residual Impacts

Residual impacts are defined as unavoidable adverse impacts to a resource that remain assuming implementation of proposed mitigation. With regard to social and economic effects, the proposed mitigation measure would be voluntary. Implementation of the proposed measure could result in public benefit by avoiding excess housing supply, excess infrastructure capacity, and the associated fiscal burdens on local governments that often characterize completion of the drilling and infrastructure construction phase of major oil and gas development projects.

4.11.3 Impacts to Socioeconomics from Alternative C

Under Alternative C, up to 5,000 new oil and gas wells would be drilled in the CCPA over the course of 10 years. ***During that time, up to 50 rigs would drill an*** average of 500 new wells per year (i.e., the same as under Alternative B); however, the total number of oil and gas well pads would be 938 pads compared to 1,500 pads under Alternative B. Alternative C also would require closed-loop drilling (i.e., no pits), increased use of pipelines for oil and water transportation, and compliance with the timing stipulations as outlined in the BLM Casper RMP (BLM 2007b) and USFS TBNG LRMP (USFS 2001).

In general, the timing limit stipulations limit or prohibit surface disturbance, occupancy, or elevated noise levels in order to promote wildlife benefits. These stipulations likely would affect the pace and scale of oil and gas development during the course of the year, as well as over the long term.

The following effects on development could be foreseen in conjunction with Alternative C:

- Approximately ***26*** percent of the CCPA would be affected by timing stipulations for raptors and/or greater sage-grouse because many stipulations are defined in terms of spatial buffers around nests or habitats (Section 2.5.2.1).
- ***W***ith timing limitations in place, development activities would ***continue to*** occur on the estimated ***74*** percent of ***the CCPA*** not affected by timing limit stipulations ***(see Section 2.5.2.1)*****.**
- ***Although timing limitations might result in some seasonal slowing in the pace of development, and hence, temporary decreases in direct employment, demand on temporary housing, and local spending and related activity in local businesses, the effects would not dramatically slow new well development activity in the CCPA.***
- Temporary construction employment would increase compared to Alternative B in order to implement the closed loop drilling and to build the additional water pipelines.
- Trucking employment would be lower than Alternative B because of the required use of water disposal pipelines and recycling. Trucking employment associated with oil transportation also would be lower.
- ***Overall levels of construction truck traffic would be lower due to the construction of fewer well pads under Alternative C, as compared to Alternative B. However, the number of rig moves under Alternative C is assumed to increase to three rig moves per pad for those pads located within a non-eagle raptor timing limit stipulation buffer (see Section 2.5.2.1). Overall, the BLM estimates that there would be approximately 1,425 rig moves, or an average of 1.5 rig moves per pad, during the 10-year development phase for Alternative C compared to 1,500 rig moves for Alternative B (for additional information see Section 2.5.2.10). Therefore, there is no substantial difference between Alternative B and Alternative C regarding the number of rig moves.***
- The overall number of rig mobilization and demobilization activities would be ***approximately the same as*** Alternative B. ***Reductions in the number of such activities*** due to the ***reduced*** number of wells per pad ***would be largely offset by*** additional rig moves required to reduce the possibility of “stranding” a rig (i.e., rendering a rig temporarily unproductive because it is not able to be relocated due to the timing limit stipulations) for the duration of one or more timing limit stipulations.
- The period of time to complete development activities on approximately 15 to 20 percent (Section 2.5.2.1) of the larger multi-well pads could be extended due to timing limit stipulations.
- Development of additional water supply, disposal, and oil transport pipelines would require additional capital investment, but future investment in trucking equipment would be reduced. ***The values of these investments have not been provided by the OG, consequently the net costs to individual operators and effects on the pace and level of development cannot be determined.***
- ***Timing limit stipulations would require additional rig mobilization and de-mobilization and additional periods of inactivity*****.** ***Such effects would increase development costs and could adversely affect the economic returns for operators*****.** ***The number of affected operators, and the frequency, magnitude*****,** ***and overall effects on development economics and returns are unknown.***
- Strategic planning with respect to the siting and sizing of well pads could allow operators with more extensive land positions to conduct development (e.g., by focusing development on areas subject to timing limit stipulations [federal minerals] during a portion of the year, then moving operations to locations ***on federal minerals and fee and state minerals and surface unaffected by such limitations***). The opportunity for an individual operator to pursue such

strategies would favor operators with larger leasehold interests and a combination of federal and non-federal interests.

- Ongoing production and typical well maintenance activities would not be affected by the timing limit stipulations.

Employment

The net implications of the timing limit stipulations and infrastructure requirements associated with Alternative C for direct employment during the initial development likely would result in greater intra-year variability (i.e., the difference between the high and lows) than under Alternative B. Peak employment likely would be higher during periods when timing limit stipulations would not be in effect, but lower during periods when the timing limit stipulations curtail activity levels. As noted, timing limit stipulations would affect ***approximately 26*** percent of ***CCPA***. The effects of timing limit stipulations would minimally affect development in the CCPA on a seasonal basis. The deployment of drilling rigs associated with Alternative C would represent more than a three-fold increase above the average number of rigs drilling during the fall of 2014. This level of activity would result in a substantial increase in traffic, drilling, and construction activity compared to recent levels and would result in corresponding substantial increases in demand for law enforcement, fire suppression, emergency response, road maintenance, and weed and pest control within the CCPA.

As described under Alternative B, the development and completion of well pads and wells would involve multiple work crews, each involved for varying durations of time. Alternative C would result in substantial construction employment in conjunction with the development of 938 new multi-well pads, although it would be lower than under Alternative B. Well drilling and completion are the most labor-intensive activities in the entire development process. Peak construction employment in the early years also would be higher due to the additional gathering, water supply, and water disposal requirements. Over time the use of the water supply, water disposal, and oil transportation pipelines under Alternative C would result in lower trucking employment requirements than under Alternative B, even during the initial 10-year development period.

Labor market conditions under Alternative C would be similar to those under Alternative B, with unemployment declining to low, single-digit rates during periods of rapid growth. Labor force participation rates would also increase, and substantial levels of labor in-migration would result.

Indirect and induced employment supported by Alternative C would tend to respond to the seasonal variations in direct employment levels; with slight expansions during periods of development and construction activity not affected by timing limit stipulations and contracting when activity would be curtailed by timing limit stipulations. Indirect and induced employment would be lower in the long-term under Alternative C compared to Alternative B due to the fewer trucking jobs that would be supported.

Although the net effect of Alternative C on employment cannot be quantified at this programmatic stage of analysis, there may be some variability in employment level ***over*** the course of ***a*** year. The timing limit stipulations generally would affect development ***approximately 26*** percent of the CCPA between March and June (**Table 2.5-2**), although some areas could be affected during other periods. The effects of the timing limit stipulations would be in addition to the normal limitations imposed by winter weather. Consequently, development employment likely would peak between June and November, with a portion of that period overlapping the summer tourism and travel season. The overlap could increase competition for seasonal labor in the convenience retail and hospitality industries, especially in Douglas.

Declining employment, rising unemployment and out-migration would occur following the completion of development. The changes would be comparable to those for Alternative B.

Personal Income

Alternative C would generate substantial personal income in the region, some of which would accrue to existing residents and the remainder accruing to non-local workers who relocate temporarily to fill construction and other development related jobs. Ongoing production and maintenance activities would support additional personal income over the long-term. ***Some of the gains in personal income could be offset by a higher cost of living that likely would accompany the proposed development under Alternative C.*** The personal income effects on different groups of individuals under Alternative C would be similar to those under Alternative B.

Effects on farm income under Alternative C would be lower than under Alternative B due to lesser effects on authorized grazing use on federal grazing allotments (Section 4.9)***, short-term or long-term loss of production on some production on some private crop or grazing lands, and other indirect effects including changes in operating practices and increased operating costs. Reductions in federally permitted grazing of as many as 767 AUMs per year (Section 4.9) would result in a net reduction of 12,758 federally permitted AUMs would occur over 20 years under Alternative C. The economic value to local ranchers of such reductions would be $235,513 over 20 years under Alternative C; an average of $11,776 per year. The average annual loss, before any offsets provided by surface use and damage agreements, is equivalent to less than 0.02 percent of the total farm income of Converse County ranchers in 2012. Based on a net economic value of $16.96 per AUM for cattle (Wyoming Department of Revenue, Property Tax Division 2015) and annual fee of $1.69 per federally permitted AUM (BLM 2015), federal grazing fees would be reduced by $17,988 over the 20-year period. The rate is revised annually and is $1.41 per AUM for 2018. The surface use and damage payments would offset the economic losses from grazing reductions for affected landowners. The reductions in federally permitted AUMs, along with the associated effects on ranch income for the affected ranchers would continue long-term, decreasing in magnitude as reclamation occurs. Tenants who lease private grazing or cropland on non-federal surface and would be affected by oil and gas development would not receive compensation under a surface use agreement. The number of tenants that would be affected and the magnitude of any resulting economic effects are unknown.***

The mitigation measures for range resources outlined in Section 4.9 are designed to reduce impacts on permittees with grazing allotments on federal lands.

Population

Implementation of Alternative C would provide long-term economic stimulus in the three-county analysis area, providing employment opportunities for residents of the region and stimulating substantial net labor migration of temporary workers. This would be particularly true for workers with the specialized skills needed in the oil field. The demand for transportation, support, and workers to fill the indirect and induced jobs created also would contribute to future in-migration. Driven by migration, Alternative C would promote substantial population influx across the region, with the largest gains occurring in Natrona County. Substantial gains also would be anticipated in Converse and Campbell counties.

Alternative C likely would result in net population gains of comparable magnitude to those under Alternative B (i.e., approximately 8,000 to 9,500). Alternative C would support more short-term construction jobs, but the population influx under Alternative C likely would include an incremental increase in temporary single-status workers than would be the case under Alternative B. The difference would be due to potential effects of the timing limit stipulations in limiting development and the effects of increased utilization of pipeline gathering and transmission systems in reducing the number of trucking jobs. Although single-status workers would place demands on temporary and rental housing as well as local facilities and services, increase market demand for private-sector businesses, and generate public-sector revenues, they would have fewer indirect demands on facilities, services, and conventional housing than migrating households. The number of temporary non-resident workers would decline substantially following completion of new well development, as many of the long-term production-related direct jobs would be full-time.

The relative increase in the number of single-status, temporary workers compared to Alternative B could alter the residency distribution among the new residents as single-status workers would place added emphasis on the availability of motels, hotels, and RV housing, particularly those in proximity to the offices and equipment yards of employers. They also would place added strain on schools, other community amenities, and availability of conventional rental housing than would year-round residents, but to a lesser extent.

Housing

As with Alternative B, Alternative C would generate substantial demand for temporary and conventional housing in the three-county analysis area to accommodate the Project-related workforce and associated household population. ***Average monthly rents and average sales prices of homes would increase dramatically at the outset of development, especially in Converse County.*** Peak demand for housing, particularly temporary housing such as hotel and motel rooms, RV pads, and temporary workforce accommodations, likely would be higher than that anticipated for Alternative B during the early years of development under Alternative C. This demand would be to accommodate the construction workforce for the additional water supply, water disposal, and gathering systems. Over time, temporary housing demand under Alternative C would decrease below the levels anticipated for Alternative B due to the displacement of trucking employment as the water and oil transportation pipelines become operational.

Temporary housing demand could be slightly higher during months without timing limit stipulations (i.e., typically June through November) compared to Alternative B, to accommodate the higher levels of employment needed to achieve the level of drilling and development anticipated under Alternative C. Correspondingly, temporary housing demand would diminish during periods when timing limit stipulations would be in effect, resulting in higher vacancies in those accommodations. The variability in demand would depend on the differences in the number of rigs during periods when timing limit stipulations would apply.

The short-term variations in employment levels and temporary housing demand could contribute to hiring challenges for proprietors and serve as a disincentive to the development of additional temporary housing facilities. These fluctuations in housing also could encourage more temporary workers to locate in Casper and Gillette where more temporary accommodations would be better able to accommodate the seasonal fluctuations in demand.

Long-term demand for conventional rental and owner-occupied housing under Alternative C likely would be lower than that anticipated for Alternative B due to reductions in the number of trucking jobs. ***Accordingly, conventional housing vacancies under Alternative C would be somewhat lower as development is completed than would be anticipated under Alternative B.***

Community Infrastructure and Services

Under Alternative C, demand for public infrastructure and services would be similar to those anticipated under Alternative B, but could be higher in the earlier years of development than anticipated under Alternative B due to the added workforce needed for construction of the additional infrastructure (e.g., water supply, water disposal, and gathering systems) under Alternative C. Demand subsequently would diminish in response to the reduced traffic volumes and the displacement of trucking employment as the additional water and oil transportation pipelines would become operational.

Intra-year variations in activity levels in response to timing limit stipulations could incrementally generate fluctuations in public service demand under Alternative C, particularly within the CCPA. Such fluctuations would be in contrast to more regular, demands under Alternative B, and would result from reductions in traffic and the number of workers employed during periods that timing limit stipulations would be in effect, which would correspondingly reduce demand for road maintenance, law enforcement, traffic management, and emergency response services. Conversely, demand for those services could increase during periods when timing limit stipulations are not in effect to account for the higher levels of activity necessary to achieve the level of drilling anticipated under Alternative C. The magnitude of the variations in demand would depend on the number of rigs and active well pads affected by timing limit stipulations in any given year, and on whether the affected operators had leases that would allow them to move to locations unaffected by the timing limit stipulations.

Seasonal demand for county and municipal infrastructure and services outside the CCPA also could fluctuate with the implementation of timing limit stipulations. The resultant fluctuations in demand could present challenges for some services, particularly law enforcement and emergency response. However, the magnitude of those effects likely would be minor due to the relatively small number of active well pads affected by timing limit stipulations and availability and access to well pads that would be unaffected by timing limit stipulations. The fluctuating demands would be in contrast to the more regular demands under Alternative B.

Municipal water and wastewater demand could fluctuate with the seasonal variations in drilling, but because much of the employment associated with drilling would involve workers in existing temporary accommodations, capacity to accommodate that demand would be included in water and wastewater system capacities. Workers in temporary accommodations typically generate substantially less water and wastewater service demand than comparable populations in conventional housing, so incremental demand associated with seasonal workforce fluctuations ***could result in slightly higher peak demand that could exceed provider capacity for any one community, although the overall differences on water and wastewater demand would be modest as compared to Alternative B*****.**

Under Alternative C, Converse County and the special districts and volunteer organizations that provide services within the CCPA as well as counties and communities that would host Project-related workers and population would incur additional staff, equipment, and operating costs to respond to the increased demand.

Staff recruitment and retention would be challenging in a rapidly expanding economy, particularly under housing shortage conditions. In contrast to those under Alternative B, these challenges would be exacerbated by the seasonally larger workforces that would occur under Alternative C as well as by the seasonal fluctuations in activity and workforce if timing limit stipulations were to result in incremental increases and decreases in activity.

Although the revenues generated by Alternative C would be substantial, the bulk of those revenues would not be available until sometime after service providers would begin experiencing development-related demand. Sales and use tax revenue distributions would lag expenditures by a matter of months, and receipt of production and property tax revenues would lag by 1 or 2 years. Therefore, developing the service capacity to respond to the increased demand and the variability of such demand over the course of a year would be challenging for the counties, municipalities, special districts, and volunteer organizations that provide services and infrastructure in the three-county area.

Public Infrastructure and service demand reductions following the completion of development would be similar to those anticipated under Alternative B, but the resulting staff reductions could be concentrated slightly more in services that respond to development activity and traffic, such as the Converse County law enforcement, emergency response, and road and bridge services.

Public Schools

Under Alternative C, increases in school enrollment would follow the trends in resident population; increasing over time as non-temporary employment would increase, but declining when drilling activity would be completed and the production levels decrease. Population change associated with Alternative C primarily would affect the same four school districts as discussed for Alternative B.

Projected public school enrollments associated with Alternative C, based on a continuation of recent enrollment-to-population ratios could result in increased enrollment of nearly 1,100 additional students. The total number of additional students under Alternative C could be slightly lower than those provided on **Table 4.11-8** for Alternative B because the seasonal effects of timing limit stipulations on development could result in more jobs being filled by single-status workers relocating on a short-time basis. As under Alternative B, the incremental increases in student enrollment likely would be concentrated in the kindergarten and elementary grades during the early years of development, shifting into the secondary grades over time, and the largest increases would occur in Natrona County School District #1, Campbell County School District #1, and Converse County School District #1. Other school districts serving the analysis area and nearby areas could gain Project-related enrollments, but the numbers would be limited.

As discussed for Alternative B, the foreseeable enrollment increases under Alternative C would be insufficient in magnitude to necessitate construction of additional schools. Rather, some class sizes could increase and a district could need to add or reopen one or more classrooms in order to maintain the state mandated district-wide 16:1 student-teacher ratios in kindergarten through third grade. Depending on the existing school capacities at the time, districts may use modular classrooms, alter enrollment areas for existing schools, or reconfigure the range of grades served in existing schools to avoid overcrowding or accomplish other education objectives. For those districts requiring expanded capacity, the challenge would be to seek and obtain approval from the Wyoming School Facilities Commission for new school facilities.

Although Wyoming teacher salaries are relatively high compared to other public school districts in the U.S., the two districts serving Converse County likely would experience difficulty recruiting and retaining teachers due to the limited housing availability, the local cost of living, and the limited child care options for some. Districts also could experience difficulty recruiting and retaining custodians, school-bus drivers, and administrative staff, given the anticipated workforce competition during the early years of development.

As discussed in Section 3.11.9, the Wyoming School Foundation Program was established to provide guaranteed levels of funding to school districts in the state, with funding based on the number of students and classrooms as well as adjustments for small schools, transportation, special programs, the local cost of living, and other factors. Therefore, to the extent that locally generated revenues are not sufficient, the school districts affected by increases in enrollment from Alternative C could expect some financial aid from the state to fund the required increases for teachers and operating costs, although adjustments for increases in enrollments and cost of living often lag actual enrollment increases by a year.

Enrollment under Alternative C would decrease substantially at the end of the 10-year development period. As with Alternative B, school districts might not have constructed new schools to accommodate development-related growth, but likely added instructional and support staff. School district revenues would decline after development ceases, either from a reduction in production-related revenues or Wyoming School Foundation distributions. Staff reductions would be likely in most districts, but possibly less than under Alternative B, given the anticipated lower Alternative C-related enrollment levels.

Fiscal Conditions

Estimated future oil and natural gas mineral development revenue under Alternative C would be comparable to those for Alternative B (**Table 4.11-13**) because the total number and timing of new wells and production facilities would be the same. Minor differences would occur for a number of reasons. For example, the amounts and regional distribution of local sales and ad valorem tax receipts under Alternative C could differ slightly from that under Alternative B due to differences in the percentage share of single-status workers, the residency distribution of those workers, and/or the location of well pads and ancillary facilities including pipeline networks***, and differences in the timing and costs of well development. The magnitude of the differences is unknown but would likely not be substantial when compared to the overall levels of investment and tax revenues that would be generated.*** The overall distribution of revenues under Alternative C also would be comparable to that under Alternative B (**Figure 4.11-13**).

Similar to Alternative B, although the revenues generated to the public sector by Alternative C would be substantial, local governments would correspondingly be required to make substantial expenditures to respond to demand from development activities and from population increases associated with Alternative C. The amount, timing, and priorities of expenditures that county and municipal governments would make in response to development are not known at this time but likely would be comparable to those under Alternative B.

As under Alternative B, Converse County, the City of Douglas, and the Town of Glenrock likely would experience the largest increase in future expenditures due to Alternative C. For Converse County, increased law enforcement, road and bridge, and general administrative expenditures initially would account for the bulk of the increases. For the City of Douglas and the Town of Glenrock, the initial priorities would include increased budgets for police and public works.

As noted under Alternative B, most local governments in the analysis area have expanded infrastructure during past periods of energy development, thereby providing some capacity to respond to growth before additional expansion would be required under Alternative C. Additionally, production-related revenues from existing wells within the CCPA would provide revenue streams for counties, school districts, the Wyoming School Foundation Fund, and some special districts as future development would occur.

As with Alternative B, revenues to the State of Wyoming and affected local governments from all sources would decline substantially as development under Alternative C is completed and mineral production levels decline over time. For local governments, declining revenues would coincide with reduced demand for public infrastructure and services, likely resulting in some staff reductions and changes in service delivery.

Social Conditions and Trends

Implementation of Alternative C would result in similar socioeconomic impacts as those described for Alternative B, including increased economic activity, employment opportunities, and improved material standard of living and quality of life for many local residents and non-local workers. Many local businesses would realize higher sales revenues, and Converse County and the entities that would receive tax revenues from development may be able to expand and improve facilities and services, all of which could positively affect the quality of life of many county residents.

The potential adverse effects of development on social conditions associated with Alternative C during the early years of development also could be somewhat greater than those associated with Alternative B. The higher levels of construction employment anticipated under Alternative C during the initial years of implementation could amplify difficulties some business and local governments could have attracting and retaining employees. Higher housing demand likely would result in corresponding increases in housing costs, more fixed income residents could be priced out of the housing market, and incoming workers would have more difficulty finding housing.

The larger peak workforce and temporary population influxes associated with Alternative C likely would result in higher seasonal traffic volumes and congestion, and correspondingly higher rates of traffic offenses and accidents, crime, and social problems than anticipated under Alternative B. Long-term traffic volumes and congestion could be lower than under Alternative B due to the indirect effects of additional pipelines in reducing the volume of truck traffic.

Changes to the rural setting within the CCPA would be slightly less than those associated with Alternative B due to the fewer number of well pads, less disturbance for roads, and less truck traffic. Less development in areas valued for their historic, cultural, scenic, or recreation amenities and in or near rural residential areas could result in somewhat less dissatisfaction and conflict with rural residents (Section 3.11.11, Social Conditions and Trends). However, given that development on individual well pads likely would be longer in duration due to the increased number of wells per pad, dissatisfaction and conflict with adjacent rural residents could be heightened. Health, safety, and environmental concerns could be reduced for, workers, recreational users, and some residents of the CCPA. However, health, safety, and environmental concerns likely would be heightened for those residents of the CCPA, whose properties would be near well pads, given the anticipated longer duration and larger scale of development activities.

As development is completed and employment and population in the three-county analysis area declines, unemployment levels, housing vacancies, and business contractions would be likely. These effects would be most noticed in communities where population gains were largest relative to their size, such as Douglas, Glenrock, and Wright. Given the anticipated larger temporary workforce and smaller long-term workforce under Alternative C, more vacancies would be in temporary housing and fewer in conventional housing, possibly moderating vacancies and adverse property value effects. As with Alternative B, some residents would view the loss of economic activity and the lower material standard of living as negative. Others would likely view the return to more stable community conditions with fewer temporary and transient workers and lower levels of traffic as positive.

Environmental Justice

As noted in Section 3.11.13, Environmental Justice, the percentage of minority populations and low-income populations living within and near the CCPA is below the statewide and national percentages for those populations, and no concentrations of racial or low-income populations or Native Americans have been identified in or near the CCPA. Therefore, no disproportionately high and adverse human health or environmental effects on an identified environmental justice population would be anticipated under Alternative C.

According to Section 4.2.3.1, impacts to cultural resources related to Alternative C would be similar to those under Alternative B but less extensive because Alternative C would have fewer total acres of disturbance. Certain areas of the CCPA would contain stipulations that would restrict or preclude development. According to **Table 4.2-11**, an estimated 115 cultural resource components of Native American concern would be affected by Alternative C.

Under Alternative C, a more landscape-oriented management approach would be taken for resources of Native American concern, particularly with regard to the Pine Ridge Area. Within the entire Pine Ridge area, tribal consultation would be required for any action to help identify and evaluate sites of Traditional Cultural Religious Significance within the landscape. Mitigation measures CR-1 through CR-4 also would apply to Alternative C.

Avoidance or minimization of impacts on resources of Native American concern and the implementation of Tribally approved mitigation plans coupled with mitigation measures CR-1 through CR-4, including tribal monitoring of disturbance activities, would avoid disproportionately high and adverse impacts on resources of Native American concern under Alternative C.

Several Tribes have commented that increased development activity in the project area could impact water and air quality on reservations that are downstream and downwind from this project area.

4.11.3.1 Mitigation and Mitigation Effectiveness

Additional mitigation and mitigation effectiveness suggested under Alternative C would be the same as that under Alternative B. The need for the operators to cooperate in the development of additional temporary worker housing would be more pronounced under Alternative C due to the increased numbers of construction workers and seasonal variation in housing demand. That variation also could serve to discourage other private sector investment in such housing.

4.11.3.2 Residual Impacts

Residual impacts are defined as unavoidable adverse impacts to a resource that remain assuming implementation of proposed mitigation. Residual impacts associated with development under Alternative C would be the same as for Alternative B.

4.11.4 Relationship between Local Short-term Uses of the Human Environment and Maintenance and Enhancement of Long-term Productivity

The relationship between local short-term uses of the human environment and maintenance and enhancement of long-term productivity is the disclosure regarding whether the short-term use of a resources associated with a project affects the long-term sustainability of that resource. Development and production of the energy resources located in the CCPA would stimulate economic activity and support local economic opportunities for households and communities across Converse, Natrona, and Campbell counties. In addition to the direct, indirect, and induced employment opportunities stimulated under Alternative C, federal mineral rents and royalties along with state revenues collected from severance, sales and use, ad valorem, and lodging would generate public revenues that would be reinvested in programs and infrastructure across the state. A portion of these revenues along with revenues generated through other local taxes would be used within the three-county analysis area to provide additional public services and infrastructure in communities surrounding the CCPA.

Development of these resources also would result in positive effects for residential, commercial, and industrial consumers outside the region. Some of the infrastructure put in place to serve this project may support future production and distribution of energy resources from other deposits in the region or nearby.

Higher development and production rates in the short term, however, carry with them potential trade-offs in social and economic conditions when compared to those that would exist assuming lower, more sustained development and production levels over a longer time horizon. Furthermore, the consumption of the energy resources in the short term precludes their use at a future time. Which of these futures is preferable is largely a matter of individual preference, particularly as the alternatives affect different groups of individuals over time.

4.11.5 Irreversible/Irretrievable Commitment of Resources

Irreversible/irretrievable impacts are subsets of unavoidable adverse/residual impacts. Irreversible impacts are those that cannot ever be restored; they would be lost forever. Irretrievable impacts are those for which the resource value would be irretrievably lost until restoration of that resource takes place. Development and production of the energy resources located in the CCPA would require the investment of human, natural, and monetary resources. Most of those investments would be irretrievable and could preclude or foreclose opportunities associated with other alternatives. Meeting the demands for goods and services directly and indirectly associated with the Project (e.g., the commitment of natural and other resources to develop infrastructure and housing or the commitment of gravel and asphalt to build and maintain highways) also would be irreversible. Housing, infrastructure, and highways could serve other uses during and after the period associated with the alternatives contemplated for this assessment.

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4.12 Soils

The analysis area for direct and indirect impacts to soil resources includes the CCPA.

Potential impacts to soil resources include soil disturbance affecting the potential for erosion, runoff, and subsequent sediment loading (discussed in Section 4.16, Water Resources); saltwater spills related to oil and gas development; and salvage and replacement of topsoil and the potential for contamination through mixing of soils.

The methodology for analysis of impacts to soil resources included examining soil types, their extent, and their physical and chemical characteristics in relation to estimations of disturbance within the CCPA. The analysis of the impacts to soil resources was based on the assumption that OG-committed design features, standard BMPs, required design features, and other RMP and LRMP resource protection measures would be implemented for the Project.

Soil resources are managed according to the management goals and objectives from the BLM ROD for the CFO RMP (BLM 2007b) and the USFS TBNG LRMP (USFS 2001).

Assumptions used in the analysis of impacts to soil resources include:

- SSURGO data is more accurate than STATSGO soil mapping.
- Soil disturbed during Project activities would be susceptible to erosional forces, such as wind and water.

4.12.1 Impacts on Soils from Alternative A – No Action

Under Alternative A, new drilling would continue in the CCPA as disclosed under NEPA (Section 2.3.2). Approximately 10,253 acres of soils would be disturbed associated with the development of 1,663 new oil and gas wells on 361 new well pads, associated facilities, and infrastructure (**Table 2.3-3**).

Table 4.12-1 provides an estimation of the impacts to soils with limiting characteristics identified within the CCPA based on the percent of that soil type present within the CCPA (**Table 3.12-1**). This table is only an estimation of impacts that could occur to various soil types as it is possible that the BLM may require avoidance of particular soils identified during site-specific reviews.

Table 4.12-1 Potential Disturbance of Soils with Limitations from Alternative A

Limiting Soil Characteristic	Potential Disturbance (acres)
Water Erodible	1,425
Wind Erodible	1,930
Droughty Soils	4,507
Hydric Soils[1]	386
Shallow Depth to Bedrock	3
Prime Farmland	5
Compaction Prone	3,050
Limited Reclamation Potential	29

[1] Smaller areas of hydric soils may exist but may not be captured due to the scale of mapping.

Source: NRCS 2014.

Under Alternative A, impacts to soil resources would include soil compaction, soil mixing, wind and water erosion, and modification of soil structure and porosity. Roads and well pads would result in long-term impacts to soil productivity and quality due to the increase in bulk density and decrease in vegetative cover and input of organic matter.

4.12.2 Impacts on Soils from Alternative B – Proposed Action

Under Alternative B, approximately 5,000 new oil and gas wells would be drilled on 1,500 multi-well pads over a period of 10 years (500 new wells per year). Additional surface disturbance would result from the construction of other service well pads, access roads, pipelines, electric power lines, and ancillary facilities (**Table 2.4-1**). An estimated 52,667 acres of disturbance would result from oil and gas development under Alternative B.

4.12.2.1 Impacts on Soils

Under Alternative B, approximately 52,667 acres of soils would be impacted to varying degrees as a result of construction. **Table 4.12-2** provides an estimation of the impacts to soils with limiting characteristics identified within the CCPA based on the percent of that soil type present within the CCPA (**Table 3.12-1**). This table is only an estimation of impacts that could occur to various soil types as it is possible that the BLM may require avoidance of particular soils identified during site-specific reviews.

Table 4.12-2 Potential Disturbance of Soils with Limitations from Alternative B

Limiting Soil Characteristic	Potential Disturbance (acres)
Water Erodible	7,318
Wind Erodible	9,913
Droughty Soils	23,149
Hydric Soils[1]	1,985
Shallow Depth to Bedrock	13
Prime Farmland	26
Compaction Prone	15,665
Limited Reclamation Potential	147

[1] Smaller areas of hydric soils may exist but may not be captured due to the scale of mapping.

Source: NRCS 2014.

The most notable impacts to soils would occur in association with the construction of well pads (21,400 acres) and the associated construction/production facilities (874 acres). Wells would be co-located on multi-well pads throughout the CCPA. Grading and leveling would be required to construct the well pads and facilities with the greatest level of effort required on more steeply sloping areas. During construction, the soil profiles (i.e., layers) would be mixed by excavation activities, resulting in a corresponding loss of soil structure. Soils would be compacted as a result of the construction, and further compaction would occur due to continued vehicle traffic during production activities. The potential for erosion would increase through the loss of vegetation cover and soil structure compared to an undisturbed state. Soil productivity would decrease primarily as a result of profile mixing and compaction along with the loss in vegetative cover.

A decrease in soil productivity also would occur in association with planned soil salvage and stockpiling activities as microbial action would be curtailed, at lease to some degree, in the topsoil stockpiles. These impacts would begin immediately as the soils would be subjected to grading and construction activities and continue through the production phase.

Cuttings pits may be used during drilling under Alternative B, and soil mixing would occur during excavation of the pits. This would impact the soil porosity and soil quality. After drilling, cuttings could be hauled off-site or buried in place. If the cuttings were buried in place, there would be site-specific long-term impacts to soil quality. Depending on the composition of the cuttings, soil contamination impacts could occur if a liner is not used.

Approximately 13,121 acres of soils would be impacted to varying degrees as a result of proposed road construction and upgrading. Rutting may occur if roads or well pads are trafficked during wet periods. Rutting disrupts natural surface water hydrology by diverting and concentrating water flows, which creates accelerated erosion. Where the topography is relatively flat grading would be limited to the upper subsurface soil horizons. As a result, subsurface soils would not be subject to profile mixing. Where cut and fill slopes occur, the soil profiles would be mixed with a corresponding loss of soil structure. Compaction would lead to a loss of soil structure; decreased infiltration, permeability, and soil aeration; as well as increased runoff and erosion. Increased erosion could lead to a decrease in soil fertility and an increase in sedimentation. New roads would be constructed with a six-inch base of three-inch minus gravel with a 3:1 slope for ditches on both sides. Where necessary, water turnouts would be installed within the ROW to provide proper drainage along the road (Section 2.2.1.2). Surfacing and proper drainage would help to reduce the effect of erosion and rutting. Construction activity would not be conducted using frozen or saturated soils material or during periods when watershed damage would be likely to occur.

As described in Section 2.4.2, new primary collector roads and well access roads would be built to be permanent and would remain in place for at least the productive life of the wells. Roads would be maintained and kept in good repair while in service, including maintaining proper crown, ditching, and drainage to prevent unnecessary erosion.

Pipeline and electrical line construction would result in temporary impacts to soil resources because these facilities would be revegetated after construction is complete. Anticipated impacts would include surface disturbance, which would include vegetation removal and soil compaction. This would lead to an increase in runoff and erosion. Due to the linear nature of these facilities, it is anticipated that adjacent vegetation would help to slow off-site sedimentation. However, where these facilities would cross waterbodies, sedimentation could occur. Where the soil profile would be trenched or removed, topsoil also could be mixed with subsoil, which would affect soil productivity. Approximately 17,272 acres would be impacted during construction from these linear facilities.

Droughty soils could affect reclamation success due to their low water holding capacity. During periods of drought, vegetation reestablishment on droughty soils would be difficult and could require additional measures to retain moisture. The acreage of droughty soils potentially impacted by Alternative B is listed in **Table 4.12-2**.

The duration and intensity of these impacts to soils would vary according to the inherent characteristics of the soils to be impacted. The duration and intensity of the impacts also would be determined by site maintenance and reclamation activities. Impacts to soils associated with well pads, facilities, and roads would continue through the production phase on approximately 23,928 acres. This would result in continued impact on soil quality and productivity. Temporary roads required for the construction of facilities and other roads that would not be needed for production would be reclaimed fully as soon as practicable.

The operators would be required to comply with all land management agency requirements, which would help reduce impacts to soil resources. Additionally, the BLM Wyoming Reclamation Policy IM No. WY-2012-032 (BLM 2012i) requires a site-specific reclamation plan for all energy-related surface-disturbing activities, which would be required during the site-specific APD process.

Interim and final reclamation activities for all disturbances on federal lands would be consistent with that described in Section 2.4.5. Roads would be reclaimed according to the guidance contained in Chapter 6 (Reclamation and Abandonment) of the Gold Book (USDOI-USDA 2007), the BLM Wyoming IM No. WY-2012-032 (BLM 2012i), the applicable Forest Service Directives.

4.12.2.2 Mitigation and Mitigation Effectiveness

SOIL-1: Soils ***on federal surface estate*** will be analyzed prior to disturbance ***in coordination with BLM or USFS*** to determine soil characteristics, vegetation composition and ground cover, proposed seed mixtures and application rates, and the need for potential soil amendments.

SOIL-2: To the maximum extent possible, disturbance to soils with limiting characteristics will be avoided.

SOIL-3: ***All suitable topsoil, not to exceed 12 inches in depth, will be*** separated, salvaged, and used when revegetating disturbed areas. ***Operators should use care not to mix soils with limiting characteristics (subsoil) with topsoil.***

SOIL-***4***: If ***a reasonable amount of time*** will pass between the end of construction and initiation of reclamation, erosion controls will be applied to disturbed areas.

SOIL-***5***: During reclamation, areas that have been compacted will be decompacted to the full depth of compaction by subsoiling, paraplowing, or parabolic ripping. Where soils are shallow, scarification will be the chosen method. Compaction depth will be determined on a case-by-case basis by an environmental inspector or soil scientist. Each operator will be responsible for decompacting soils on their developed leases.

SOIL-***6***: Fertilizers and/or other amendments will be used as needed to improve revegetation and reclamation success.

Mitigation measure SOIL-1 would reduce erosion, runoff, rutting, and sediment loading by improving reclamation success through the development of proper reclamation methods prior to conducting surface disturbing activities. Mitigation measure SOIL-2 would reduce damage to soils with limiting characteristics through avoidance. This also would result in reduced erosion, runoff and sediment loading. Mitigation measure SOIL-3 would improve reclamation success by retaining the topsoil with characteristics most suitable for revegetation. Mitigation measure SOIL-4 would reduce surface runoff erosion and sediment loading using mechanical methods approved by land management agencies or surface use agreements. Mitigation measure SOIL-***5*** would ensure decompaction of compacted soils, prepare the seedbed, and increase infiltration of precipitation and reduce runoff and erosion. Mitigation measure SOIL-***6*** would reduce erosion, runoff, rutting, and sediment loading by improving reclamation success on soils with limiting characteristics through the application of fertilizers and other soil amendments.

4.12.2.3 Residual Impacts

Residual impacts are defined as unavoidable adverse impacts to a resource that remain assuming implementation of proposed mitigation. Mitigation measures may reduce impacts to soil resources but may not fully mitigate the impacts. Site-specific losses to long-term soil quality and productivity would occur under Alternative B due to long-term soil disturbance related to well pads, facilities, roads, and topsoil stockpiles. This impact would be localized and affect only a subset of disturbed areas; therefore, no compensatory mitigation is warranted.

4.12.3 Impacts on Soils from Alternative C

Under Alternative C, development would include drilling 5,000 oil and gas wells from 938 new multi-well pads over a 10-year period. Additional surface disturbance would result from the construction of other service well pads, access roads, pipelines, electric power lines, and ancillary facilities; however, the total disturbance for these Project components would be 14,699 fewer acres than under Alternative B

(**Table 2.5-1**). This would result in a 37 percent fewer pads than under Alternative B. An estimated 37,267 acres of disturbance would result from development under Alternative C.

4.12.3.1 Impacts on Soils

Under Alternative C, soils would be impacted to varying degrees as a result of exploration and development of oil and natural gas. Alternative C would have very similar impacts to Alternative B, but the overall surface disturbance impacts to soil resources would be approximately 30 percent less based on the assumption that a greater number of wells would be drilled from each pad. The reduction in well pads required for Alternative C would proportionately reduce the soil resource impacts from access roads, gas gathering pipelines, temporary water pipelines, and overhead electrical lines in comparison to Alternative B.

Table 4.12-3 provides an estimation of the impacts to soils with limiting characteristics identified within the CCPA based on the percent of that soil type present within the CCPA (**Table 3.12-1**). This table is only an estimation of impacts that could occur to various soil types as it is possible that the BLM may require avoidance of particular soils identified during site-specific reviews.

Table 4.12-3 Potential Disturbance of Soils with Limitations from Alternative C

Limiting Soil Characteristic	Potential Disturbance (acres)
Water Erodible	5,178
Wind Erodible	7,014
Droughty Soils	16,380
Hydric Soils[1]	1,405
Shallow Depth to Bedrock	9
Prime Farmland	18
Compaction Prone	11,084
Limited Reclamation Potential	104

[1] Smaller areas of hydric soils may exist but may not be captured due to the scale of mapping.

Source: NRCS 2014.

Under Alternative C, closed-loop drilling would be required across the CCPA. No pits would be used for drilling fluids, and all fluids would be contained in tanks. This would reduce the potential for soil mixing and impacts to soil quality related to pit excavation. It also would reduce the potential for soil and water contamination from petroleum drilling muds compared to Alternative B.

Impacts to soils associated with well pads, facilities, and roads would continue through the production phase on approximately 14,651 acres. This would result in a continued impact on soil quality and productivity. As with Alternative B, temporary roads required for the construction of facilities and other roads that would not be needed for production would be reclaimed fully as soon as practicable.

Under Alternative C, interim reclamation would be required to meet the managing agencies approval for suitable wildlife habitat on federally managed lands and lands above federal mineral estate (approximately 65 percent of the CCPA). Interim reclamation would occur on private surface in all alternatives in accordance with surface use agreements and specific reclamation goals outlined in IM 2012-032 (BLM 2012i). Reclamation would occur as described in Section 2.2.4 and Section 2.5.2.9.

4.12.3.2 Mitigation and Mitigation Effectiveness

Proposed mitigation measures and mitigation effectiveness for Alternative C would be the same as for Alternative B (Section 4.12.2.2).

4.12.3.3 Residual Impacts

Residual impacts are defined as unavoidable adverse impacts to a resource that remain assuming implementation of proposed mitigation. Site-specific losses to long-term soil quality and productivity would occur under Alternative C due to long-term soil disturbance related to well pads, facilities, roads, and topsoil stockpiles. This impact would be localized and affect only a subset of disturbed areas; therefore, no compensatory mitigation is warranted.

4.12.4 Relationship between Local Short-term Uses of the Human Environment and Maintenance and Enhancement of Long-term Productivity

The relationship between local short-term uses of the human environment and maintenance and enhancement of long-term productivity is the disclosure regarding whether the short-term use of a resources associated with a project affects the long-term sustainability of that resource. Overall site productivity primarily would be a matter of revegetation success. Productivity varies with vegetation community, but more importantly, would vary with land management objectives as they relate to the establishment of desirable or productive vegetation types. In contrast, soil quality is an inherent soil resource characteristic involving aeration, permeability, texture, salinity and alkalinity, microbial populations, fertility, and other physical and chemical characteristics that are accepted as beneficial to overall plant growth and establishment. Based on this concept, there would be impacts to short-term uses and long-term productivity related to the quality of native soils after Project-related disturbance, until successful revegetation is achieved.

4.12.5 Irreversible/Irretrievable Commitment of Resources

Irreversible/irretrievable impacts are subsets of unavoidable adverse/residual impacts. Irreversible impacts are those that cannot ever be restored; they would be lost forever. Irretrievable impacts are those for which the resource value would be irretrievably lost until restoration of that resource takes place. An irretrievable loss of soil productivity and quality would be associated with development of well pads, the road network, electrical network, and support facilities. At the completion of the Project, the disturbed areas would be reclaimed; therefore, no irreversible commitment of soil resources would be anticipated.

4.13 Transportation

The analysis area for direct and indirect impacts to transportation includes the CCPA, the City of Douglas, and federal, state, BLM, and USFS roads providing access to the CCPA. The greatest impact to transportation resources would be the increased traffic and use of new and existing roads due to additional trips generated during Project construction and production. Additional trips generated would be greatest during the drilling and completion phases of the Project.

The methodology for analysis of impacts to transportation includes:

- Used Project schedule, trip generation factors, trip types, routes, trip assignments, existing and future traffic conditions, and site access points set forth in the Transportation Management Plan to:
  - Identify traffic associated with the alternatives by number of trips, types of vehicles, timing of trips, and origin/destination.
  - Describe traffic increases on area highways and roads in the context of baseline traffic estimates, where available. Area highways and roads include Wyoming State Highways and Converse County, BLM, USFS, and private roads.
- Estimated potential impacts of new and improved roads and improved interchanges.
- Identified potential conflicts with other county, BLM, USFS, and private road users.
- Identified potential impacts of oversize/overweight loads.
- Identified conflicts with other county, BLM, USFS, and private road users (e.g., ranchers, recreationists, or general public).
- Identified potential for increased traffic accidents.

Transportation is managed according to the goals and objectives of the BLM ROD and Approved Casper RMP (BLM 2007b), the USFS TBNG LRMP (USFS 2001), and the 2015 Converse County Land Use Plan (Converse County 2015a).

Assumptions used in the analysis of impacts to transportation include:

- Potential Project-related effects of new and improved roads and related disturbance on soils, noxious weeds and invasive plant species, wildlife and wildlife habitat, and visual, recreation and range resources have been described within their respective sections and cross-referenced in this Transportation discussion as appropriate.
- The Project work force would be housed almost entirely outside of the CCPA boundary, which would require all workers to travel on public roads to and from work each day.
- All roads on USFS lands would follow the applicable BMPs and meet or exceed standards and guidelines for Transportation listed in the TBNG LRMP.
- All use and modification of state highways would be conducted in accordance with State of Wyoming laws and WYDOT regulations.
- All use and modification of Converse County Roads would be conducted in accordance with Converse County laws and regulations.
- Primary access to the CCPA would be from I-25, Wyoming WY 59 and U.S. Highway 18/20.
- All access roads would be closed and reclaimed during decommissioning, subject to the approval by the BLM, USFS, State of Wyoming, and private landowners as appropriate. An

access road is a road used specifically by an operator to access a project well pad or other Project component.

4.13.1 Impacts to Transportation from Alternative A – No Action

Under Alternative A, new development would continue as disclosed under NEPA (Section 2.3.2). This new development would include drilling of 1,663 new oil and gas wells on 361 pads as well as the construction of other service well pads, roads, production facilities, pipelines, and electrical power lines. Access to well and production pad locations would require construction of approximately 386 miles of new well/production pad access roads, with an estimated average of 1 mile of new access road per well pad. Transportation resources would be impacted by increased traffic from construction and production activities, with the greatest impacts occurring during the drilling and completion phases, diminishing during production. Impacts to transportation resources could include traffic delays, primarily during construction activities; pavement damage, increased maintenance costs due to heavy axle weights; and elevated safety concerns to local road users such as ranchers and recreationists from increased traffic levels. The risk of vehicle accidents would increase in the winter during adverse weather conditions as would the risk of increased severe accidents related to the heavy vehicles used in oil and gas construction and operations.

4.13.2 Impacts to Transportation from Alternative B – Proposed Action

4.13.2.1 Impacts to Transportation

Under Alternative B, approximately 5,000 new oil and gas wells would be drilled on 1,500 multi-well pads over a period of 10 years (500 new wells per year). Additional surface disturbance would result from the construction of other service well pads, access roads, pipelines, electric power lines, and ancillary facilities (**Table 2.4-1**). An estimated 52,667 acres of disturbance would result from oil and gas development under Alternative B. Of this total disturbance, approximately 13,121 acres would be from access roads, approximately 21,400 acres would be from well pads, and the remainder would be from a combination of production and linear facilities.

New roads would be constructed as needed to provide access to the new wells. In addition to the approximately 2,978 miles of roads already in place within the CCPA, construction of approximately 1,970 miles of new roads would be needed. Approximately 1 mile of new access road would be needed for each of the new 1,580 well pads (includes well pads, water source well pads, and disposal well pads) and 390 miles of new primary collector roads that would be needed to serve multiple well pads or other Project facilities. Primary collector roads would provide access to large blocks of land in the CCPA, while well pad access roads would provide access from primary collector and/or existing local roads to the well pads.

Transportation resources would be impacted by increased traffic from construction and production activities, with the greatest impacts occurring during the drilling and completion phases. Light/medium vehicles are defined as vehicles weighing less than 26,000 pounds, while heavy vehicles are those weighing 26,000 pounds or more. Based on information provided in Section 2.4.8, the estimated maximum average number of annual round trips for well construction associated with Alternative B would be approximately ***197,408*** light truck trips and approximately ***185,929*** heavy truck trips (**Table 4.13-1**) ***for a total of approximately 383,337 annual trips***. These trips would occur sequentially with the different phases of construction. **Table 4.13-1** provides the per well, daily, and annual average road trips anticipated over the 10-year construction period for each well construction phase. As detailed in **Table 4.13-1**, vehicle trips during well construction would be concentrated during activity-specific durations lasting anywhere from 10 to 30 days.

Table 4.13-1 Vehicle Trips for Well Development for Alternative B

Well *Development* Phase	Average Round Trips per *Development Phase*		Average Annual Round Trips *for Well Development*[1]		Average Daily Round *T*rips per *Well*/Well Pad[1]		Average Daily Round *T*rips for All *Wells*/Well Pads[1]	
	Light Truck	Heavy Truck	Light Truck	Heavy Truck	Light Truck	Heavy Truck	Light Truck	Heavy Truck
Pad Construction[2]	176 (per pad)	38 (per pad)	34,408 (pads)	7,429 (pads)	9	2	1,760	391
Drilling (Well)[3]	209	69	104,500	34,500	7	2	3,500	1,000
Rig Move[4]	10	300	***1,500***	***45,000***	***2***	***60***	***300***	***9,000***
Completion (Well)[5]	114	198	**57,000**	**99,000**	**12**	***20***	**6,000**	**10,*000***
Well Development Total[6]	509	605	***197,408***	***185,929***	***30***	***84***	***11,560***	***20,391***

[1] Based on average 10-year construction period.

[2] ***Based on*** an average rate of 150 new multi-well pads constructed per year*, plus approximately 45 pads for production, water supply wells and injection,* and average construction duration of 19 days.

[3] ***Based on*** an average rate of 500 wells drilled per year and average drilling duration of 30 days.

[4] ***Based on*** an average rate of ***one rig move per pad, 150 new multi-well pads per year****,* and average rig move duration of ***5*** day***s***.

[5] ***Based on*** an average of 500 wells completed per year and average construction completion duration of 10 days.

[6] Does not include commuting workers.

Source: Draft Transportation Plan (OG 2015a).

While **Table 4.13-1** provides detail regarding light and heavy truck traffic for well pad construction, **Table 4.13-2** details light and heavy truck construction traffic for the aboveground and linear facilities associated with Alternative B over the 10-year construction period. Construction of the freshwater make-up ponds and compression facilities would generate the most traffic from construction of aboveground facilities. These aboveground facilities may be constructed at any time during the 10-year construction timeframe and would result in increased traffic levels that may not be spread evenly through the construction time period.

Approximately 2,900 miles of new gathering and mainline pipeline and approximately 1,970 miles of new roads would be constructed under Alternative B. As shown in **Table 4.13-2**, construction of aboveground facilities, pipelines, and roads would result in a substantial amount of light and heavy truck traffic throughout the 10-year construction timeframe.

It is anticipated that workers commuting to the CCPA would add to traffic on regional US and Wyoming state roadways. The majority of commuters traveling into the western portion of the CCPA likely would travel from Casper utilizing I-25 to either WY 95 or WY 387. Commuters from Douglas likely would comprise the next largest commuter group and would utilize WY 93, followed by commuters from Gillette utilizing WY 59.

The majority of commuters traveling into the central portion of the CCPA likely would travel from Casper utilizing I-25 to either WY 93 or WY 95. Those commuters from Douglas would comprise the next largest commuter group into the central portion of the CCPA and would utilize WY 59 or 93, followed by commuters from Glenrock and Gillette utilizing WY 93 or 95, and WY 59, respectively.

The majority of commuters traveling into the eastern portion of the CCPA likely would travel from Douglas via WY 59. It is anticipated that commuters from Casper would comprise the next largest commuter group into the eastern portion of the CCPA and would utilize I-25 to WY 59, followed by commuters from Glenrock and Gillette both utilizing WY 59.

Table 4.13-3 shows the total estimated volume of light and heavy truck activity that could be expected during the production and operation phase under Alternative B. Operations-related traffic would be greatest during year 10, then decline steadily as wells reach the end of their 30-year life. Heavy truck traffic associated with production would consist of oil truck and wastewater truck trips, as well as both light and heavy truck trips associated with workovers and maintenance activities. Oil would be transported by truck or rail to a refinery for processing. Should oil be transported to a refinery by truck, this could further add to traffic levels during production and operations.

An increase in traffic within the CCPA and the surrounding transportation network (**Figure 3.13-1**) would be evident during the life of the Project. **Table 4.13-4** provides the estimated traffic levels in 2028 (i.e., year 10, which would be the anticipated peak traffic year for the Project) on local U.S. and state highways servicing the CCPA. The methodology for determining estimated traffic levels on U.S. and state highways is detailed in the Draft Transportation Plan (OG 2015a). In summary, the methodology used peak year 2028 traffic estimates based on the Project emissions inventory as well as best estimates of anticipated distribution of Project traffic based in part on locations of previously approved oil and gas developments. Locations of future traffic would be influenced by factors such as the pace and location of APDs. Percent increases from 2016 traffic levels would range from 5 percent to 679 percent. Overall, the estimated traffic increases on state highways due to Alternative B would be substantial compared to 2016 levels. Potential impacts from the increased traffic levels on state roads could include increased maintenance costs and safety hazards; however, the increase would not be anticipated to affect the free-flowing nature of the state highways within and near the CCPA.

Table 4.13-2 Vehicle Activity for Construction of Facilities for Alternative B

Facility Type	Number or Miles of Facilities	Average Round Trips per Facility/Mile		Average Annual Round Trips for All Facilities[1]		Average Daily Round-trips per Facility/Mile		Average Daily Round-trips for All Facilities[1]	
		Light Truck	Heavy Truck	Light Truck	Heavy Truck	Light Truck	Heavy Truck	Light Truck	Heavy Truck
Aboveground Facilities									
Gas Plants	2	1,630	580	326	116	10	4	2	1
Oil / Condensate Storage	6	49	17	29	10	40	4	24	2
Centralized Processing Facilities	2	82	29	16	6	10	4	2	1
Compression Facilities	50	82	29	410	145	10	4	50	20
Equipment / Pipe Storage Yard	1	815	290	82	29	10	4	1	<1
Electrical Substations	12	49	17	59	20	10	4	12	5
Workforce Facility (Offices)	1	163	58	16	6	10	4	1	<1
Freshwater Makeup Ponds	30	130	46	390	138	10	4	30	12
Aboveground Facilities Total		**3,000**	**1,066**	**1,328**	**470**	**110**	**32**	**122**	**42**
Linear Facilities									
New Pipeline	2,900	98	15	28,420	4,350	10	19	2,900	5,510
New Road	1,970	127	240	25,019	47,280	10	19	1,970	3,743
Linear Facilities Total[2]		**225**	**255**	**53,439**	**51,630**	**20**	**38**	**4,870**	**9,253**

[1] Based on average 10-year construction period.

[2] Does not include commuting workers.

Source: Draft Transportation Plan (OG 2015a).

Table 4.13-3 Anticipated Average Vehicle Activity for Production and Operations for Alternative B

Project Year	10		31		39	
Number of Producing Wells	5,000		4,500		500	
Vehicle Type	Light Truck	Heavy Truck	Light Truck	Heavy Truck	Light Truck	Heavy Truck
Production and Operations Average Daily Trips[1]	3,396	3,147	3,056	1,212	339	132

[1] Does not include commuting workers.

Source: OG 2015a.

Table 4.13-4 Anticipated Local Highway Average Daily Trips for Alternative B

Route	Location	2016 All Vehicles	2028 Truck Traffic[1]			Percent Change 2016-2028
			Light	Heavy	Total	
I-25	Deer Creek	4,443	1,000	1,800	2,800	63
	Junction US 20/26/87 East Douglas	3,889	100	100	200	5
	Junction US 20/26/87 West Douglas	4,461	300	500	800	18
WY 59	Junction US 20/26/87 and I-25 Business	4,846	300	500	800	17
	Junction 4th Street	2,467	2,300	2,900	5,200	211
	Converse / Campbell County	2,445	1,000	1,100	2,100	86
WY 93	Junction Route 43/WY 95	7,733	2,000	1,600	3,600	47
WY 95	Junction US 20/26/87	1,885	1,000	1,600	2,600	138
	North Platte River	383	1,000	1,600	2,600	679

[1] Does not include commuting workers.

Sources: Draft Transportation Plan (OG 2015a).

Due to the limited existing road network in the CCPA, it is assumed that portions of major county roads would see increases in traffic; however, because well locations are not known and as a result of the dispersed nature of these roads, the change in traffic levels could not be estimated for county roads. However, the county road network within Converse County is slightly less developed compared to neighboring counties; therefore, there is a higher degree of certainty which roads would be utilized for the Project. The primary county roads anticipated for use include Ross Road (County Road 31), Bill Haul Road (County Road 63), Jenne Trail Road (County Road 34), Highland Loop (County Road 32), and Steckly Road (USFS Road). The recommended total improvement costs for Converse County roads, based on 2012 traffic counts, would be $430,000, or approximately $823 per mile of county road (Mountain-Plains Consortium 2013). The leading reasons these roads would require improvements were for dust control and to alleviate washboarding. Increased traffic due to Project activity could cause short-term delays on local roads, mostly during construction activities and safety concerns to local road users such as ranchers and recreationists. These impacts to local users would be greatest during construction, but would diminish during production.

The WYDOT and the Wyoming Highway Patrol require permits for oversize and/or overweight vehicles operating on any Wyoming State Highway, and the USFS requires road use permits for travel on off-lease roads. Converse County ***also*** require***s*** similar permits on county roads that would help regulate energy traffic and compensate for road damage. Potential safety impacts from the estimated increase in traffic levels are discussed in detail in Section 4.4.

To minimize impacts, the existing road network would be used to the extent practical. New roads and pipeline corridors would follow contours and use topography to the extent safe and practical. New roads or necessary improvements to existing routes would be developed in accordance with standards in the Gold Book and BLM Manual 9113 unless otherwise specified by the applicable agency or private landowner. Design characteristics for new roads would follow standard operating procedures as described in Section 2.4.2.1 and would vary based on site-specific topography and soil characteristics supplied with individual well plats during the APD process. Section 6.0 of the OGs Transportation Plan details the procedures intended to minimize construction of roads needed to implement Project activities.

4.13.2.2 Mitigation and Mitigation Effectiveness

The following proposed mitigation measures would reduce impacts to transportation-related activities:

TRANS-1 Cooperative road management plans will be developed among the operators, Converse County, the state of Wyoming, and private landowners that will address maintenance requirements and responsibilities, as well as highlight potential areas of enhanced safety concern.

TRANS-2 Pipelines will be buried at road crossings. The operator will bury all ***permanent*** pipelines crossing county roads to a minimum depth of ***10*** feet.

TRANS-3 Passing areas will be constructed as directed by the AO.

TRANS-4 Heavy and/or slow-moving equipment will be used only at night or during non-peak driving times. Flaggers and/or flag cars will be used to alert non-Project traffic of upcoming Project equipment.

TRANS-5 Additional permanent and temporary signage will be placed along roadsides to alert motorists of upcoming construction vehicles.

TRANS-6 Signage will be installed in areas of heavy equipment and heavy truck traffic.

The potential for transportation impacts such as elevated road maintenance costs from increased traffic resulted in Mitigation measures TRANS-1 and TRANS-2, which would address maintenance requirements and responsibilities, and ensure that roads used for the Project would not be degraded. Increased traffic due to Project activity could cause short-term delays on local roads and safety concerns to local road users such as ranchers and recreationists. Mitigation measures TRANS-3 and TRANS-4 would minimize traffic delays. Mitigation measures TRANS-5 and TRANS-6 would minimize roadway public health and safety threats.

4.13.2.3 Residual Impacts

Residual impacts are defined as unavoidable adverse impacts to a resource that remain assuming implementation of proposed mitigation. Residual impacts to transportation that would remain after implementation of additional mitigation measures would include elevated traffic levels and expansion of the local roadway network. This would create increased need for road maintenance and subsequent increased maintenance costs to *state and* local governing agencies as well as an increased safety threat to local road users. Due to the low level of residual impacts, no compensatory mitigation is warranted.

4.13.3 Impacts to Transportation from Alternative C

4.13.3.1 Impacts to Transportation

Under Alternative C, 5,000 new oil and gas wells would be drilled from 938 new multi-well pads over a ten year period. This would be approximately 37 percent fewer pads than under Alternative B. Additional surface disturbance would result from the construction of other service well pads, access roads, pipelines, electric power lines, and ancillary facilities; however, this additional disturbance also would be less than under Alternative B (**Table 2.5-1**). This development would be constructed on approximately 37,267 acres throughout the CCPA. Of this total disturbance, approximately 8,388 acres would be from access roads, 13,544 acres would be from well pads, and the remainder would consist of a combination of production and linear facilities. Disturbance during construction under Alternative C would be 29 percent less than under Alternative B.

As with Alternative B, new roads would be constructed as needed to provide access to the new wells. In addition to the approximately 2,978 miles of roads already in place within the CCPA, construction of approximately 1,262 miles of new roads would be needed under Alternative C, which would be 33 percent less than under Alternative B. Approximately one mile of new access road would be needed for each of the new 1,018 well pads (includes well pads, water source well pads, and disposal well pads), and 244 miles of new primary collector roads that would be needed to serve multiple well pads or other Project facilities.

Under Alternative C operators would move rigs more frequently than under Alternative B to avoid the timing limitation stipulations for raptors for which BLM would not be granting exceptions under this alternative. For purposes of analysis, the BLM conservatively assumed 3 rig moves per pad if located within a timing limit stipulation buffer. Approximately 26 percent of the CCPA is located within a timing limitation stipulation buffer with the remainder of the CCPA (74 percent) located outside of a buffer. Based on these assumptions, the average number of rig moves for Alternative C would be 1.5 rig moves per pad for an estimated total of 1,425 rig moves.

Transportation resources would be impacted the greatest during the drilling and completion phases. The anticipated maximum average number of annual round trips for well ***development*** associated with Alternative C would be approximately ***184,977*** light truck trips and approximately ***180,475*** heavy truck trips (**Table 4.13-5**) ***for a total of approximately 365,452 annual trips***. This would ***represent a*** 6 percent ***decrease in*** annual light truck ***trips*** and ***a 3 percent decrease in*** heavy truck round trips ***under Alternative C*** compared to Alternative B. **Table 4.13-5** provides the per well, daily, and annual average road trips anticipated over the 10-year construction period for each well construction phase. As detailed in **Table 4.13-5**, vehicle trips during well construction would be concentrated during activity-specific durations lasting anywhere from ***5*** to 30 days.

While **Table 4.13-5** portrays detail regarding light and heavy truck traffic for well pad construction, **Table 4.13-6** portrays light and heavy truck construction traffic for the linear facilities associated with Alternative C over the 10-year construction period. Impacts to traffic due to development of aboveground facilities under Alternative C would be the same as under Alternative B (**Table 4.13-2**). For linear facilities, approximately 2,005 miles of new gathering and mainline pipeline and approximately 1,262 miles of new roads would be constructed under Alternative C. This would be approximately 33 percent less truck traffic related to pipeline and road construction than under Alternative B.

Table 4.13-7 shows the total estimated volume of light and heavy truck activity that could be expected during the operation and production phase under Alternative C. As under Alternative B, operations related traffic would be greatest during year 10, then decline as wells reach the end of their 30-year life. ***Light truck t***raffic under Alternative C would be approximately 6 percent less than under Alternative B ***and heavy truck traffic would be approximately 3 percent less than under Alternative B*** due to the development of fewer well pads under Alternative C.

Table 4.13-5 Vehicle Trips for Well Development for Alternative C

Well Construction Phase	Average Round Trips per *Construction Phase*		Average Annual Round Trips for All Wells[1]		Average Daily Round *T*rips per *Well*/Well Pad		Average Daily Round *T*rips for All *Wells*/Well Pads[1]	
	Light Truck	**Heavy Truck**	**Light Truck**	**Heavy Truck**	**Light Truck**	**Heavy Truck**	**Light Truck**	**Heavy Truck**
Pad Construction[2]	176 (per well)	38 (per well)	22,070 (pads)	4,765 (pads)	9	2	1,129	251
Drilling (Well)[3]	209	69	104,500	34,500	7	2	3,500	1,000
Rig Move[4]	10	300	***1,407***	***42,210***	***2***	***60***	***281***	***8,442***
Completion (Well)[5]	114	198	57,000	99,000	12	2*0*	6,000	10,*0*00
Well Development Total[6]	**509**	**605**	***184,977***	***180,475***	***30***	***84***	***10,910***	***19,693***

[1] Based on average 10-year construction period.

[2] ***Based on*** an average rate of ***94*** new multi-well pads constructed per year*,* ***plus approximately 31 pads for production, water and injection,*** and average construction duration of 19 days.

[3] ***Based on*** an average rate of 500 wells drilled per year and average drilling duration of 30 days.

[4] ***Based on*** an average rate of ***1.5 rig moves per pad, 94 multi-well pads per year****,* and ***the*** rig move ***process (mobilization and demobilization) is assumed to take5*** days*.*

[5] ***Based on*** an average of 500 wells completed per year and average construction completion duration of 10 days.

[6] Does not include commuting workers.

Source: Draft Transportation Plan (OG 2015a).

Table 4.13-6 Vehicle Activity for Construction of Linear Facilities for Alternative C

Facility Type	Number or Miles of Facilities	Average Round Trips per Facility/Mile		Average Annual Round Trips for All Facilities[1]		Average Daily Round-trips per Facility/Mile		Average Daily Roung-trips for All Facilities[1]	
		Light Truck	Heavy Truck	Light Truck	Heavy Truck	Light Truck	Heavy Truck	Light Truck	Heavy Truck
New Pipeline	2,005	98	15	19,649	3,008	10	19	2,005	3,810
New Road	1,262	127	240	16,027	30,288	10	19	1,262	2,398
Linear Facilities Total[2]		**225**	**255**	**35,676**	**33,296**	**20**	**38**	**3,267**	**6,207**

[1] Based on average 10 year construction period.

[2] Does not include commuting workers.

NOTE: Vehicle activity for construction of aboveground facilities for Alternative C would be the same as for Alternative B (**Table *4*.13-2**).

Source: Draft Transportation Plan (OG 2015a).

Table 4.13-7 Anticipated Average *Daily* Vehicle *Traffic* for Production and Operations for Alternative C

Project Year	10		31		39	
Number of Producing Wells	5,000		4,500		500	
Vehicle Type	Light Truck	Heavy Truck	Light Truck	Heavy Truck	Light Truck	Heavy Truck
Production and Operations Average Daily Trips[1]	***3,192***	***3,053***	**2,883**	**1,143**	**320**	**125**

[1] Does not include commuting workers.

Source: Draft Transportation Plan (OG 2015a), modified to account for an estimated 6 percent decrease ***in light truck traffic and a 3 percent decrease in heavy truck traffic at Project Year 10*** compared to Alternative B.

An increase in traffic within the CCPA and the surrounding transportation network (**Figure 3.13-1**) would be evident during the life of the Project. **Table 4.13-8** provides the estimated traffic levels in 2028 (i.e., year 10, which would be the anticipated peak traffic year for the Project) on local U.S. and state highways servicing the CCPA. As is noted in Section 4.13.2.1, the methodology for determining estimated traffic levels on U.S. and state highways is detailed in the Transportation Plan. Percent increases from 2016 traffic levels would range from 5 percent to ***651*** percent. Overall, the estimated traffic increases on state highways due to Alternative C would be substantial compared to 2016 levels. Potential impacts from the increased traffic levels on state and county roads under Alternative C would be similar in scope but less in scale to those discussed for Alternative B. Due to the development of fewer well pads under Alternative C, transportation impacts would be slightly less than under Alternative B.

Table 4.13-8 Anticipated Local Highway Average Daily Trips for Alternative C

Route	Location	2016 All Vehicles	2028 Truck Traffic[1] Light	Heavy	Total	Percent Change 2016-2028
I-25	Deer Creek	4,443	***940***	***21,746***	***2,686***	**60**
	Junction US 20/26/87 East Douglas	3,889	**94**	***97***	***191***	**5**
	Junction US 20/26/87 West Douglas	4,461	***282***	***485***	***767***	**17**
WY 59	Junction US 20/26/87 and I-25 Business	4,846	***282***	***485***	***767***	**16**
	Junction 4th Street	2,467	***2,162***	***2,813***	***4,975***	***202***
	Converse / Campbell County	2,445	***940***	***1,067***	***2,007***	***82***
WY 93	Junction Route 43/WY 59	7,733	***1,880***	***1,552***	***3,432***	**44**
WY 95	Junction US 20/26/87	1,885	***940***	***1,552***	***2,492***	***132***
	North Platte River	383	***940***	***1,552***	***2,492***	***651***

[1] Does not include commuting workers.

Source: Draft Transportation Plan (OG 2015a), modified to account for an estimated 6 percent decrease ***in light truck traffic and a 3 percent decrease in heavy truck traffic*** compared to Alternative B.

4.13.3.2 Mitigation and Mitigation Effectiveness

Proposed mitigation measures and mitigation effectiveness for Alternative C would be the same as for Alternative B (Section 4.13.2.2).

4.13.3.3 Residual Impacts

Residual impacts are defined as unavoidable adverse impacts to a resource that remain assuming implementation of proposed mitigation. As with Alternative B, after implementation of additional mitigation measures, residual impacts to transportation for Alternative C that would remain would include elevated traffic levels and expansion of the local roadway network. This would create the need for additional road maintenance and subsequent increased maintenance costs to ***state and*** local governing agencies as well as an increased safety threat to local road users

4.13.4 Relationship between Local Short-term Uses of the Human Environment and Maintenance and Enhancement of Long-term Productivity

The relationship between local short-term uses of the human environment and maintenance and enhancement of long-term productivity is the disclosure regarding whether the short-term use of a resource associated with a project affects the long-term sustainability of that resource. Over the 40-year life of the Project, a more extensive road network would be in place for enhanced dispersed recreational access and other uses. Over the long term, some minor well pad roads may be reclaimed, resulting in a reduction in the transportation network created for development within the CCPA.

4.13.5 Irreversible/Irretrievable Commitment of Resources

Irreversible/irretrievable impacts are subsets of unavoidable adverse/residual impacts. Irreversible impacts are those that cannot ever be restored; they would be lost forever. Irretrievable impacts are those for which the resource value would be irretrievably lost until restoration of that resource takes place. Project-related traffic increases would continue for the life of the Project, but would be reversible and would cease upon completion of reclamation. Project-related impacts due to development of new roads could be reversible, but new roads are typically retained. There would be no irretrievable transportation impacts associated with the Project.

4.14 Vegetation

The impact analysis area for direct and indirect impacts to vegetation is the CCPA. Resources presented in this section include vegetation communities, noxious weeds and invasive plant species, and special status plant species.

The methodology for analysis of impacts to vegetation communities included:

- Vegetation communities were identified within the analysis area as described by LANDFIRE in Section 3.14.1, General Vegetation (LANDFIRE 2014).
- Exact locations of impacts have not been defined (i.e., no site-specific disturbance could be determined); therefore, a proportional estimate of disturbance impacts to vegetation communities was calculated by multiplying the percent of vegetation community present in the CCPA (**Table 3.14-1**) by the disturbance for each alternative/parameter being analyzed.
- Occurrence potential for some federally listed and special status plant species was determined based on predictive distribution models created by WYNDD.
- Although the proportional estimate of impacts to vegetation communities does include Wetland and riparian areas, operators likely would avoid disturbing these areas to the extent practical.
- The acreage of impacts that would have been assigned to open water were proportionately distributed to the vegetation communities adjacent to open water (i.e., 40 percent to wetland/riparian, 30 percent to grassland, and 30 percent to mixed shrubland).
- For special status species without WYNDD models, potentially suitable habitat was estimated through LANDFIRE data and desktop GIS analysis based on species required vegetative communities and known distribution.
- Special status plant species that were identified as potentially occurring within the CCPA were carried forward for impact analysis. Species were carried forward in the impact analyses if occurrence has been documented, geographic range currently exists within the analysis area, and/or suitable habitat is presented.
- Impacts to special status plant species were estimated based on the specific vegetation community requirements per species (i.e., the acreage of suitable habitat within the CCPA) and the likelihood that those vegetation communities would be impacted based on the proportional disturbance for each alternative.

Vegetation is managed according to the management goals and objectives from the BLM ROD for the CFO RMP (BLM 2007b) and the USFS TBNG LRMP (USFS 2001). The USFWS has jurisdiction over the management of federally endangered, threatened, and proposed species populations. The BLM manages BLM sensitive species in accordance with BLM Manual 6840 (BLM 2008d), and the USFS manages USFS sensitive species in accordance with FSM 2670. In addition, the BLM and USFS manage federally listed species habitats in coordination with the USFWS.

Assumptions used in the analysis of impacts to vegetation communities, noxious weeds and invasive plant species, and special status plants include:

- LANDFIRE data is the most accurate information available concerning vegetation communities at the scale of the Project.
- Vegetation community impacts are assumed to be proportional to the amount of surface disturbance (i.e., increased surface disturbance would result in a corresponding increase to vegetation impacts).

- Impacts to plant communities could lead to reduction of productivity as well as changes in species composition.
- Increase in noxious weeds and invasive plant species is assumed to be proportional to the amount of surface disturbance.
- Erosion from disturbed areas would be minimal once vegetation or other surface stabilization is established.

4.14.1 Impacts to Vegetation from Alternative A – No Action

4.14.1.1 Impacts to General Vegetation

Under Alternative A, new development would continue within the CCPA as disclosed under previous NEPA documents (Section 2.3.2). An estimated 10,253 acres of disturbance would result from new development under Alternative A (**Table 2.3-3**).

Table 4.14-1 displays estimated new disturbance for each vegetation community based on impacts for Alternative A. Vegetative communities within the CCPA are displayed in **Figure 3.14-1**. **Table 4.14-2** provides the estimated acres impacted by Alternative A based on the percent of surface ownership/ administration as noted on **Table 2.1-1**. If construction would occur adjacent to the boundary of the CCPA, indirect effects such as dust and establishment of noxious weed and invasive plant species could impact vegetation communities outside of the analysis area.

Table 4.14-1 Estimated Vegetation Community Disturbance Under Alternative A

Vegetation Cover Type	Estimated Disturbance during Construction (acres)[1]
Grassland	6,799
Sagebrush shrubland	2,255
Barren/sparsely vegetated	860
Conifer	77
Agriculture	70
Developed	70
Wetland/riparian	67
Mixed shrubland	55
Total	**10,253**

[1] Totals among tables may vary due to rounding.

Table 4.14-2 Estimated Disturbance by Surface Ownership / Administration under Alternative A

Surface Owner / Administrator	Percent Owned / Administered	Estimated Impact (acres)[1]
BLM-administered	6	615
USFS-administered	4	410
State of WY	7	718
Private	83	8,510
Total	**100**	**10,253**

[1] Totals among tables may vary due to rounding

The vegetation communities that would be impacted the most under Alternative A include grassland, sagebrush shrubland, and barren/sparsely vegetated communities. These three communities are the most abundant within the CCPA; therefore, there would be a higher likelihood they would be impacted.

Surface-disturbing activities during construction would include vegetation clearing for well pads and related facilities, installation of pipelines and new roads, trampling/crushing of vegetation, and potential hazardous spills from vehicles and equipment. Other impacts to vegetation would include increased erosion, sedimentation, fugitive dust generation, changes in the quantity and arrangement of surface fuels, habitat fragmentation, the potential for the spread and establishment of noxious weeds and invasive plant species, and damage to vegetation through herbicide drift when treating noxious weeds and invasive plant species on public and/or agricultural lands. The extent of impacts would depend on factors such as sensitivity of the vegetation community, type and timing of Project activities, and physical parameters (e.g., topography, community, forage). The BLM Casper RMP (BLM 2007b) and the TBNG LRMP (USFS 2001) have several standards, guidelines, objectives, and management decisions developed to reduce impacts from fugitive dust; fire; erosion and sedimentation, and infestations of noxious weeds and invasive plant species to general vegetation.

Surface disturbing activities and vehicular travel on unpaved roads typically would produce fugitive dust. Approximately 386 miles of new roads would be constructed under Alternative A. Travel along these roads would contribute to impacts on the surrounding vegetation community. Fugitive dust that settles on vegetation could affect photosynthesis, respiration, transpiration, water use efficiency, and allow the penetration of phytotoxic pollutants. Dust also may exacerbate secondary stressors such as drought and insects (Farmer 1993). Factors that would determine the degree and extent of effects from fugitive dust emissions include wind speed, precipitation events, and the application and effectiveness of dust suppression techniques. The USFS has adopted a guideline (Physical Resources Goal A4) that requires energy developers to partner with the USFS as well as state and local agencies to create dust control plans for unpaved roads within the TBNG (USFS 2001).

Extensive networks of roads and utility corridors could lead to fragmentation of native landscapes. Landscape fragmentation is defined as the transformation or break-up of large patches of continuous, connected areas into a number of smaller patches that are isolated from each other and often separated by areas of disturbance. Landscape fragmentation could result in loss of habitats, decreased species diversity, and decreased numbers and populations of native vegetation. Landscape fragmentation also could increase the potential for spread of non-native plants.

The conversion and loss of vegetation would impact the quantity and arrangement of surface fuels, resulting in impacts to the fire regime within the CCPA. Fire conditions are the product of the combination of fire frequency, intensity, severity, seasonality, size of burn, and fire pattern. Fire can cause dramatic and immediate changes to vegetation, eliminating some plants while others may establish where they did not previously exist (USDA 2000). Grassland and shrubland fires and fire size have increased, which has become a concern with the increase in urban encroachment and development (USDA 2000). When fire regimes are disturbed, ecological processes such as regeneration, growth and mortality, decomposition, nutrient fluxes, hydrology, and wildlife activity could potentially be affected. Vegetation communities within the CCPA have been impacted by wildfires that have resulted in shrub removal and the establishment of invasive annual grasses (e.g., cheatgrass), which increases the biomass of the sagebrush/shrubland vegetation community and provides fine fuels that could spread fire quickly. The fire frequency in these effected areas has increased from a 30- to 100-year return interval to as little as 5 years (Brooks and Pyke 2001). This has resulted in a change from the natural sagebrush and mixed shrubland vegetation communities to one dominated by annual grasses. These annual grasses return to the landscape quicker than woody shrubs and have a more frequent fire return interval, which make it difficult for sagebrush and shrubland vegetation to return to the landscape without seeding or other treatments.

Specific BLM and USFS goals and objectives related to fire management and biodiversity include:

- Goal FM:1 (BLM Casper RMP) involves wildland fire and fuels for the protection of public health, safety, property, and resource values. The BLM aims to maintain a mix of seral stages within several vegetation communities and to manage these communities to maintain Condition Class 1 status (i.e., 0- to 35-year frequency, low to mixed severity). Vegetation communities in Condition Classes 2 (i.e., 0- to 35-year frequency, high severity) and Condition Class 3 (i.e., 35- to 100+ -year frequency, mixed severity) will be managed to restore such communities toward Condition Class 1.
- Goal BR:1 (BLM Casper RMP) describes the use of fire to manage for the biological integrity of terrestrial ecosystems to sustain vegetation, fish, wildlife, and special status species, while providing for multiple uses on BLM lands.
- Goal 1.c (TBNG LRMP) entails increasing the amount of forests and grasslands restored to or maintained in a healthy condition, including the use of prescribed fire, to reduce the potential damage caused by wildfires.

Reclamation activities common to all alternatives are described in Section 2.2.4. Activities related to vegetation would include dust abatement and the restoration of roads and well pads to desired vegetation communities. Reclamation activities for all road disturbances would be consistent with the guidance contained in Chapter 6 of the Gold Book (USDOI-USDA 2007) and the BLM Wyoming IM 2012-032 (BLM 2012i), including seeding and regrading. Abandonment and reclamation activities disclosed in previous NEPA documents would be followed under Alternative A.

4.14.1.2 Impacts Related to Noxious Weeds and Invasive Plant Species

Surface disturbance and associated landscape fragmentation would increase the potential for noxious weeds and invasive plant species to spread and establish proportionate to the amount of disturbance. Surface disturbance increases the potential to provide pathways for further spread and establishment of noxious weeds and invasive plant species into adjacent undisturbed areas (Gelbard and Belnap 2003; Watkins et al. 2003) and serve as a source of propagules (D'Antonio et al. 2001). Localized surface disturbances could facilitate the invasion of noxious weeds and invasive plant species by removing native vegetative communities, creating areas of bare ground, and increasing light and nutrient availability (Burke and Grime 1996; Stohlgren et al. 2003, 1999; Watkins et al. 2003). Noxious weeds and invasive plant species would compete with native plants, degrade and modify native communities, and reduce resources for native species (e.g., moisture, soil nutrients, and light). Noxious weeds and invasive plant species also could be spread by vehicles, equipment, and workers.

Increased road networks and traffic volumes have a strong correlation to the invasion and spread of noxious weeds and invasive plant species. The disturbance and redistribution of seed propagules are difficult to control. Even when care is taken to identify and pretreat infested areas and establish vehicle wash stations, the construction of 386 miles of new roads likely would spread noxious weeds and invasive plant species to some extent, causing impacts to vegetation communities.

Measures designed to reduce the invasion and spread of noxious weeds and invasive plant species from oil and gas development as established in the BLM IM No. WY-2012-032 (BLM 2012i) includes the following steps:

- Assess for invasive plants before initiating surface disturbing activities;
- Development of an invasive plant management plan by the operator;
- Control invasive plants utilizing an integrated pest management approach; and
- Monitor invasive plant treatments.

The BLM works cooperatively with the State of Wyoming and the Converse County weed control districts through the cooperative weed and pest management program to conserve and enhance all resources within the CCPA.

USFS Goal 1.c within the TBNG LRMP relates to restoration and maintenance of forests and grasslands to reduce the risk of invasive species establishment. Objectives include consultation with appropriate partners and agencies to develop and implement invasive species management plans as well limiting further expansion of areas already affected by noxious weeds and invasive plant species.

In areas of existing noxious weed and invasive plant species occurrence, control during construction and production activities could be difficult due to the lack of available local seed sources.

4.14.1.3 Impacts to Special Status Plant Species

Analysis of impacts to special status plant species focuses on federally listed, federal candidate, BLM sensitive, and USFS sensitive species identified as occurring or potentially occurring within the analysis area based on agency correspondence and available habitat and occurrence data. Potential impacts to special status plant species could result from temporary habitat removal with temporary loss of individuals as a result of partial removal of vegetative material, trampling or crushing of special status plants by construction vehicles and equipment, permanent loss of individuals as a result of land clearing, the establishment of noxious weeds and invasive plant species, accumulation of fugitive dust, and the destruction of individuals or populations as a result of herbicide application for weed control.

Special status plant species identified as potentially occurring within the CCPA and carried forward for impact analysis included two federally listed species (Ute ladies'-tresses orchid and western prairie-fringed orchid), one BLM sensitive species (Porter's sagebrush), and four Forest sensitive species (Barr's milkvetch, prairie dodder, Visher's buckwheat, and common twinpod). The full list of species initially considered for analysis is contained in **Appendix F**. Life histories for these special status plant species are discussed in Sections 3.14.3.3 and 3.14.3.4.

Six of the seven special status plant species have known occurrences or potentially suitable habitat within the CCPA, and one species (western prairie-fringed orchid) occurs in riparian areas of the North Platte River downstream of the CCPA (**Tables 3.14-4** and **3.14-5**). The western prairie-fringed orchid could be affected by water depletions in the North Platte River system resulting from Project-related activities. Potential direct and indirect effects on special status plant species and their associated habitats as a result of construction, production, and decommissioning activities are described below.

<u>Ute Ladies'-tresses Orchid – Federally Threatened</u>

There are known locations and suitable habitat for Ute ladies'-tresses orchid within the CCPA. Based on a predictive distribution model created by WYNDD, approximately 6,675 acres of suitable habitat are found within the CCPA (**Figure 3.14-3**) (WYNDD 2008a). Ute ladies'-tresses orchid is a wetland dependent species, and under Section 404(b)(1) of the Clean Water Act, wetlands alternatives that avoid jurisdictional wetlands must be explored and impacts avoided if possible. On BLM***-administered lands***, no new surface disturbing activities would occur within 500 feet of Class 1 and 2 waterbodies, and a Controlled Surface Use stipulation would apply from 500 feet to 0.25 mile of those waterbodies requiring the use of best available technology and/or BMPs to minimize impacts (BLM 2007b). This would decrease the chance that impacts would occur to Ute ladies'-tresses orchid; however, estimated surface disturbance to habitat would be 41 acres.

Water-related activities during construction and production (e.g., dust abatement, road compaction, and water used during drilling) could have indirect impacts on surface water, which would indirectly impact habitat for Ute ladies'-tresses orchid. Potential impacts to surface water resources could include the reduction of water quality from sedimentation or spills of fuel, lubricants, drilling fluids, or water containing elevated levels of salinity or other constituents. Impacts to surface water resources also could include deterioration of existing channel network conditions due to accelerated runoff and drainage from well pads, roads, or pipelines.

Available surface water quantities could be reduced as a result of withdrawals for well drilling or dust abatement. WSEO procedures and agency permit requirements would limit the consumptive use of surface water to current (existing) or approved levels. Ute ladies'-tresses orchid likely would not be affected, especially considering that the consumptive use would not exceed already approved levels.

Ute ladies'-tresses orchid may be impacted by collection or trampling of individual plants as access to populations would increase due to the proliferation of roads within the CCPA. Other impacts to Ute ladies'-tresses orchid would be the same as described for general vegetation (Section 4.14.1.1).

Western Prairie Fringed Orchid – Federally ***Threatened***

The western prairie fringed orchid is not found within the CCPA; however, it does occur downstream of the CCPA among riparian habitats of the North Platte River in Nebraska and potentially could to be affected by water depletion activities upstream within the Platte River Basin. The analysis for surface and groundwater effects for this species under Alternative A would be the same as for Ute ladies'-tresses orchid.

The amount of surface water used during well development, production, road compaction, and dust abatement under Alternative A likely would not impact downstream populations of western prairie fringed orchid, especially considering that water use would be kept within already approved levels.

Porter's Sagebrush – BLM Sensitive

There currently are no documented occurrences of Porter's sagebrush within the CCPA; however, an estimated 74,233 acres of potentially suitable habitat occurs along the western boundary within the CCPA as determined by a predictive distribution model created by WYNDD (WYNDD 2008b) (**Figure 3.14-4**). Based on the proportional estimate of disturbance for Alternative A, approximately 507 acres of this habitat could be impacted. Approximately 92 percent of this suitable habitat is located among grasslands and sagebrush shrublands, the most abundant vegetation communities. Of the 74,233 acres of suitable habitat, approximately 68 percent is located on private lands, approximately 26 percent on BLM surface estate, and the remaining 4 percent is located on USFS surface estate. Types of impacts to Porter's sagebrush would be the same as described for general vegetation (Section 4.14.1.1).

Barr's Milkvetch – USFS Sensitive

There currently are six documented occurrences of Barr's milkvetch within the CCPA based on occurrence data (WYNDD 2016). Barr's milkvetch occurs in the northeastern corner of the CCPA, primarily on USFS-administered lands; although, WYNDD data indicates suitable habitat in the extreme southeast portion of the CCPA (WYNDD 2016). The species is found mostly on barren/sparsely vegetated communities, which is the third most abundant vegetation community within the CCPA (**Figure 3.14-1**). However, habitat for Barr's milkvetch is restricted to soils that are sandy/silty or sandy, which reduces the sparsely vegetated/barren areas that could support this species. Approximately 79 percent of barren/sparsely vegetated community is located on private lands within the CCPA, with the rest split evenly (approximately seven percent each) on lands administered by the USFS, BLM, and the state. Other types of impacts to Barr's milkvetch would be the same as described for general vegetation (Section 4.14.1.1).

Prairie Dodder – USFS Sensitive

There are no documented occurrences of prairie dodder within the CCPA; however, potentially suitable habitat does exist. The species is found primarily on sand prairie hills, a component of the larger grassland community. There are approximately 84,706 acres of sand prairie hill community within the

CCPA (**Figure 3.14-5**). Approximately 85 percent of suitable habitat for the species is located on private lands, 7 percent occurs on state lands, 5 percent on BLM-administered lands, and 3 percent on USFS-administered lands. Types of impacts to prairie dodder would be the same as described for general vegetation (Section 4.14.1.1).

<u>Visher's Buckwheat - USFS Sensitive</u>

There currently are no documented occurrences of Visher's buckwheat within the CCPA; however, potentially suitable habitat does exist based on vegetative community. The species is found mostly within sparsely vegetated habitats, only in soils that are loamy or clay, which would restrict the sparsely vegetated systems shown on **Figure 3.14-1** that would support the species. Approximately 79 percent of sparsely vegetated communities are located on private lands, with the remaining 21 percent split evenly (7 percent each) between BLM-, USFS-, and state-administered lands. Types of impacts to Visher's buckwheat would be the same as described for general vegetation (Section 4.14.1.1).

<u>Common Twinpod – USFS Sensitive</u>

There currently are no documented occurrences of common twinpod within the CCPA; however, potentially suitable habitat does exist based on vegetative community. The species is found mostly within sparsely vegetated badlands, only in soils that are sandy/silty or sandy, which would restrict the sparsely vegetated systems shown on **Figure 3.14-1** that would support the species. Approximately 79 percent of sparsely vegetated communities are located on private lands, with the remaining 21 percent split evenly (7 percent each) between BLM-, USFS-, and state-administered lands. Types of impacts to common twinpod would be the same as described for general vegetation (Section 4.14.1.1).

4.14.2 Impacts to Vegetation from Alternative B – Proposed Action

Under Alternative B, approximately 5,000 new oil and gas wells would be drilled on 1,500 multi-well pads over a period of 10 years (500 new wells per year). Additional surface disturbance would result from the construction of other service well pads, access roads, pipelines, electric power lines, and ancillary facilities (**Table 2.4-1**). The BLM Casper RMP (BLM 2007b) and the TBNG LRMP (USFS 2001) have several standards, guidelines, objectives, and management decisions developed to reduce impacts from fugitive dust, fire, erosion and sedimentation, and noxious weeds and invasive plant species to vegetation resources. The OG also has committed to following design features to mitigate impacts to vegetation resources under Alternative B, which are provided in Section 2.4 and Chapter 6.0.

4.14.2.1 Impacts to General Vegetation

The total estimated construction surface disturbance from Alternative B would be approximately 52,667 acres or 3.5 percent of the CCPA. **Table 4.14-3** and **Table 4.14-4** display the estimated disturbance to each vegetation community from development under Alternative B and the estimated acres impacted based on the percent of surface ownership/administration as noted on **Table 2.1-1**.

The types of impacts to vegetation under Alternative B would be the same as discussed under Alternative A, except 42,414 more acres of surface disturbance would occur under Alternative B.

Reclamation activities under Alternative B would take place as described in Section 2.4.5.2, Final Reclamation. All surface equipment would be removed and areas would be contoured to maintain the approximate profile of the pre-existing conditions of the location. With the exception of roads or facilities that would be retained for future use, all remaining disturbances would be reclaimed. Any follow-up surveys and weed treatments would be conducted by a qualified operator representative. On non-federal lands where reclamation may not be to BLM or USFS standards, impacts would be indeterminate, continuing beyond the life of the Project.

Table 4.14-3 Estimated Vegetation Community Disturbance Under Alternative B

Vegetation Cover Type	Estimated Disturbance during Construction (acres)[1]
Grassland	34,924
Sagebrush shrubland	11,585
Barren/sparsely vegetated	4,418
Conifer	394
Agriculture	360
Developed	362
Wetland/riparian	345
Mixed shrubland	279
Total	**52,667**

1 Totals among tables may vary due to rounding.

Table 4.14-4 Estimated Disturbance by Surface Ownership / Administration under Alternative B

Surface Owner / Administrator	Percent Owned / Administered	Estimated Impact (acres)[1]
BLM-administered	6	3,160
USFS-administered	4	2,107
State of WY	7	3,687
Private	83	43,713
Total	**100**	**52,667**

1 Totals among tables may vary due to rounding

Following reclamation, reduction in shrub community with increased herbaceous plants temporarily could provide forage for some wildlife species and livestock, although initially these areas would support less wildlife and livestock forage until native grasses, forbs, and shrubs become established. Successful establishment of herbaceous vegetation would take a minimum of 3 to 5 years, depending on soil and precipitation. Shrubland communities would require at least 10 to 25 years for recolonization, and mature woodlands would require a minimum of 30 to 50 or more years. In some areas reclamation may be problematic, particularly in areas with soil reclamation constraints, low regional annual precipitation rates, and the invasion of noxious weeds and invasive plant species, successful reestablishment of native vegetation may take longer. Some plant communities may not return to pre-construction conditions due to alteration of soils, invasions of noxious weeds and invasive plant species, and loss of biological soil crust. The inability to revegetate disturbed areas with pre-disturbance or suitable native species would be a substantial impact.

4.14.2.2 Impacts Related to Noxious Weeds and Invasive Plant Species

The spread and establishment of noxious weeds and invasive plant species correlates with the amount of surface disturbance, and areas of bare ground would be more susceptible to invasion by non-native species than areas with established vegetation. Therefore, there would be a greater likelihood of spreading and aiding the establishment of noxious weeds and invasive plant species under Alternative B because there would be more surface disturbance than under Alternative A. The BLM Casper RMP (BLM 2007b) and the TBNG LRMP (USFS 2001) have several standards, guidelines, objectives, and management decisions developed to reduce the spread of noxious weeds and invasive plant species.

The types of impacts related to noxious weeds and invasive plant species would be the same for Alternative B as discussed for Alternative A.

4.14.2.3 Impacts to Special Status Plant Species

Based on the increased density of well pads and new roads that would result from development under Alternative B, special status plant species would be subject to a greater degree of impacts compared to Alternative A. The extent of these impacts would vary geographically across the CCPA and would depend upon the exact locations of Project components. If construction would occur adjacent to the boundary of the CCPA, indirect effects such as dust and establishment of noxious weeds and invasive plant species could impact special status plant species outside of the analysis area.

Ute Ladies'-tresses Orchid – Federally Threatened

Types of impacts to Ute ladies'-tresses orchid would be the same as described under Alternative A, but there would be a higher likelihood of impacting habitat for the species under Alternative B because there would be more surface disturbance. Lease stipulations may restrict disturbance or occupancy on lands within floodplains, within or near riparian areas and wetlands, and at public water reserves. On BLM-administered lands, no new surface disturbing activities would occur within 500 feet of waterbodies (BLM 2007b), which decreases the chance that impacts would occur to Ute ladies'-tresses orchid; however, estimated surface disturbance to habitat would be 211 acres.

Under Alternative B, water would be needed for use during well development, production, road compaction, and dust abatement. Water would be obtained from existing permitted surface and groundwater sources, as well as proposed new groundwater supply wells. WSEO procedures and agency permit requirements would limit the consumptive use of surface water to current (existing) or approved levels, and no new surface water sources would be used. The types of potential Impacts to surface water and Ute ladies'-tresses orchid habitat under Alternative B would be the same as Alternative A. Impacts to surface water could be greater under Alternative B because there would be greater surface disturbance than under Alternative A.

Groundwater withdrawal likely would not impact seep and spring areas and associated wetland habitat within the CCPA because seep and spring areas occur above the bedrock aquifers.

Other impacts to Ute ladies'-tresses orchid would be the same as described under Alternative A. The BLM Casper RMP (BLM 2007b) and the TBNG LRMP (USFS 2001) have several standards, guidelines, objectives, and management decisions developed to reduce impacts to wetland communities, which also would reduce impacts to potentially suitable habitat for Ute ladies'-tresses orchid. ***In addition, all applicable conservation measures contained in the Final Biological Assessment for the Casper Field Office Proposed RMP (BLM 2007d) and the USFWS Biological Opinion for the Casper RMP (BLM 2007b) would be applied.*** The operator group also has committed to design features to mitigate impacts to wetlands under Alternative B, which are provided in Section 2.5 and Chapter 6.0.

Western Prairie Fringed Orchid – Federally ***Threatened***

The Western prairie fringed orchid is not found within the CCPA; however, it does occur downstream of the CCPA among riparian habitats of the North Platte River in Nebraska and potentially could be affected by water depletions upstream. ***Under Alternative B, well drilling and completion and dust control would require up to 8,050 acre-feet of additional source water per year. Water would be withdrawn from up to 50 new groundwater wells drilled into the Wasatch/Fort Union Aquifer and, to a lesser extent, the Fox Hills/Lance Aquifer System. However, specific well locations and sources have not been identified at this time. Any new depletions in the North Platte subbasin in Wyoming would contribute to flow reductions in the Platte River in Nebraska and would result in adverse effects on federally listed species, including Western prairie fringed orchid. The Platte River Recovery Implementation Program was established in 2006 to assist in the conservation***

and recovery of specific target species and their associated habitats along the central and lower Platte River in Nebraska. This Platte River Recovery Implementation Program called for a basin-wide cooperative approach agreed to by the states of Wyoming, Nebraska, and Colorado and the USDOI to address adverse impacts of existing and certain new water related activities on the Platte River target species and associated habitats. The Platte River Recovery Implementation Program also provides Section 7 compliance for effects to the target species from such activities including avoidance of any prohibited take of such species. The State of Wyoming is in compliance with their obligations under the Platte River Recovery Implementation Program.

If the proposed water-related activity would deplete more than 0.1 acre-feet in the Platte River system and would rely on surface water or hydrologically connected groundwater, an evaluation would be required by the WSEO. If the WSEO were to determine that the activity would be considered an existing water-related activity, further action could be required to maintain compliance with the Platte River Recovery Implementation Program. In this case, a Wyoming Platte River Recovery Agreement would be executed between the water user and the Wyoming State Engineer.

Surface and groundwater effects related to Alternative B upstream of western prairie fringed orchid habitat and OG-committed design features concerning wetlands as discussed for Ute ladies'-tresses orchid would be the same for western prairie fringed orchid. Due to the low percentages of change to surface water and groundwater levels (Sections 4.16.2.1 and 4.16.2.2), Alternative B likely would not have downstream effects on the western prairie fringed orchid. After the 10 years of development, surface water and groundwater would be expected to return to pre-Project levels.

Porter's Sagebrush – BLM Sensitive

Under Alternative B, the types of impacts to Porter's sagebrush would be the same as described under Alternative A, but would be to a greater degree due to greater surface disturbance. As discussed for Porter's sagebrush under Alternative A, an estimated 74,233 acres of suitable habitat occurs along the western boundary within the CCPA (WYNDD 2008b) (**Figure 3.14.4**). Based on the proportional estimate of disturbance for Alternative A, approximately 2,602 acres of this habitat could be impacted.

Barr's Milkvetch – USFS Sensitive

The types of impacts to Barr's milkvetch under Alternative B would be the same as described under Alternative A, but would be to a greater degree due to more surface disturbance. Approximately 4,417 acres of sparsely vegetated systems (the vegetative community of Barr's milkvetch) could be affected by surface disturbance under Alternative B, compared to 861 acres under Alternative A. Types of impacts under Alternative B would be the same as described for Barr's milkvetch under Alternative A.

Prairie Dodder – USFS Sensitive

The types of impacts to prairie dodder under Alternative B would be the same as described under Alternative A, but would be impacted to a greater degree due more surface disturbance. Approximately 84,706 acres of sand prairie hill, potentially suitable habitat for prairie dodder, occur within the CCPA. Under Alternative B, it is estimated that 2,969 acres of sand prairie hill would be impacted. Types of impacts and OG-committed design features under Alternative B would be the same as described for prairie dodder under Alternative A.

Visher's Buckwheat - USFS Sensitive

The types of impacts to Visher's buckwheat under Alternative B would be the same as described under Alternative A, but would be to a greater degree due to greater surface disturbance. Approximately 4,417 acres of barren/sparsely vegetated systems, the vegetative habitat of Visher's buckwheat, may be impacted by surface disturbance under Alternative B. However, actual suitable habitat for Visher's buckwheat likely is less due to soil restrictions of the species. Types of impacts and OG-committed design features for Visher's buckwheat under Alternative B would be the same as described under Alternative A as well as those described for general vegetation.

Common Twinpod – USFS Sensitive

The types of impacts to common twinpod under Alternative B would be the same as described under Alternative A, but would be to a greater degree due to the greater surface disturbance. Approximately 4,417 acres of barren/sparsely vegetated systems, the vegetative habitat of common twinpod, may be impacted by surface disturbance under Alternative B. However, actual suitable habitat for common twinpod likely is less due to soil restrictions of the species. Types of impacts and OG-committed design features for common twinpod under Alternative B would be the same as described under Alternative A.

4.14.2.4 Mitigation and Mitigation Effectiveness

The following mitigation measure would be implemented to reduce impacts to general vegetation.

VEG-1 The OG will ***participate in existing statewide*** native seed collection efforts to increase native local seed stock. ***Local native seed sources will be considered when deemed practical and feasible to meet reclamation goals.***

Local seed sources are difficult to find. VEG-1 would help reduce impacts to native vegetation because plants grown through the collection and cultivation of local native seed sources could be used to restore impacted areas and areas where the spread of noxious weeds and invasive plant species would be most likely to occur once disturbance footprints have been identified.

The following mitigation measure would be implemented to reduce impacts from noxious weed and invasive plant species:

VEG-2 Prior to surface disturbance ***on federal lands***, the oil and gas operator will arrange for infestations of noxious weeds and invasive plant species to be mapped and submitted to the land manager to develop a treatment plan.

Mitigation VEG-2 would help reduce the spread of noxious weeds and invasive plant species. Areas of known infestations could be avoided for use as staging areas, reducing the chance that propagules would be dispersed by workers, vehicles, and equipment. By mapping infestations, areas also could be quickly prioritized for treatment.

The following mitigation measures would be implemented to reduce impacts to special status plants species:

SSPS-1 Known individuals and populations of Ute ladies'-tresses orchid and areas identified as suitable habitat through consultation with the USFWS will be avoided ***within suitable*** habitat, 2 years of surveys in suitable habitat ***in late July through mid-August*** will be required and consultation with USFWS may be necessary.

SSPS-2 The following protective measures will be followed in areas of Ute ladies'-tresses suitable habitat:

- ***a) Use directional drilling at pipeline crossings of known or suitable habitat.***
- ***b) Route roads around known or suitable habitat.***
- ***c) Implement dust abatement within 0.25 mile of known or suitable habitat.***

SSPS-***3*** Species requiring surveys will be identified by the BLM and USFS during the APD process. For species identified as requiring surveys, site- and species-specific surveys will be conducted. The timing and methodology of the surveys will be determined by the BLM or USFS in consultation with the appropriate agency. Surveys will be conducted in areas identified as suitable habitat. If individuals or populations are identified during surveys, species-specific avoidance through design modifications will be developed and implemented in consultation with the appropriate agency. For species that cannot be avoided, species-specific mitigation will be developed in consultation with the appropriate agency. If species or habitat avoidance remains infeasible, impact minimization and further mitigation measures could be developed in consultation with the operator, BLM, USFS, and USFWS prior to construction.

Mitigation SSPS-1 ***and SSPS-2*** would protect Ute ladies'-tresses orchid because known individuals and populations as well as suitable habitat would be avoided if possible. ***S***urveys within ***suitable habitat*** would be conducted, and consultation would occur with the USFWS to determine further action if individuals are found. Presence of the species would be assumed in predicted habitat for ESA Section 7 consultation purposes.

Mitigation SSPS-***3*** would protect special status species because site and species specific surveys would be conducted in areas of suitable habitat, and consultation with the appropriate agency would occur to determine further action if individuals are found.

4.14.2.5 Residual Impacts

Residual impacts are defined as unavoidable adverse impacts to a resource that remain assuming implementation of proposed mitigation. Residual impacts to vegetation resources resulting from Alternative B would include the following:

- The health of vegetation communities and special status plant species could be compromised due to the settling of fugitive dust on plants in areas adjacent to surface disturbance.
- The health of surrounding vegetation communities and special status plant species could be compromised due to herbicide treatment of noxious weeds and invasive plant species.
- Adherence to the BLM IM No. WY-2012-032 (BLM 2012i) would not completely eliminate the threat of invasion and spread of noxious weeds and invasive plant species. This would remain as a potential impact throughout construction, production, decommissioning, and reclamation.
- Residual and long-term impacts to vegetation on private and state land (approximately 90 percent of the CCPA) would be indeterminate because reclamation to BLM or USFS standards would not necessarily be attained.

4.14.3 Impacts to Vegetation from Alternative C

Under Alternative C, 5,000 new oil and gas wells would be drilled from 938 new multi-well pads over a 10-year period, which would be approximately 37 percent fewer pads than under Alternative B. This would proportionately reduce the surface impact from well pads (including other service well pads), access roads, pipelines, electrical power lines, and ancillary facilities. The total estimated construction surface disturbance from Alternative C would be approximately 37,267 acres, or approximately 2.5 percent of the CCPA (**Table 2.5-1**). This alternative would not include changes to any of the proposed construction/production facilities discussed under Alternative B.

The impacts to vegetation would be similar to Alternative B except 15,400 fewer acres would be disturbed from activities under Alternative C, resulting in less impact. Certain areas in the CCPA would contain stipulations that would restrict or preclude development. Timing stipulations associated with the protection of raptors and sage-grouse would be applied to approximately 20 percent of the CCPA; therefore, indirect disturbance of vegetation due to fugitive dust emissions would be less than under Alternative B because development would ***be subject to timing limit stipulations***. ***Potential impacts related to adhering to timing limitation stipulations could include longer development timelines***

for a lease area and delayed interim reclamation of temporary disturbance. For more information on timing limit stipulations, see Section 2.5.2.1.

4.14.3.1 Impacts to General Vegetation

Table 4.14-5 and **Table 4.14-6** display the estimated disturbance to each vegetation community from development under Alternative C and the estimated acres impacted based on the percent of surface ownership/administration as noted on **Table 2.1-1**.

Table 4.14-5 Estimated Vegetation Community Disturbance Under Alternative C

Vegetation Cover Type	Estimated Disturbance during Construction (acres)[1]
Grassland	24,712
Sagebrush shrubland	8,197
Barren/sparsely vegetated	3,126
Conifer	279
Agriculture	255
Developed	256
Wetland/riparian	244
Mixed shrubland	198
Total	**37,267**

[1] Totals among tables may vary due to rounding.

Table 4.14-6 Estimated Disturbance by Surface Ownership / Administration under Alternative C

Land Owner	Percent Owned / Administered	Estimated Impact (acres)[1]
BLM-administered	6	2,236
USFS-administered	4	1,490
State of WY	7	2,609
Private	83	30,932
Total	**100**	**37,267**

[1] Totals among tables may vary due to rounding.

The types of impacts to vegetation under Alternative C would be the same as discussed under Alternative B, except there would be 15,400 fewer acres of surface disturbance. Upon completion of construction activities, all disturbed areas not necessary for production would undergo interim reclamation to minimize environmental impacts. On federal surface and mineral estate (approximately 65 percent of the CCPA), interim reclamation would be required to meet the BLM or USFS approval for suitable wildlife habitat under Alternative C. For more information concerning reclamation and vegetation, see Section 4.14.2.1, Impacts to General Vegetation from Alternative B.

4.14.3.2 Impacts Related to Noxious Weeds and Invasive Plant Species from Alternative C

Surface disturbance under Alternative C would be less than under Alternative B; therefore, impacts related to noxious weeds and invasive plant species based on direct construction disturbance would be less than Alternative B. However, the potential spread of noxious weeds and invasive plant species under Alternative C would be the same when compared to Alternative B because timing stipulations would not stop disturbance completely, but rather the disturbance would occur in other areas of the CCPA. The types of impacts related to noxious weeds and invasive plant species would be the same for Alternative C as discussed for Alternative B.

4.14.3.3 Impacts to Special Status Plant Species

Based on the decreased number of well pads and new roads compared to Alternative B, special status plant species would be subject to a lesser degree of impacts under Alternative C. The extent of these impacts would vary geographically across the CCPA and would depend upon the exact locations of Project components.

<u>Ute Ladies'-tresses Orchid – Federally Threatened</u>

Types of impacts to Ute ladies'-tresses orchid would be the same as described under Alternatives A and B. There would be less likelihood that habitat for the species would be impacted under Alternative C than under Alternative B due to less surface disturbance; however, estimated surface disturbance to habitat would be approximately 149 acres.

Impacts to surface water and groundwater resources would have indirect impacts to habitat for Ute's ladies'-tresses. Under Alternative C, direct and indirect impacts to surface water and groundwater would be similar to those discussed under Alternative B, but impacts would not be expected to the species from surface and groundwater use.

<u>Western Prairie Fringed Orchid – Federally ***Threatened***</u>

The Western prairie fringed orchid is not found within the CCPA; however, it does occur downstream of the CCPA among riparian habitats of the North Platte River in Nebraska and potentially could be affected by water depletions upstream. The types of impacts to habitat and individual western prairie fringed orchid would be the same under Alternative C as those described under Alternatives A and B but to a lesser degree than under Alternative C due to less surface disturbance. Surface and groundwater effects related to Alternative C would impact riparian areas (i.e., habitat) and would be similar to those described under Alternative B, but impacts would be less under Alternative C due to less surface disturbance.

<u>Porter's Sagebrush – BLM Sensitive</u>

The types of impacts to Porter's sagebrush under Alternative C would be the same as described under Alternatives A and B, but to a lesser degree than under Alternative B. There is approximately 74,233 acres of sand prairie hill within the CCPA, the potentially suitable habitat of Porter's sagebrush. Under Alternative C, an estimated 1,841 acres of this habitat would be impacted, which would be 761 acres less than under Alternative B.

<u>Barr's Milkvetch – USFS Sensitive</u>

The types of impacts to Barr's milkvetch under Alternative C would be the same as described under Alternatives A and B, but to a lesser degree than under Alternative B. Under Alternative C, an estimated 3,130 acres of impact would occur to sparsely vegetated systems, which is potentially suitable habitat for Barr's milkvetch. This would be approximately 1,294 acres less than under Alternative B.

<u>Prairie Dodder – USFS Sensitive</u>

The types of impacts to prairie dodder under Alternative C would be the same as described under Alternatives A and B, but to a lesser degree than under Alternative B.

<u>Visher's Buckwheat – USFS Sensitive</u>

The types of impacts to Visher's buckwheat under Alternative C would be the same as described under Alternatives A and B, but to a lesser degree than under Alternative B. An estimated 3,130 acres of surface disturbance would occur to barren/sparsely vegetated systems, which is potentially suitable habitat of Visher's buckwheat. This would be approximately 1,296 acres less than under Alternative B. However, suitable habitat would be restricted further by soil requirements of the species.

Common Twinpod – USFS Sensitive

The types of impacts to common twinpod under Alternative C would be the same as described under Alternatives A and B, but to a lesser extent than under Alternative B. Under Alternative C, an estimated 3,130 acres of surface disturbance would occur to sparsely vegetated systems, potentially suitable habitat for common twinpod. This would be approximately 1,296 acres less than under Alternative B. However, suitable habitat would likely be less based on soil requirements of the species.

4.14.3.4 Mitigation and Mitigation Effectiveness

As under Alternative B, no further mitigation measures have been identified for general vegetation under Alternative C. Mitigation measures VEG-1, SSS-1, and SSS-2 for noxious weeds and invasive plant species as well as those for special status plant species as discussed under Alternative B also would apply to Alternative C. Mitigation effectiveness also would be the same as discussed under Alternative B.

4.14.3.5 Residual Impacts

Residual impacts are defined as unavoidable adverse impacts to a resource that remain assuming implementation of proposed mitigation. Residual impacts to general vegetation resources resulting from Alternative C would be the same as for Alternative B.

Residual impacts from noxious weeds and invasive plant species resulting from Alternative C would be similar to those discussed for Alternative B but with the following differences:

- Less surface disturbance would decrease the potential to spread noxious weeds and invasive plant species; and
- Fewer miles of roads, pipelines, and electrical lines incrementally would reduce the spread of noxious weeds and invasive plant species.

Residual impacts to special status plant species resulting from Alternative C would be the same as described under Alternative B with the following differences:

- Less surface disturbance would decrease the potential to spread noxious weeds and invasive plant species to habitat for special status plant species; and
- Less surface disturbance would reduce fugitive dust.

4.14.4 Relationship between Local Short-term Uses of the Human Environment and Maintenance and Enhancement of Long-term Productivity

The relationship between local short-term uses of the human environment and maintenance and enhancement of long-term productivity is the disclosure regarding whether the short-term use of a resource associated with a project affects the long-term sustainability of that resource. For all alternatives, Project-related impacts that may affect vegetative productivity include the disturbance of shrub and woody dominated vegetation that would require 10 to 100 years to reestablish (Avirmed et al. 2015***; Hild et al. 2009***). Populations of weedy annual species (e.g., halogeton, cheatgrass) may become established in localized areas for extended periods of time. The decrease in vegetation community types could impact ecological function, livestock and wildlife grazing, and recreation activities in and around the areas that would be disturbed.

For areas with low reclamation potential (i.e., slow revegetation rates and low revegetation success), the proposed Project could result in impacts to vegetation communities that would extend beyond construction, production, and decommissioning activities. This could affect long-term habitat value (including special status plant species habitat) and human uses of these areas.

Under Alternative B, reclamation would be guided by the landowner surface use agreement and may not result in pre-disturbance conditions. Long-term impacts would be indeterminate in these locations, continuing beyond the life of the Project. Approximately 43,714 acres and 30,932 acres of private land would be impacted under Alternatives B and C, respectively.

4.14.5 Irreversible/Irretrievable Commitment of Resources

Irreversible/irretrievable impacts are subsets of unavoidable adverse/residual impacts. Irreversible impacts are those that cannot ever be restored; they would be lost forever. Irretrievable impacts are those for which the resource value would be irretrievably lost until restoration of that resource takes place. For vegetative communities successfully reclaimed, as defined by each land management agency, no irreversible commitments of the resource would be anticipated. Under Alternative B, reclamation would not be required on non-federal surface estate, which is the majority of the land ownership within the CCPA. If reclamation does not result in pre-disturbance conditions, that would be an irreversible/irretrievable commitment of resources. The alteration of vegetation communities may persist during the life of the Project, resulting in an irretrievable loss of these resources because this would result in the permanent conversion of plant communities.

Following reclamation, reduction in shrub communities with increased herbaceous plants could temporarily provide forage for some wildlife species and livestock. Impacts would persist for an undetermined amount of time because it would take 20 to 50 years for impacted areas to develop the structure and function of their pre-disturbance vegetative condition. Reclaimed areas initially would support less wildlife and livestock forage until revegetation is considered successful, at which point native grasses, forbs, and shrubs would become established. The inability to revegetate disturbed areas with pre-disturbance or suitable native species would be considered an irreversible impact.

All potential impacts to special status plant species and their habitats would be irretrievable until decommissioning, after which time all land uses could be reclaimed. However, reclamation activities may have limited success in areas with poor soils. Some vegetation communities would take upwards of 50 years to reestablish, and some areas may never return to their pre-disturbance condition. As such, these impacts would represent an irreversible commitment of special status plant species. Additionally, any fragmentation of native habitats and establishment of noxious weeds and invasive plant species resulting in the conversion of native plant communities not able to be reclaimed to pre-disturbance conditions would be considered irreversible.

4.15 Visual Resources

The analysis area for impacts to visual resources is the viewshed of the CCPA inside the 15-mile background distance zone of the BLM Visual Resource Management System.

Potential impacts to visual resources include the degradation of views from ***Highway 59;*** multiple ***historic trails (including*** the Bozeman Trail***); the*** Child's Cutoff of the Oregon-California NHT; and other sensitive views in the analysis area including Pumpkin Buttes, multiple ranch residences, the City of Douglas, the towns of Bill, Edgerton, Glenrock, Lost Springs, Midwest, and Rolling Hills (**Figure 3.15-1**).

The methodology for analysis of impacts to visual resources included the following key steps:

- Impacts on BLM- and USFS-administered lands were determined by comparing the characteristics and extents of the landforms, vegetation, and structures related to development with the visual resource inventory components of scenic quality, sensitivity levels, and distance zones using the procedures outlined in the BLM Visual Contrast Rating Handbook H-8431-1 (BLM 1986b) and the USFS Scenery Management Handbook 701 (USFS 1995).
- The contrast rating process was used at the three KOPs ***(defined in Section 3.15)*** along the trails as the viewpoints for conducting the impacts relative to the RMP conformance analysis and the LRMP consistency analysis.
- Potential impacts to VRM and SIOs classes were calculated by multiplying the total acreage of the classes by the disturbance acreage divided by the CCPA acreage.
- ***The Bozeman Trail, Child's Cutoff of the Oregon-California NHT, Oregon-California-Mormon-Pony Express NHT and the Rock Creek-Fort Fetterman Stage Road were analyzed as linear KOPs for visually sensitive areas within the analysis area (Figure 3.15-1).***
- ***A viewshed analysis was conducted, focusing on the area within 3 miles of the Bozeman Trail, Child's Cutoff of the Oregon-California NHT, and the Rock Creek to Fort Fetterman Stage Road, to determine the geographic area of potential adverse visual effects to trails from oil and gas development within the CCPA (Appendix B). Three infrastructure heights were analyzed (12 feet, 22 feet, and 60 feet) to represent a range of oil and gas infrastructure.***

Visual resources are managed according to management goals and objectives of the BLM ROD for the CFO RMP (BLM 2007b) and the USFS TBNG LRMP (USFS 2001).

The objectives for VRM classes (BLM 1986b) and SIO classes (USFS 1995) that occur within the analysis area (**Figure 3.15-6**) are stated in their respective guidance documents as follows:

- VRM Class II: "…the level of change to the characteristic landscape should be low."
- VRM Class III: "…the level of change to the characteristic landscape should be moderate."
- VRM Class IV: "…the level of change to the characteristic landscape can be high."
- SIO High: "…deviations may be present but must repeat the form, line, color, texture, and pattern common to the landscape character so completely and at such scale that they are not evident."
- SIO Moderate: "…noticeable deviations must remain visually subordinate to the landscape character being viewed."

- SIO Low: "….deviations begin to dominate the valued landscape character being viewed but they borrow valued attributes such as size, shape, edge effect, and pattern of natural openings, vegetative type changes, or architectural styles outside the landscape being viewed."

Assumptions for the analysis of impacts to visual resources include:

- All alternatives would result in some degree of visual change in the CCPA as most Project components would be visible from various vantage points.
- All segments of historic trails***, regardless of eligibility under the NHT system, are included in the linear KOPs (see Section 3.15)*** until visual inventory surveys reveal otherwise.

4.15.1 Impacts to Visual Resources from Alternative A – No Action

Under Alternative A, new drilling and completion of wells and infrastructure would continue as disclosed under NEPA (Section 2.3.2), and existing oil and gas facilities would continue operations, closure, and reclamation activities under the terms of current agreements as authorized by the BLM and USFS. Effects on viewers and visual resources would result from the construction of additional development as summarized on **Table 2.3-3**. **Table 4.15-1** provides a summary of the estimated disturbance of BLM VRM and USFS SIO classes on federal lands under Alternative A.

Table 4.15-1 Estimated Disturbance to BLM VRM and USFS SIO under Alternative A

Classification	Acres in Analysis Area	Disturbance in Analysis Area	
		Acres	Percent of Class
BLM VRM			
Class II	185,573	49	<0.1
Class III	970,458	770	0.1
Class IV	2,015,142	7,624	0.4
USFS SIO			
High	28,866	0	0.0
Moderate	48,240	24	<0.1
Low	702,160	1,768	0.3

4.15.2 Impacts to Visual Resources from Alternative B – Proposed Action

4.15.2.1 Impacts to Visual Resources

Under Alternative B, approximately 5,000 new oil and gas wells would be drilled on 1,500 multi-well pads over a period of 10 years (500 new wells per year). Additional surface disturbance would result from the construction of other service well pads, access roads, pipelines, electric power lines, and ancillary facilities (**Table 2.4-1**). An estimated 52,667 acres of disturbance would result from oil and gas development under Alternative B. Of this total disturbance, approximately 13,121 acres would be from access roads, approximately 21,400 acres would be from well pads, and the remaining 18,146 acres would be from a combination of production and linear facilities.

Development under Alternative B would increase the amount of visual contrast that currently exists between existing/authorized facilities and the natural character of the landscape. The primary change in visual effects from the currently approved levels would be the addition of oil and gas production facilities, storage tanks, pipelines, electrical lines, roads, and earthwork. Visual effects also would be extended through the increased activity in the CCPA.

Prior to completion of reclamation, the facilities would exhibit strong form and color contrast, especially under bright, clear light conditions. Moderate to strong line and landform contrasts primarily would be generated by the shapes of the structures and road embankments. Moderate texture contrasts would be generated between the bare surfaces of well pads and the vegetation textures and patterns in the natural landscape. The clearing of vegetation for construction of roads could produce strong visual contrast when compared with the textures and patterns of surrounding landscape. Development under Alternative B would increase the visual effects in the vicinity of the facilities and adjacent undeveloped areas. The visual contrast effects to landforms and vegetation gradually would become less noticeable with reclamation. OG-committed design features specific to visual impacts (see Chapter 6.0, Mitigation) would focus on colors of structures, recontouring of all disturbed areas to blend with the natural topography, stabilization of erosion, and the establishment of an acceptable vegetative cover.

The facilities developed under Alternative B would have visual characteristics during active production that would be similar to existing facilities; notably geometric structure forms, lines, colors, and textures and exposed earth surfaces. As a result, Alternative B would result in similar but increased visual effects to those already occurring from existing facilities, including moderate to strong form and color contrasts, moderate line contrast, and weak to moderate texture contrast. Therefore, the key considerations would be the degree of additional visual impacts and the amount of allowable contrast under the VRM Class II, III, and IV objectives on BLM-administered lands and the change allowed under SIO High, Moderate, and Low objectives on USFS-administered lands.

Table 4.15-2 Estimated Disturbance to BLM VRM and USFS SIO under Alternative B

Classification	Acres in Analysis Area	Disturbance in Analysis Area	
		Acres	Percent of Class
BLM VRM			
Class II	185,573	254	0.1
Class III	970,458	3,961	0.4
Class IV	2,015,142	39,230	1.9
USFS SIO			
High	28,866	0	0.0
Moderate	48,240	124	0.3
Low	702,160	9,098	1.3

The viewshed analysis of the Bozeman Trail and Child's Cutoff of the Oregon-California NHT (**Appendix B**) demonstrated that oil and gas infrastructure would be visible to varying distances from historic trails, particularly in southern portions of the CCPA. Infrastructure also would be visible from areas along the western route of the Bozeman Trail, which is located outside the western boundary of the CCPA. Taller infrastructure would be more visible than shorter infrastructure. In central and western portions of the CCPA, in particular, lower-elevation areas in basins and drainages could support oil and gas infrastructure that would not have a visual impact on historic trails. Appendix W of the Casper ROD and Approved Resource Management Plan Amendment establishes NSO areas along portions of the Bozeman Trail that also would reduce visual impacts from associated observation points.

In addition to the Bozeman Trail and Child's Cutoff of the Oregon-California NHT, users of the visual resources within the CCPA also would be concerned with impacts to the Oregon-California-Mormon-Pony Express NHT and the Rock Creek-Fort Fetterman Stage Road, which fall outside of the CCPA but within the 15-mile background distance zone to the south of the CCPA. The Bozeman Trail crosses the western portion of the CCPA and Child's Cutoff of the Oregon-California NHT crosses the CCPA area near its southern boundary (**Figure 3.15-3**). The immediate foreground viewsheds of these linear KOPs are visually sensitive areas. Due to the viewer sensitivity of the trail KOPs, visual contrasts from Alternative B would be greatest in the foreground vicinities of trail KOPs, particularly where they are in close proximity to substantial changes in the characteristic landscapes. Lighting used to facilitate around-the-clock operations would increase visual contrasts at night in the view from all trails and from the three KOPs. The drilling and production facilities would be visible on the skyline in the foreground view from all trails and from the three KOPs. Due to the relative scale of the facilities, and change in color, line, form, and texture (moderate to strong contrasts) in the immediate foreground from trail KOPs, the proposed facilities would be expected to achieve the requisite “high” level of landscape change during active production for VRM Class IV areas or SIO Low areas. The visual contrasts from facilities would be reduced after reclamation; however, the long-term visual effects would not be expected to achieve the VRM Class II or III objectives or SIO High or Moderate objectives unless the overall horizontal, planar form of each drill pad and roadway would be reshaped to repeat the surrounding angular landforms in the middleground.

The production activities and facilities in view in areas where high levels of changes would be permitted in the characteristic landscape (i.e., VRM Class IV or SIO Low areas) would be in compliance with VRM objectives and SIOs.

Night sky/night lighting of the operations (i.e., production areas, machinery, vehicles, light towers, and roadway intersections) would impact the characteristic night landscape. There would be an increase in the existing sky glow conditions in the view from all locations within the viewshed, including the three KOPs. Greater sky glow impacts would be apparent during non-moonlit nights, from reflections on clouds, and during the clearest and darkest nights. Night-time activities, such as star gazing, camping, hiking, dispersed recreation, and driving would experience higher noticeable changes to the characteristic night sky. Structures, landforms, and vegetation nearest to the light sources would be reflected by operations lighting and would have increased visibility to viewers in the surrounding landscape out to and beyond the background distance zone.

4.15.2.2 Mitigation and Mitigation Effectiveness

The following proposed mitigation measures would reduce impacts to visual resources:

VIS-1: Pinyon-juniper and conifer woodlands will be removed only when necessary for construction and operation. If removal is necessary, edges of any clearings will be feathered to mimic the natural characteristic of the landscape.

VIS-2: BLM environmental colors (Standard Environmental Color Chart CC-001; BLM 2014e) will be used for surface coatings of permanent structures. Color selection will be based on site-specific assessment.

VIS-3: Topography and vegetation will be utilized to the greatest extent possible to screen views from trails and other KOPs.

VIS-4: During reclamation, disturbed areas will be recontoured to pre-disturbance contours.

VIS-5: Crossings of trails by linear Project components will be at right angles with structures set as far back from the crossing as possible. ROWs and structures should be appropriately screened.

VIS-6: Lighting at facilities will be minimized to the greatest extent permitted by OSHA regulations, and lights will be down-shielded to reduce night glare and light pollution.

Mitigation measure VIS-1 would reduce noticeable contrasts due to vegetation removal. Implementa***tion*** of this measure would help maintain a naturalness of the viewshed. Mitigation measures VIS-2 through VIS-5 would reduce the noticeable presence and surface disturbance of permanent Project components and would help blend these components with the surrounding natural colors and landscape. Mitigation measure VIS-6 would reduce the impact of lighting to the night sky and reduce night time light pollution.

4.15.2.3 Residual Impacts

Residual impacts are defined as unavoidable adverse impacts to a resource that remain assuming implementation of proposed mitigation. Regardless of BMPs, OG-committed design features, and additional mitigation, the presence of development activities and temporary and permanent structures still would be noticeable within the viewshed. This would affect residents living in rural communities and those engaging in recreational or ceremonial activities. In the majority of the CCPA, compensatory mitigation would not be warranted as development would meet the requirements of the existing VRM class.

4.15.3 Impacts to Visual Resources from Alternative C

4.15.3.1 Impacts to Visual Resources

Under Alternative C, 5,000 new oil and gas wells would be drilled from 938 new multi-well pads over a 10-year period. This would be approximately 37 percent fewer pads than under Alternative B. Additional surface disturbance would result from the construction of other service well pads, access roads, pipelines, electric power lines, and ancillary facilities; however, this additional disturbance also would be less than under Alternative B (**Table 2.5-1**). This development would be constructed on approximately 37,267 acres throughout the CCPA. Of this total disturbance, approximately 8,388 acres would be from access roads, 13,544 acres would be from well pads, and the remaining 15,335 acres would consist of a combination of production and linear facilities. Disturbance during construction under Alternative C would be 29 percent less than under Alternative B.

Under Alternative C, impacts to visual resources would be similar to those for Alternative B but with fewer acres of disturbance in VRM Class II, III, and IV areas (74; 1,158; and 11,472 fewer acres impacted, respectively) and SIO Moderate and Low areas (36 and 2,660 fewer acres impacted, respectively) (**Table 4.15-3**). The reduction in disturbance primarily would be a result of 701 fewer well pads, 708 fewer miles of roads, and 1,457 fewer miles of pipelines and electrical distribution lines.

Table 4.15-3 Estimated Disturbance to BLM VRM and USFS SIO under Alternative C

Classification	Acres in Analysis Area	Disturbance in Analysis Area	
		Acres	Percent of Class
BLM VRM			
Class II	185,573	180	0.1
Class III	970,458	2,803	0.3
Class IV	2,015,142	27,758	1.4
USFS SIO			
High	28,866	0	0.0
Moderate	48,240	88	0.2
Low	702,160	6,438	0.9

4.15.3.2 Mitigation and Mitigation Effectiveness

Mitigation and mitigation effectiveness would be the same as discussed under Alternative B (Section 4.15.4.2).

4.15.3.3 Residual Impacts

Residual impacts are defined as unavoidable adverse impacts to a resource that remain assuming implementation of proposed mitigation. Residual impacts resulting from Alternative C would be similar to those under Alternative B. Alternative C would have fewer well pads and fewer miles of linear disturbance (pipelines and electrical distribution lines) affecting visual resources and viewers; therefore, the intensity of the impacts would be incrementally reduced. In the majority of the CCPA, compensatory mitigation would not be warranted as development would meet the requirements of the existing VRM class.

4.15.4 Relationship between Local Short-term Uses of the Human Environment and Maintenance and Enhancement of Long-term Productivity

The relationship between local short-term uses of the human environment and maintenance and enhancement of long-term productivity is the disclosure regarding whether the short-term use of a resources associated with a project affects the long-term sustainability of that resource. The productivity of visual resources relies entirely on the naturalness of the landscape character within the viewshed. Vegetation clearing, the presence of Project components, and Project activity would result in long-term (i.e., 55 to 60 years) impairment to visual resources.

4.15.5 Irreversible/Irretrievable Commitment of Resources

Irreversible/irretrievable impacts are subsets of unavoidable adverse/residual impacts. Irreversible impacts are those that cannot ever be restored; they would be lost forever. Irretrievable impacts are those for which the resource value would be irretrievably lost until restoration of that resource takes place. There would be no irreversible commitment of resources because decommissioning and successful reclamation would return visual resources in the CCPA to pre-disturbance conditions. All alternatives would result in an irretrievable loss of the quality of visual resources due to surface disturbance and activity. Once decommissioning and reclamation are complete, visual resources within the CCPA could be returned to pre-disturbance condition; however, under Alternative B reclamation on private lands would be conducted as agreed between the landowner and the operator. If the landowner decides that they want reclamation to result in something other than the pre-disturbance condition, impacts to the visual quality of the viewshed would remain after reclamation.

4.16 Water Resources

The analysis area for direct and indirect impacts to surface water resources includes the HUC-12 drainages within or intersected by the CCPA. The analysis area for direct and indirect impacts to groundwater is bounded on the north at Township 42 North (approximately 5 to 12 miles north of the CCPA), on the west and east by the outcrop of the Fox-Hills/Lance aquifer, and on the south by the structural limit of the Powder River Basin (the Fox Hills/Lance aquifer does not cropout on the south).

Potential impacts that could occur to surface water resources include the reduction of water quality in rivers, streams, or impoundments from sedimentation or spills of fuel, lubricants, drilling fluids, or produced water containing elevated levels of salinity or other constituents; reduction in available surface water quantities for existing beneficial uses if sizeable project withdrawals are made for well drilling and completion or dust abatement; and deterioration of existing channel network conditions due to direct construction disturbance or from accelerated runoff and drainage from well pads, roads, or pipelines.

Potential impacts to groundwater resources could include the following:

- Groundwater quality and quantity impacts resulting from groundwater withdrawal.
- Groundwater quality impacts resulting from well drilling, completion, and production.
- Groundwater quality impacts resulting from the injection of formation fluids (e.g., produced water).
- Impacts to groundwater from compaction of soils due to construction activities.

The methodology used for analysis of surface water resources impacts included the following discussions and impact indicators:

- Qualitative description of potential effects from Project disturbance (e.g., erosion, sedimentation, channel degradation, contamination from potential leaks and spills).
- Qualitative discussion of water use and WSEO policies and procedures.
- Quantitative comparison of respective potential disturbance estimates per alternative, including a general breakdown of potential disturbance areas by hydrographic basin.

The methodology used for analysis of groundwater resources impacts included the following major items:

- Conduct an analysis of general groundwater quality in the county and those activities that may cause degradation of that water quality.
- Conduct a groundwater model analysis to assess drawdown effects from various scenarios of groundwater pumping.
- Determine current groundwater consumption and uses in the analysis area for comparison to water needs for the Project.
- Estimate current volume of water disposal/injection to compare to volumes expected to be generated to determine adequacy of proposed disposal numbers.
- Provide a qualitative assessment of risk to aquifers from injection disposal.

Water resources are managed according to the management goals and objectives from the BLM ROD for the CFO RMP (BLM 2007b) and the USFS TBNG LRMP (USFS 2001). The BLM manages the CFO to maintain or improve surface water and groundwater resources consistent with applicable state and federal standards and regulations, to provide for physical and legal availability of water to facilitate authorized uses on public lands, to protect and provide conservation of those waters, and to bring all watersheds to their full potential conditions (BLM 2007b). The USFS manages the TBNG to maintain the sustainability of ecosystem characteristics and the quality of watershed functions and conditions (USFS 2001). Specific standards and guidelines are contained in the management plans.

Assumptions used in the analysis of impacts to water resources included the following:

- WSEO procedures and agency permit requirements would limit the consumptive use of surface water to current (existing) or approved levels.
- Potential disturbance from the Project has been estimated as if it would occur with even distribution across hydrographic basins because of the lack of location-specific information.
- Groundwater would be the primary source for the proposed development's water needs.
- Potential major sources of groundwater would be the Lower Tertiary aquifers (the Wasatch Formation and members of the Fort Union Formation), and to a lesser extent, the upper Cretaceous Fox Hills Sandstone/Lower Hell Creek aquifer.
- Water consumption for each well would be expected to consume ***up to 26.2*** acre-feet (***203,000*** barrels) including drilling, completion, and dust abatement (Section 2.2.2.4).
- Each oil and gas production well would be expected to generate an average 1.2 acre-feet (9,125 barrels) per year of produced water (Section 2.2.3.4) or 25 barrels per day.
- Disposal wells would inject at an average rate of 51.0 acre-feet (400,000 barrels) per year (WOGCC 2016b) and would be the primary method of disposal of produced water and other oilfield water.

4.16.1 Impacts to Water Resources from Alternative A – No Action

Under Alternative A, new development would occur within the CCPA as disclosed under NEPA (Section 2.3.2). Under Alternative A, approximately 1,663 new oil and gas wells would be drilled on 361 well pads over a period of 15 years (110 new wells per year). An estimated 10,253 acres of new disturbance would result from the construction of well pads (including other service well pads), access roads, and other Project facilities (**Table 2.3-3**).

4.16.1.1 Impacts to Surface Water Resources

Under Alternative A, impacts to water resources generally would be expected from surface disturbance during construction of access roads, pipelines, well pads, and supporting facilities. This surface disturbance would create unprotected soil surfaces, which would increase the potential for accelerated soil erosion and sedimentation as well as for elevating suspended sediments and salinity in runoff. Direct impacts would be most likely to occur during construction of drainage crossings for access roads and/or pipelines and at well pad locations near drainages during periods of precipitation, runoff, and streamflow. Indirect impacts from disturbance would occur within all disturbed areas not near drainages.

Installation of culverts or other stream crossing methods across streams with streamflow at or shortly after the time of construction likely would result in direct impacts of increases in sediment available for entrainment and transport by the channelized flow. These crossings would be installed in accordance with requirements contained in the Gold Book (USDOI-USDA 2007). Such installations could temporarily result in elevated levels of total suspended solids and increases in turbidity at and downstream from the stream crossing; however, total suspended solids and turbidity levels would be expected to begin decreasing within several days after the completion of in-stream construction activities, or with the end of runoff-inducing precipitation events. Removal of streambank vegetation could contribute to bank instability. Upon reclamation, revegetation, and finalized bank stabilization, these impacts would be expected to return to near pre-construction levels. Lease stipulations could restrict disturbance or occupancy on federally administered lands within floodplains, within or near riparian areas and wetlands, and at public water reserves. On BLM-administered lands, no new surface disturbing activities would occur within 500 feet of Class 1 and 2 waterbodies (BLM 2007b). ***The North Platte River is Class 1 water; therefore, it would fall under the BLM Casper RMP stipulation of 500-foot No Surface Occupancy (NSO) and 0.25-mile Conditional Surface Use (CSU).*** Waters other than Class 1 or Class 2 waterbodies would be considered on a case-by-case basis. ***Specific criteria (e.g., 500 feet from water) have been established based upon the best information available. However, such items as geographical areas and seasons must be delineated at the field level. Exception, waiver, or modification of requirements developed from this guideline must be based upon environmental analysis of site-specific proposals (e.g., activity plans, plans of development, plans of operation, and APDs) and, if necessary, would allow for other mitigation to be applied on a site-specific basis.***

Compaction of soils from construction of project facilities such as well pads and access roads would decrease the infiltration rates of the soil and increase runoff rates during precipitation events from these specific areas. Areas of disturbance adjacent to and directly upslope of streams that are not successfully reclaimed also could contribute to impacts on surface water through increased levels of stream sedimentation from accelerated rates of soil erosion during precipitation-driven runoff events. SWPPPs would be prepared at the APD stage in accordance with the Wyoming Pollutant Discharge Elimination System rules and regulations and WDEQs General Permit to Discharge Stormwater Associated with Large Construction. Site-specific BMPs for stormwater runoff control would be specified in the SWPPP and applied during construction and reclamation to minimize these impacts from increased erosion and increased runoff rates.

The analysis of surface water quality impacts was based on the assumption that surface disturbance within a given watershed serves as an indicator of the potential for increased sediment and salt runoff. Marston and Dolan (1988) conducted research to investigate the major criteria that control upland erosion in an environment similar to the CCPA. This research showed that slope and vegetative cover exert the most influence on upland erosion rates. Erosion was found to be inversely correlated with vegetation density (i.e., as vegetation density decreases, upland erosion increases). Vegetative cover would be removed with new oil and gas development, which would increase erosion. With the application of reclamation measures consistent with the BLM and USFS guidelines, vegetative cover would be reestablished, thereby reducing rates of soil erosion. As the reestablishing vegetative cover approaches desired density levels, the erosion rate from those reclaimed areas also would approach pre-construction levels.

Assuming an even distribution of additional disturbance under Alternative A, **Table 4.16-1** provides the estimated surface disturbance that would occur for each hydrographic area (i.e., basin and watershed). The disturbance would impact approximately 0.5 percent across the analysis area and would range from less than 0.1 percent to approximately 0.7 percent for each watershed.

Table 4.16-1 Surface Disturbance by Hydrographic Area under Alternative A

Basin / Watershed	Surface Disturbance in Hydrographic Area	
	Acres	**Percent of Area[1]**
Cheyenne River Basin		
Sand Creek	1,199	0.6
Upper Antelope Creek	904	0.4
Upper Dry Fork Cheyenne River	1,168	0.7
Lower Dry Fork Cheyenne River	836	0.6
Lightning Creek	1,243	0.6
Dry Creek	686	0.5

Table 4.16-1 Surface Disturbance by Hydrographic Area under Alternative A

Basin / Watershed	Surface Disturbance in Hydrographic Area	
	Acres	Percent of Area[1]
Walker Creek	696	0.5
Twentymile Creek	390	0.4
Cheyenne River Basin Subtotal[2]	**7,122**	**0.6**
North Platte River Basin		
Sand Spring Creek	60	0.1
Sand Creek-North Platte River	953	0.4
Deer Creek	<1	<0.1
Sage Creek	647	0.7
La Prele Creek	34	0.1
Antelope Creek-North Platte River	559	0.5
Glendo Reservoir-North Platte River	190	0.2
Shawnee Creek	508	0.7
Lost Creek	105	0.1
North Platte River Basin Subtotal[2]	**3,056**	**0.4**
Powder River Basin		
Dry Fork Powder River	10	<0.1
Upper Salt Creek	65	0.1
Powder River Basin Subtotal[2]	**75**	**0.1**
Total[2]	**10,253**	**0.5**

[1] Based on total acres within the analysis area as provided on **Table 3.16-1**.

[2] Minor discrepancies in totals due to values being rounded up to nearest whole number.

RMP requirements could restrict disturbance or occupancy on federally administered lands within floodplains, within or near riparian areas and wetlands, and at public water reserves. On BLM-administered lands, no new surface disturbing activities would occur within 500 feet of Class I and Class 2 waterbodies (BLM 2007b).

Surface water quality could be directly affected by leaks or spills of petroleum products or other hazardous materials from construction or production equipment (including during transportation of produced water to disposal locations) into streams or waterbodies, or indirectly by leaks or spills onto upland surfaces where contaminants could migrate to streams or waterbodies. However, protective measures to minimize the risk of contamination from accidental releases at oil and gas production and processing facilities would be implemented according to SPCC plans prepared during the APD process in fulfillment of 40 CFR 112.

During review of APDs, other reasonable measures to minimize impacts under Alternative A could be specified by the BLM in accordance with the 43 CFR 3101.1-2. For example, relocation of proposed facilities by up to 656 feet (200 meters) would be deemed consistent with lease rights. Specific areas of potential upland and streambank or channel erosion would be identified during the detailed design phase.

Water would be used during development for well drilling and completion, road compaction and dust abatement, and other construction uses. WSEO procedures and agency permit requirements would limit the consumptive use of surface water to current (existing) or approved levels.

4.16.1.2 Impacts to Groundwater Resources

Under Alternative A, approximately 1,663 new oil and gas wells would be drilled over a 15-year period. The water would be supplied by existing water supply wells either under control of the oil and gas operators or purchased from active appropriators. If each oil and gas well would consume ***up to 26.2*** acre-feet (***203,000*** barrels) of water, then drilling 110 wells per year would consume approximately ***2,900*** acre-feet per year (***22.5*** million barrels). There are 17 existing Class II wastewater disposal wells in Converse County and five new disposal wells would be constructed under Alternative A (**Table 2.3-3**).

Groundwater Drawdown

A numerical screening level groundwater model was developed for the groundwater analysis area, which includes the CCPA and portions of adjacent areas. The model was developed to support the analysis of potential groundwater drawdown impacts for expansion of oil and gas development within the CCPA. A full description of the groundwater model is provided in the Groundwater Model Report (**Appendix E**).

The screening level model conducted for this analysis is sufficiently rigorous to provide a valid analysis to quantify a range of potential future groundwater scenarios. Screening-level models based on limited information can be used to provide a framework for evaluating system dynamics and organizing field data (USEPA 2009). The model was designed to provide a conservative analysis and included a scenario to analyze water use for Alternative A whereby operators would use water from existing sources.

For Alternative A, the majority of the groundwater drawdown impacts were assumed to be from the 71 water supply wells used for oil and gas activities (**Appendix E**). Attributes of these 71 water wells considered include the well location, well total depth (from which an estimate was made of the screened interval), and flow rate per well. Pumping the existing water wells for 15 years produced less than 10 feet of drawdown in any of the aquifers. Drawdown was limited to approximately 10 feet and confined to the region directly surrounding the well, generally extending no more than approximately 2,000 feet from the well.

Groundwater Depletion

The estimated consumption of groundwater from the Wasatch-Fort Union Formation by oil and gas development under Alternative A (22,500 acre-feet, or 175 million barrels for the development period) would represent a small portion of the groundwater resource (less than 0.01 percent). Therefore, consumption under Alternative A would have a negligible impact on groundwater resources.

Groundwater Contamination from Surface Spills and Leaks of Fuels and Chemicals

Potential groundwater contamination could occur from surface leaks and spills of fluids from storage containers, transportation accidents, and leaks from impoundments. Leaks and spills of chemicals used for hydraulic fracturing also may pose a contamination risk. The groundwater sources most likely to be affected would be alluvial aquifers because they are shallow, unconfined, and composed of materials that transmit fluids more easily than the deeper aquifers composed of rock.

To minimize the risk of contaminating shallow aquifers due to leaks and spills, the transportation, storage, and disposal of fuels and chemicals would be done in accordance with regulatory requirements of applicable federal and state programs. In addition, operators would maintain and implement SPCC plans for petroleum-based materials and emergency response plans for non-petroleum materials (i.e., various ingredients of fracturing fluids and well treatment chemicals). Hydraulic fracturing chemicals would be disclosed to the WOGCC as required by rule (WOGCC Rules, Chapter 3, Section 45).

FracFocus© (2016) maintains a national registry that provides a means through which oil and gas operators can list, by well, the ingredients used in fracturing fluids, subject to proprietary ingredients exceptions.

A recent study by Gross et al. (2013) analyzed the frequency of spills that impacted groundwater in Weld County, Colorado, in the Denver Basin of Colorado. Review of Colorado Oil and Gas Conservation Commission data enabled researchers to determine that out of 18,000 active wells in Weld County, the frequency of surface spills that impacted groundwater was 0.5 percent over a 1-year period (July 2010 to July 2011). Spilled materials were composed of crude oil, produced water, and other unidentified materials. Hydraulic fracturing fluids were not specifically identified. The study also did not differentiate wells from other infrastructure that would be present on a production location such as tanks, heater treaters, and flowlines. Gross et al. (2013) used the number of reported active wells to establish a spill incident rate per number of wells, while indicating that the surface spills originated from associated tank batteries, production equipment, flowlines, or other fluids handling equipment.

The 0.5 percent per year frequency of surface spills impacting groundwater represents slightly less than 90 incidents per 18,000 wells in one year. Applying that spill rate to 110 new wells that would be drilled in one year under Alternative A, there would be a potential for less than 1 spill incident to affect groundwater in 1 year. This calculation considers only production wells because it is not certain how many source water and disposal wells would be drilled in any given year. Applying the spill rate from Weld County would be a conservative estimate of risk because other basins could have different hydrogeological characteristics.

Based on review of reported spills in Pennsylvania from drilling in the Marcellus shale, the majority (90 percent) of surface spills of fracturing fluids likely would be less than 30 barrels (1,260 gallons), and 50 percent of the spills likely would be 38 gallons or less (Gradient 2013). The regulatory requirements to remediate spills would reduce the risk to shallow groundwater resources. Therefore, impacts to groundwater would be negligible.

The WOGCC rules require groundwater baseline sampling (WOGCC Rules, Chapter 3, Section 46) prior to commencement of drilling. Operators must submit a groundwater sampling, analysis, and monitoring plan with the APD. The rule requires that initial sampling and analysis must occur within 1 year of well spud and subsequent sampling and testing must occur within 2 years of initial sampling. As noted in Lease Notice 1, a Condition of Approval (COA) for development on federal minerals would include a setback of 0.25 mile near occupied dwellings or structures. Domestic water supply wells would be closely associated with occupied structures; therefore, this COA would provide setbacks from domestic wells.

Contamination of Usable Waters from Hydraulic Fracturing

The impact analysis for hydraulic fracturing was restricted to the specific process by which fluids and proppant are injected into a well under pressure to enhance well productivity by creating fractures. These fractures act as conduits to facilitate the movement of fluids to the wellbore. Hydraulic fracturing is conducted on oil and gas producing zones that are thousands of feet below the surface and is an intrinsic and necessary part of well completion. Potential impacts often attributed to hydraulic fracturing include those from air emissions, wastewater disposal, surface spills, transportation, noise, and flaring. For this analysis, only potential subsurface effects of hydraulic fracturing to usable waters were considered. For discussions regarding the other potential impacts, see Section 4.1, Air Quality; Section 4.7, Transportation; and Section 4.13, Noise.

Usable Waters. A usable water ***(also see Section 2.2.2.2)*** is defined by the USEPA as “an aquifer or portion of an aquifer that:

- Supplies any public water system or that contains a sufficient quantity of groundwater to supply a public water system; and
- Currently supplies drinking water for human consumption; or
- Contains fewer than 10,000 mg/L total dissolved solids and is not an exempted aquifer." (USEPA 2002)

Aquifers potentially at risk from contamination under Alternative A would be usable waters as designated under the Safe Drinking Water Act.

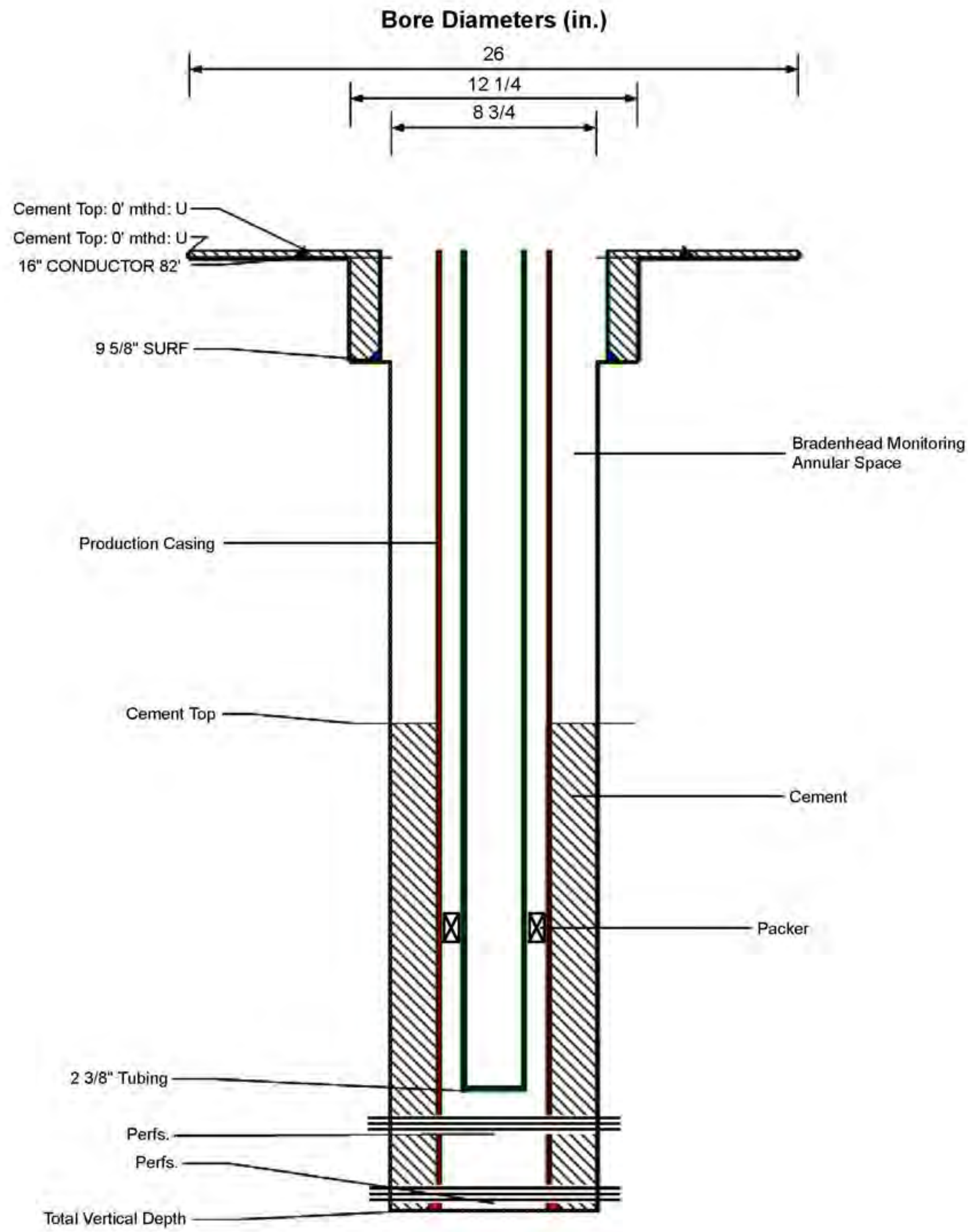
Hydraulic fracturing is used during well completion to increase productivity of the wells. The technique uses a combination of mostly water and sand (or proppant) that is pumped into the hydrocarbon zone at pressures sufficient to fracture the formation. Once fractures are created, sand (proppant) is pumped into the fractures to keep the fractures open and facilitate the flow of oil and gas to the wellbore. The fracturing mixture also contains various chemicals to increase the effectiveness of the fracturing and fluid recovery process. These chemicals could include acids, biocides, corrosion inhibitors, friction reducers, and scale inhibitors. The mixture of chemicals used depends on the specific geological conditions, well conditions, and fracturing method.

Contamination of potential usable waters through the migration of fracturing chemicals or hydrocarbons through the fractures created was identified as a concern during scoping for this Project. Rock mechanics indicates that in most cases, the artificially created fractures are vertical (Hubbert and Willis 1957), which raises concerns regarding the risk that the fractures could migrate to such an extent that they provide a pathway for fracturing chemicals to contaminate usable waters. The risk would be mitigated by a number of physical conditions intrinsic to the nature of oil and gas wells, geology of the basin, and hydraulic fracturing.

Limits to Fracture Height Growth. Fracture height data from many wells in several oil and gas basins in diverse parts of the United States have indicated that maximum fracture height was approximately 300 feet (Fisher and Warpinski 2011). Two major factors limit the vertical growth of fractures are: having an insufficient amount of fluid to propagate fractures through thick rock sections that lie between the target zone and potential usable waters; and varying in-situ stresses due to changes in lithology (e.g., from sandstone to shale) preventing uncontrolled growth of fractures. Shales generally are under higher stress than sandstones, and that difference in stress dissipates the fracturing energy.

Limits to Upward Fluid Flow. Upward fluid gradients, if present, likely would not have sufficient energy to move fracturing fluids through the stratification of brines found in sedimentary basins (Flewelling and Sharma 2014). The fact that oil and gas become trapped notwithstanding, the density contrast with water (hydrocarbons lighter than water) is further evidence that upward movement of fracturing fluids would not be likely. Further, upon completion of well stimulation and pumping for fracture development, the well would go into production and the pressure in the wellbore would be reduced. At this point, the natural tendency for fluids (hydrocarbons and fracturing fluids) would be to flow to the well (Gradient 2013).

Local Geologic Conditions in the Powder River Basin. Fracture heights in the southern Powder River Basin would be expected to range from 60 to 160 feet, while the horizontal half-lengths would be expected to vary from 200 to 350 feet (WOGCC 2016a). A fracture half-length is the length of the fracture from wellbore to the tip of the fracture. The potential target formations (Teckla, Teapot, Parkman, Sussex, Turner, and Dakota) are sandstones that are hydrogeologically isolated within thick shale sections. The Fox Hills/Lower Hell Creek Aquifer would be the deepest potential aquifer and is separated from the target zones by hundreds to thousands of feet of low permeability shale, which would make it very unlikely that fractures could be propagated vertically into a usable water. Also, it is not certain that



Source: COGCC 2016.

CONVERSE COUNTY OIL AND GAS EIS

Figure 4.16-1

Typical Well Construction

Print Date: 8/11/2017

the Fox Hills/Lower Hell Creek aquifer qualifies as a usable water (TDS less than 10,000 mg/L) in the deeper parts of the basin. The Niobrara Formation, which is largely composed of limestone and shale and not sandstone, would be a prime production target. It is prospective at depths that assure hydrogeologic isolation from potential usable waters.

Well Integrity. Given the physical limitations that inhibit upward fracture growth through the overlying rock strata, the remaining pathway for contamination would be the wellbore itself. The containment of fluids would rely on the concept of well integrity, or maintaining physical barriers to prevent the migration of fluids out of the borehole and to separate aquifers from hydrocarbon-bearing zones. As a way of estimating well integrity, a recent rule issued by the WOGCC requires monitoring of annular pressures during hydraulic fracturing operations (i.e., bradenhead monitoring) (**Figure 4.16-1**).

Monitoring pressures in well annuli (i.e., the spaces between strings of casing or the production casing and the drilled hole) could provide indications of leakage through primary barriers such as cement sheaths and casing. Remedial measures could be implemented if monitoring indicates a problem with well integrity.

Summary of Potential Impacts on Usable Waters from Hydraulic Fracturing. In a study of the potential impacts to drinking water, the USEPA did not find evidence that hydraulic fracturing has "led to widespread, systemic impacts on drinking water resources in the United States" (USEPA 2016e). Given the subsurface geology of the CCPA and the physical constraints of the fracturing process, there would be a very low probability that hydraulically created fractures would extend vertically to the point that fracturing fluids and hydrocarbons could migrate into usable waters. In addition, bradenhead monitoring would provide a means of verifying the integrity of the well during the fracturing process and would initiate remedial responses if necessary to prevent migration of fluids outside of the well (WOGCC Rules, Chapter 3, Section 45).

<u>Contamination of Usable Waters from Subsurface Injection of Wastewater</u>

Compared to evaporation ponds, underground injection would provide the lowest risk of impacts from the disposal of produced water and fracturing fluids. However, injection disposal of wastewater presents several contamination pathways of concern as defined by the USEPA. These migration pathways include "migration of fluids through a faulty injection well casing, migration of fluids upward through the annulus located between the casing and the drilled hole, migration of fluids from an injection horizon through the confining zone (strata), vertical migration of fluids through improperly abandoned or completed wells, lateral migration of fluids from within an injection zone into a protected portion of that stratum, and direct injection of fluids into or above an underground source of drinking water." (USEPA 2002)

The UIC regulatory program includes a number of requirements designed to reduce the risk of contamination through the identified pathways (USEPA 2002). Those requirements include mechanical integrity tests (MITs), inspections, file reviews, corrective actions on wells with mechanical integrity test failure, enforcement actions, and closures. In addition, operators must maintain strict compliance with permit-specified injection pressures to ensure that the injection zones and confining layers are not inadvertently fractured. The permitting process requires identification of nearby wells that penetrate the proposed injection zone within a specified area of interest; geology, including adequacy and extent of confining layers; well design; and a description of the monitoring program.

Tubing and packer failures accounted for approximately 80 percent of internal mechanical integrity test failures (Arthur et al. 2016). Often, these failures could be easily corrected by replacement or repair of equipment. Failure of casing or cement accounts for 12 to 20 percent of mechanical integrity test failures. Often the deficiencies could be repaired, but in extreme cases, the wells would be plugged.

The injection zones identified for the existing Class II disposal wells in the CCPA are in upper Cretaceous rocks and include the sandstones in the Lewis Shale, Teckla, Teapot, Parkman, and Frontier formations. These zones are hydrologically isolated from potential drinking water sources by hundreds to thousands of feet of low permeability shale and also are hydrocarbon production zones. As long as injection disposal wells operate in accordance with UIC requirements and well integrity is maintained, there would be a very low risk of contamination of potential usable waters and impacts would be negligible.

Groundwater Contamination from Other Sources

In addition to groundwater contamination from hydraulic fracturing, other potential sources of contamination include:

- Migration of drilling fluids outside the borehole and the formation of a hydraulic connection between the lost fluids and a shallow aquifer.
- “Frac hits”.
- Wellbore collisions with active wells or old plugged wells.
- Improperly constructed and/or poorly maintained water wells.

The potential risk for drilling mud to contaminate aquifers would be very low. When drilling into a porous and permeable aquifer, some of the drilling fluid, in the form of water, (i.e., mud filtrate) enters the formation (Schlumberger 2017). This phenomenon is called mud filtrate invasion. Invasion of mud filtrate into the formation would be of little extent (a few feet at most). The invasion would cause a “mud cake” to form along the sides of the borehole that slows down or stops the flow of the filtrate. When surface casing is set, cement is required from casing depth to the surface, effectively shutting off hydraulic communication between the borehole and the aquifer. The amount of invasion would be negligible compared to the entire extent of the aquifer. Additionally, drilling mud in the shallow portions of a well would not necessarily contain materials that would be regarded as contaminants.

A frac hit is an event whereby one well is affected by hydraulic fracturing treatment in another nearby well (Jacobs 2017). Frac hits occur at depths too deep to affect potential useable aquifers (see previous discussion regarding contamination from hydraulic fracturing), and generally are operational issues; however, they are becoming more common. The impacts are largely an engineering concern and could affect well productivity resulting in lost production and revenue. Uncommonly, a frac hit initiates a well control event resulting in a surface blowout. A frac hit likely would not contaminate groundwater unless the loss of well control in the affected well would cause a subsurface breach of integrity. The risk of well control events due to frac hits could be reduced through requirements for adequate pressure-rated well heads and wellhead monitoring of offset wells during fracturing operations.

Well collisions are different from frac hits as they occur when a drilling well intersects with another active well or a plugged and abandoned well. Well collisions pose environmental, health and safety, and financial consequences. The risk of well collisions could be reduced by conducting a risk analysis prior to drilling that would take into consideration factors such as existing density and location of vertical and horizontal wells.

As for poorly maintained wells increasing the risk of contamination, the BLM has no authority over private well owners who are responsible for the maintenance of their own private property. Reasonable setbacks and rules that govern surface casing and cementing would help to reduce the risk to private wells from oil and gas activities. However, rural settings offer a multitude of contamination sources, which pose risks to shallow aquifers not linked to oil and gas drilling. Such sources include equipment repair shop sumps, septic systems, fuel tanks, chemical tanks, unlined dipping vats, waste dumps, and animal confinement areas (e.g., cattle feeding operations). In addition to anthropogenic sources of contamination, ambient groundwater can have natural concentrations of metals or compounds that exceed the maximum contaminant levels specified by the USEPA.

Biogenic methane gas occurs in coals and sandstones in the Lower Tertiary rocks in the Powder River Basin (Blackstone 2007). Gas-charged sandstones may present well blow-out hazards at relatively shallow depths, as in the case of a well blow-out at Oedekoven Field from a sandstone in the Upper Fort Union Formation encountered at a depth of 300-400 feet. If coal seams and associated gas-charged sandstones were used as water sources (aquifers), there would be potential for methane gas hazards. However, these hazards would not be caused by hydraulic fracturing, but by naturally-occurring biogenic methane natural gas.

Disposal of Produced Water

As shown on **Table 4.16-2** based on input from the OG (2014), each well drilled under Alternative A would generate 7.8 acre-feet of hydraulic fracturing flowback water during the first year after well completion. In addition, each producing well would yield an average of 25 barrels of produced water per day or 1.2 acre-feet (9,125 barrels) per year over the life of the well. Under Alternative A, 858 acre-feet of flowback water would be generated each year by the drilling of 110 wells until full build out at year 15. Produced water would be generated at a rate of 132 acre-feet (1.0 million barrels) during the first year and would increase by this volume each year until all new wells are drilled. At full build-out in 15 years, the 1,663 wells developed under Alternative A would generate an estimated 1,980 acre-feet (15.4 million barrels) of produced water per year. The total wastewater generated in year 15, the maximum year of wastewater generation, would be 2,838 acre-feet (22 million barrels). This would include flowback water.

Table 4.16-2 Wastewater Volumes under Alternative A

Water Type	Volume Of Wastewater (acre-feet)		
	Per Well	**In Year 1**	**In Year 15**
Flowback[1]	7.8	858	858
Produced	1.2	132	1,980
Totals	**8.9**	**990**	**2,838**

[1] The amount of water produced by a well in the first year; assume all flowback water is recovered in the first year of production (OG 2014).

As of 2015, there were 17 Class II disposal wells operating in Converse County (WOGCC 2016b). The OG (2014) assumed a disposal well capacity of 4,100 barrels per day per well, or 193 acre-feet per year per well. With an existing 17 disposal wells available and an additional 5 wells to be built over the 15 years of development, there would be a total estimated disposal capacity of 4,244 acre-feet (33 million barrels) under Alternative A. The assumed injection capacity of 4,100 barrels per day appears to be more than adequate to dispose of the amount of wastewater that would be produced during Project development and up to year 15 and beyond. This analysis assumes no recycling of wastewater (either produced or flowback).

A review of the injection rates for the 17 existing injection wells reported to the WOGCC over a 12-month period from January to December 2015 indicated an average per well daily injection rate of 1,113 barrels per day, or approximately 406,200 barrels per year (52.4 acre-feet per year). This average rate is based on a wide range of reported injection rates and may not be representative of the maximum potential injection capacity under Alternative A. However, applying this average injection rate, the existing 17 disposal wells would be estimated to inject approximately 890 acre-feet (6.9 million barrels) per year. The addition of five new injection wells under Alternative A would provide for an additional capacity of 262 acre-feet (2.0 million barrels) per year for a total capacity of 1,152 acre-feet (9 million barrels) per year. Using the WOGCC data to estimate disposal capacity suggests that the existing and planned capacity under Alternative A may not be adequate to handle the estimated volume of wastewater.

As shown in Table 3.16-10, the evaporative facilities have an estimated disposal capacity of 1,371 acre-feet (10.6 million barrels) per year. When the additional evaporative capacity is added to the existing and projected new injection disposal capacity of 2,523 acre-feet, there is a potential deficit of disposal capacity of about 315 acre-feet per year.

Increased disposal well capacity could be added without additional disturbance by converting under-performing production wells to water disposal wells, although it is not possible to predict the actual number of production wells that could be converted to disposal wells. Capacity of commercial evaporation ponds and additional Class I well injection capacity also would affect the number of Class II disposal wells that would be needed.

Induced Seismicity

See Section 4.3, Geologic Hazards, for a detailed discussion regarding felt or damaging induced seismicity associated with oil and gas activity.

Impacts to Groundwater from Soil Compaction

Groundwater quantity impacts could result from construction of road networks, pads, pipelines, and other Project-related activity that would reduce infiltration due to compaction of soil. The total amount of new disturbance under Alternative A would be 0.7 percent of the CCPA, and disturbance would be directly related to compaction and reduction in infiltration; therefore, the impact of soil disturbance and compaction would be 0.7 percent of the CCPA.

4.16.2 Impacts to Water Resources from Alternative B – Proposed Action

Under Alternative B, approximately 5,000 new oil and gas wells would be drilled on 1,500 multi-well pads over a period of 10 years (i.e., 500 new wells per year). An estimated 52,667 acres of disturbance would result from the construction of well pads (including other service well pads), access roads, and other Project facilities (**Table 2.4-1**).

4.16.2.1 Impacts to Surface Water Resources

Under Alternative B, direct and indirect impacts to surface water resources would be similar to those discussed under Alternative A, but impacts would be greater in magnitude because of the increased amount of oil and gas development and associated surface disturbance that would occur.

Similar to Alternative A, impacts to surface water resources from development under Alternative B generally would be from surface disturbance during construction of access roads, pipelines, well pads, and supporting facilities. Installation of culverts or other stream crossing methods across streams with streamflow at or shortly after the time of construction likely would result in direct impacts of increases in sediment available for entrainment and transport by the channelized flow. These crossings would be installed in accordance with requirements contained in the Gold Book (USDOI- USDA 2007). Impacts would be expected to begin decreasing within several days after the completion of in-stream construction activities, or with the end of runoff-inducing precipitation events, and would return to near pre-construction levels with successful reclamation where it occurs. Interim reclamation under Alternative B would be required to meet BLM or USFS approval for suitable wildlife habitat on only the 10 percent of the CCPA that is federally managed surface estate (Section 2.4.5). Areas of disturbance adjacent to and directly upslope of streams that are not successfully reclaimed also could contribute to impacts on surface water through increased levels of stream sedimentation. Site-specific BMPs for stormwater runoff control would be specified in the SWPPP and applied during construction and reclamation to minimize these impacts. ***It should be noted that stormwater permits generally require disturbance***

that is not paved or graveled and be revegetated to 70 percent of the background cover for the area.

The locations of the surface disturbance and stream crossings are unknown at this time; therefore, site-specific analysis of effects to particular streams cannot be quantified. A qualitative comparison of alternatives indicates that Alternative B would have the potential for greater impacts to surface water when compared to Alternative A because of the increased level of surface disturbance that would be required.

Assuming an even distribution of additional disturbance under Alternative B, **Table 4.16-3** provides the estimated surface disturbance that would occur for each hydrographic area (i.e., basin and watershed). Surface disturbance under Alternative B would impact approximately 2.5 percent of the analysis area and would range from less than 0.1 percent to approximately 3.7 percent for each watershed.

Lease stipulations could restrict disturbance or occupancy on federally administered lands within floodplains, within or near riparian areas and wetlands, and at public water reserves. On BLM-administered lands, no new surface disturbing activities would occur within 500 feet of Class 1 and 2 waterbodies (BLM 2007b). This would preclude development on 1,077 acres of BLM-administered lands.

The North Platte River is a Class 1 water; therefore, it would fall under the BLM Casper RMP stipulations of 500-foot NSO and 0.25-mile CSU.

Table 4.16-3 Surface Disturbance by Hydrographic Area under Alternative B

Basin / Watershed	Surface Disturbance in Hydrographic Area	
	Acres	**Percent of Area[1]**
Cheyenne River Basin		
Sand Creek	6,158	3.2
Upper Antelope Creek	4,643	2.2
Upper Dry Fork Cheyenne River	5,998	3.5
Lower Dry Fork Cheyenne River	4,295	3.0
Lightning Creek	6,389	3.3
Dry Creek	3,521	2.6
Walker Creek	3,576	2.8
Twentymile Creek	2,005	2.1
Cheyenne River Basin Subtotal[2]	**36,585**	**2.9**
North Platte River Basin		
Sand Spring Creek	306	0.5
Sand Creek-North Platte River	4,900	1.9
Deer Creek	<1	<0.1
Sage Creek	3,321	3.5
La Prele Creek	175	0.5
Antelope Creek-North Platte River	2,870	2.5
Glendo Reservoir-North Platte River	977	1.0
Shawnee Creek	2,610	3.4
Lost Creek	537	0.7
North Platte River Basin Subtotal[2]	**15,696**	**1.9**

Table 4.16-3 Surface Disturbance by Hydrographic Area under Alternative B

Basin / Watershed	Surface Disturbance in Hydrographic Area	
	Acres	**Percent of Area[1]**
Powder River Basin		
Dry Fork Powder River	50	0.2
Upper Salt Creek	335	0.5
Powder River Basin Subtotal[2]	**386**	**0.4**
Total[2]	**52,667**	**2.4**

[1] Based on total acres within the analysis area as provided on **Table 3.16-1**.

[2] Minor discrepancies in totals due to values being rounded up to nearest whole number.

As under Alternative A, surface water quality could be directly or indirectly affected by leaks or spills of petroleum products or other hazardous materials from construction or production equipment (including during transportation of produced water to disposal locations via pipelines or trucks). Protective measures to minimize the risk of contamination from accidental releases at oil and gas production and processing facilities would be implemented according to the applicable SPCC plans prepared in fulfillment of 40 CFR 112. Alternative B would have a higher risk of surface water impacts from leaks or spills than that of Alternative A because of the increased activity associated with the greater magnitude of oil and gas development.

During review of APDs, other reasonable measures to minimize impacts under Alternative B could be specified by the BLM in accordance with 43 CFR 3101.1-2. Specific areas of potential upland and stream-bank or channel erosion would be identified during the detailed design phase.

Water would be used during development for well drilling and completion, road compaction and dust abatement, and other construction uses. Under Alternative B, water would be obtained from existing permitted surface and groundwater sources, as well as proposed new groundwater supply wells (Section 2.2.2.4). WSEO procedures and agency permit requirements would limit the consumptive use of surface water to current (existing) or approved levels, and no new surface water sources would be used.

4.16.2.2 Impacts to Groundwater Resources

Under Alternative B, 5,000 wells would be drilled over a 10-year period. Water for drilling operations primarily would be from groundwater sources and consumption would be approximately ***14,000*** acre-feet (***108*** million barrels) per year or an average of ***26.2*** acre-feet (***203,000*** barrels) per well (Section 2.2.2.4). As with Alternative A, the water for Alternative B would be supplied by 71 existing water supply wells controlled or appropriated by the operators; however, 50 additional wells would be drilled under Alternative B to meet the demand. Another 30 new disposal wells would be constructed to handle increased production resulting from Alternative B.

<u>Groundwater Drawdown</u>

Under Alternative B, groundwater impacts were analyzed using simulated pumping scenarios. Full descriptions of these groundwater model scenarios are provided in **Appendix E**. The results of one of the groundwater pumping scenarios are summarized here.

Dispersed Pumping Scenario. The Dispersed Pumping Scenario was developed assuming all new water wells to be developed under Alternative B would be evenly distributed over the Wasatch/Tongue River Aquifer rather than concentrated in one region of the CCPA. This scenario involved installing 50 new water wells, assuming the maximum number of new wells would be drilled and all water for the Project would be obtained from these 50 new wells. It was assumed that all 50 new water wells would come on line in Year 1. These additional 50 new water wells were proposed for a variety of reasons and may or may not be drilled as warranted by need as development would progress. While existing water wells could provide most of the needed water, this scenario is a conservative analysis because it assumed all water requirements would be met by drilling new wells.

Equally distributing the 50 new water wells under Alternative B across the Wasatch/Tongue River Aquifer would lead to isolated and very localized cones of depression centered on each pumping well. Drawdown generally would be less than 40 feet at most of the wells. One well would reach a maximum of approximately 100 feet in one well where the hydraulic conductivity was the lowest at 0.5 feet/day. Drawdown would extend to approximately 3,500 feet around many wells as defined by the 1-foot drawdown contour. Approximately 35,000 acres would be within an area impacted by at least one foot of drawdown. The 10-foot drawdown contour would be limited to approximately 1,000 feet from each of the pumping wells. Drawdown would reach a maximum after 10 years of pumping and then return to pre-pumping levels after 20 years of recovery.

Impact Summary from Groundwater Pumping. For the Dispersed Pumping Scenario under Alternative B, equally distributing 50 water wells across the Wasatch/Tongue River Aquifer would lead to isolated and very localized cones of depression centered on each pumping well. Drawdown would extend to approximately 1,000 feet around many wells as defined by the 10-foot drawdown contour. ***On that basis, it is recommended that new water wells be located at least 2,000 feet from existing water wells, springs, wetlands, and riparian areas. However, the WSEO is the agency with authority to implement setbacks for water wells.*** Drawdown would be concentrated almost entirely within the Wasatch/Tongue River Aquifer and would not extend into the deeper layers.

A 46 percent increase in permitted water use occurred during the four years since the initial analysis in 2014. Since the beginning of 2018, 35 new oil and gas groundwater well permits were issued in the project area at an average appropriation rate of 180 gallons per minute (17,420 acre-feet per year). A larger estimate of total water use required by the project, alongside a measurable increase in permitted oil and gas water uses in the CCPA, raise questions about water use and availability. However, any new water use will be subject to interference considerations as they apply to existing water rights within the project area. As such, the WSEO retains statutory authority to declare a groundwater control area and place a cap on water permitting and production, or exercise other means of regulation for both surface water and ground water uses, should any impacts to existing water rights be demonstrated in association with the project.

<u>Groundwater Contamination from Surface Spills and Leaks of Fuels and Chemicals</u>

Under Alternative B, there would be an increased potential for impacts to occur to groundwater because of the increased level of proposed activity compared to Alternative A. However, by applying the spill rate discussed for Alternative A (0.5 percent in a given year) to the number of wells that would be drilled in one year under Alternative B, there potentially would be less than 3 spill incidents to affect groundwater in 1 year. It is not certain how many source water and disposal wells would be drilled in any given year; therefore, this calculation considers only oil and gas production wells.

Impacts due to surface spills under Alternative B still would present a very small risk to groundwater for the same reasons as discussed under Alternative A: the small volume of expected spills, the low spill rate, and the regulatory requirements to remediate spills of potentially hazardous materials. Impacts to groundwater from surface spills under Alternative B would be minor to negligible.

Lease Notice 1 would contain a COA for development on federal minerals that would require a setback of 0.25 mile near occupied dwellings or structures. Domestic water supply wells would be closely associated with occupied structures; therefore, this COA would provide setbacks from domestic wells without applying additional mitigation measures.

Groundwater Depletion

As discussed under Alternative A, recoverable groundwater resources were estimated to be 1.4 billion acre-feet in the Wasatch/Tongue River sandstones, Lebo Confining Layer sandstones, and the Tullock aquifers in the Wyoming portion of the Powder River Basin (BLM 2002b). Based on the aerial extent of these aquifers in the county, there would be a potential recoverable water resource of approximately 261 million acre-feet of groundwater in the Wasatch/Lower Tertiary aquifers in Converse County. The estimated consumption of groundwater by development under Alternative B would represent a small portion (0.08 percent) of the groundwater resource. Therefore, consumption under Alternative B would have a negligible impact on groundwater resources.

Contamination of Usable Waters from Hydraulic Fracturing

Under Alternative B, no impacts to usable waters from hydraulic fracturing would be expected. As discussed under Alternative A, due to the physical constraints on fracture growth and regulatory requirements, there would be an extremely low risk of impacts to usable waters and the risk would not change because of the increased number of wells that would be drilled.

Contamination of Usable Waters from Subsurface Injection of Wastewater

Under Alternative B, the risk of contamination of usable waters would be negligible due to the regulatory oversight of injection disposal wells under the UIC program and the specific geologic setting of the southern Powder River whereby potential sandstone injection zones are relatively deep and hydrologically isolated from potential usable waters by thick sequences of low permeability shale. As under Alternative A, impacts of injection disposal on usable waters under Alternative B would be negligible.

Disposal of Produced Water

As shown on **Table 4.16-4**, and similar to Alternative A, each well drilled under Alternative B would generate 7.8 acre-feet of hydraulic fracturing flowback water during the first year after well completion OG (2014). In addition, produced water would be generated at an average of 25 barrels of produced water per day for each producing well over the life of the well (1.2 acre-feet or 9,125 barrels per year). Under Alternative B, 3,870 acre-feet (30 million barrels) of flowback water would be generated during the drilling of 500 wells each year until full build out at year 10. Produced water would be generated at a rate of 590 acre-feet (4.5 million barrels) during the first year and would increase by this amount throughout the drilling of new wells. At full build-out in 10 years, the 5,000 wells developed under Alternative B would generate an estimated 5,880 acre-feet (45.6 million barrels) of produced water per year. Including flowback water, the total wastewater generated in year 10, the maximum year for wastewater generation, would be 9,750 acre-feet (75 million barrels).

Table 4.16-4 Wastewater Volumes under Alternative B

	Volume Of Wastewater (acre-feet)		
	Per Well	**In Year 1**	**In Year 10**
Flowback[1]	7.8	3,870	3,870
Produced	1.2	590	5,880
Totals	**8.9**	**4,460**	**9,750**

[1] The amount of water produced by a well in the first year; assume all flowback water is recovered in the first year of production (OG 2014).

Using the average injection rate calculated from the WOGCC (2016b) data, the additional 30 wells that would be drilled under Alternative B would have an injection capacity of approximately 1,572 acre-feet (12.2 million barrels) per year, or 52.4 acre-feet per well. If an injection rate of 4,100 barrels per day

(193 acre-feet per well per year) is used as assumed by the OG (2014), the total estimated injection capacity would be 5,790 acre-feet (45 million barrels), which still would be substantially short of the projected maximum volume of flowback and produced water (9,750 acre-feet in year 10).

The preceding analysis suggests a potential shortage of injection capacity under Alternative B, especially if new disposal wells inject water at rates similar to the existing injection wells (see Section 4.16.1.2, subsection titled Disposal of Produced Water). However, increased disposal well capacity could be added without additional disturbance by converting under-performing production wells to water disposal wells, although it is not possible to predict the actual number of production wells that could be converted to disposal wells. Capacity of commercial evaporation ponds and additional Class I well injection capacity also would affect the number of Class II disposal wells that would be needed. Evaporation ponds could provide excess disposal capacity as well***, but the current estimated evaporative disposal capacity of 1,371 acre-feet would not substantially contribute to disposal capacity***.

Induced Seismicity

As discussed for Alternative A, a detailed discussion regarding the hazard of felt or damaging induced seismicity associated with oil and gas activity is provided in Section 4.3, Geologic Hazards.

Impacts to Groundwater from Soil Compaction

Groundwater quantity impacts may result from construction of road networks, pads, pipelines, and other Project-related activity that would reduce infiltration due to compaction of soil. The total amount of new disturbance under Alternative B would be 3.5 percent of the CCPA, and disturbance would be directly related to compaction and reduction in infiltration; therefore, the impact of soil disturbance and compaction would be 3.5 percent of the CCPA.

Impacts to Public Water Supply

As shown on **Figure 3.16-7**, there are several public water supplies in the CCPA. The largest public water supply is for the Town of Rolling Hills which has a wellhead protection program in force that would restrict the siting of potential contamination sources.

4.16.2.3 Mitigation and Mitigation Effectiveness

The following mitigation measure would be implemented to reduce impacts to surface water and groundwater under Alternative B:

WR-1 Existing stream crossings will be utilized wherever practicable and use of the crossings will be incorporated during site-specific design. All stream crossings utilized for Project development or production will be maintained by the applicable operator.

WR-2 The OG will develop and utilize an Unanticipated Pipeline Release Standard Operating Procedure coupled with a pipeline volume and flow monitoring system for the underground water supply and disposal pipelines.

Mitigation measure WR-1 would minimize the impacts to surface water from construction of additional stream crossings by reducing the number of crossings required. Mitigation measure WR-2 would be effective by closely monitoring flows and volumes as real-time inputs to and discharges from the pipeline system, making it is possible to detect if a situation is occurring when the pipeline has been compromised. Once detected, the established procedures would be followed that would require the shutdown of the water pipeline system, limiting the release from that of an undetected leak.

4.16.2.4 Residual Impacts

Residual impacts are defined as unavoidable impacts to a resource that remain assuming implementation of proposed mitigation. Although implementation of BLM and USFS water avoidance, minimization, and mitigation as well as additional mitigation measures would minimize impacts to water resources during construction, impacts to water quality from erosion and sedimentation would still be expected until completion of successful reclamation in these areas. Risk of leaks or spills of hazardous materials from oil and gas production and processing facilities would be minimized, but would still remain during transport of produced water or petroleum product by truck.

As described above for the dispersed groundwater well pumping scenario, drawdown would reach a maximum after 10 years of pumping and then return to pre-pumping levels after 20 years of recovery. The model indicates there would be long-term effects from pumping, but those effects would be negligible once water levels have rebounded. Based on the groundwater pumping model, ***dispersed well locations*** would provide a buffer between wells to minimize effects of drawdown on pre-existing wells. However, there may be residual impacts because actual water levels may not return to pre-existing conditions after 20 or more years of no pumping. There would be no residual impacts associated with depletion of the resource because impacts to the groundwater resource would be negligible.

Aside from the recommended groundwater protection mitigation measure, there may be long-term effects from spills to groundwater, especially for spills remediated through natural attenuation (i.e., the use of natural processes to lower the concentrations of contaminants rather than invasive approaches such as pumping and treating). Even the more invasive remedial processes may not be efficient at removing contaminants, and impacts from contamination could persist long term.

The lack of disposal capacity would pose a large residual impact, especially during peak production. Over time, water production would decline as a result of production decline in the late stages of well production and abandonment of wells that reach their economic life.

Compensatory mitigation for residual impacts to ground and surface water is not warranted because state and federal regulations provide the regulatory framework to address contamination of these waters, and the residual impacts would not inhibit the ability to achieve compliance with laws, policies, or land use objectives of other government agencies.

4.16.3 Impacts to Water Resources from Alternative C

Under Alternative C, approximately 5,000 new oil and gas wells would be drilled from 938 multi-well pads over a period of 10 years (i.e., 500 new wells per year); the ability to request exceptions to timing limitation stipulations would not change from the current process. The number of well pads for this alternative would be reduced relative to Alternative B based on the assumption that a greater number of wells would be drilled from each pad (Section 2.5). An estimated 37,267 acres of disturbance would result from the construction of well pads, access roads and other Project facilities (**Table 2.5-1**).

Under Alternative C, water supply and disposal pipelines would be installed on 50 percent of the development (Section 2.5.2). Alternative C also includes a requirement to recycle produced water for use as well development water on 50 percent of the development. Closed-loop drilling methods would be required on all well pads accessing federal mineral estate.

4.16.3.1 Impacts to Surface Water Resources

Under Alternative C, direct and indirect impacts to surface water resources would be similar to those discussed under Alternatives A and B. Impacts compared to Alternative A would be greater in magnitude because of the increased amount of oil and gas development that would occur; however, impacts would be lower in magnitude compared to Alternative B because there would be less surface disturbance under Alternative C.

Similar to Alternatives A and B, impacts under Alternative C would be expected to begin decreasing within several days after the completion of in-stream construction activities, or with the end of runoff-inducing precipitation events, and would return to near pre-construction levels with successful reclamation. However, interim reclamation under Alternative C would be required to meet the BLM or USFS approval for suitable wildlife habitat on federally managed lands as well as on lands above federal mineral. This requirement would apply to a total of approximately 65 percent of the CCPA under Alternative C compared to only 10 percent under Alternative B.

Assuming an even distribution of additional disturbance under Alternative C, **Table 4.16-5** provides the estimated surface disturbance that would occur for each hydrographic area (i.e., basin and watershed). Surface disturbance under Alternative C would impact approximately 1.7 percent in the analysis area and would range from less than 0.1 percent to approximately 2.5 percent for each watershed.

Table 4.16-5 Surface Disturbance by Hydrographic Area under Alternative C

	Surface Disturbance in Hydrographic Area	
Basin / Watershed	**Acres**	**Percent of Area[1]**
Cheyenne River Basin		
Sand Creek	4,357	2.3
Upper Antelope Creek	3,285	1.5
Upper Dry Fork Cheyenne River	4,244	2.5
Lower Dry Fork Cheyenne River	3,039	2.1
Lightning Creek	4,521	2.3
Dry Creek	2,492	1.8
Walker Creek	2,530	2.0
Twentymile Creek	1,418	1.5
Cheyenne River Basin Subtotal[2]	**25,888**	**2.0**
North Platte River Basin		
Sand Spring Creek	216	0.4
Sand Creek-North Platte River	3,467	1.3
Deer Creek	<1	0.0
Sage Creek	2,350	2.5
La Prele Creek	123	0.4
Antelope Creek-North Platte River	2,031	1.8
Glendo Reservoir-North Platte River	691	0.7
Shawnee Creek	1,846	2.4
Lost Creek	380	0.5
North Platte River Basin Subtotal[2]	**11,107**	**1.3**
Powder River Basin		
Dry Fork Powder River	36	0.1
Upper Salt Creek	237	0.3
Powder River Basin Subtotal[2]	**273**	**0.3**
Total[2]	**37,267**	**1.7**

[1] Based on total acres within analysis area as provided on **Table 3.16-1**.

[2] Minor discrepancies in totals due to values being rounded up to nearest whole number.

Lease stipulations could restrict disturbance or occupancy on federally administered lands within floodplains, within or near riparian areas and wetlands, and at public water reserves. On BLM-administered lands, no new surface disturbing activities would occur within 500 feet of ***Class 1 and Class 2*** waterbodies (BLM 2007b).

The North Platte River is a Class 1 water; therefore, it would fall under the BLM Casper RMP stipulations of 500-foot NSO and 0.25-mile CSU.

As under Alternatives A and B, surface water quality could be directly or indirectly affected by leaks or spills of petroleum products. Installation and production of underground water supply and disposal pipelines on 50 percent of the development would reduce the risk of leaks or spills by reducing the need for truck trips. However, there also would be a risk of leakage from pipelines and monitoring would be required to reduce the potential for catastrophic leaks. The additional requirement for closed-loop drilling methods on federal mineral estate would avoid the use of open pits used for drilling mud storage. Alternative C would have a higher risk of surface water impacts from leaks or spills than Alternative A because of the increased activity associated with increased oil and gas development; however, impacts from Alternative C would be similar but less than under Alternative B due to the implementation of closed-loop drilling methods and the reduced truck traffic as a result of the use of water pipelines.

During review of APDs, other reasonable measures to minimize impacts under Alternative C could be specified by the BLM in accordance with 43 CFR 3101.1-2. Specific areas of potential upland and stream-bank or channel erosion would be identified during the detailed design phase.

Water would be used during development for well drilling and completion, road compaction and dust abatement, and other construction uses. Under Alternative C, the requirement for water recycling would reduce the demand for freshwater to 60 percent of the water required (or a 40 percent reduction) compared to implementation of Alternative B. Water would be obtained from existing permitted surface and groundwater sources, as well as proposed new groundwater supply wells (Section 2.2.2.4). WSEO procedures and agency permit requirements would limit the consumptive use of surface water to current (existing) or approved levels, and no new surface water sources would be used.

4.16.3.2 Impacts to Groundwater Resources

Under Alternative C, 5,000 wells would be drilled over a 10-year period. Each oil and gas well would require ***up to 26.2*** acre-feet (***203,000*** barrels) of water per year, but recycling would reduce demand for freshwater. Water for drilling operations primarily would be from groundwater sources and consumption would be approximately 4,200 acre-feet (32.6 million barrels) per year with the implementation of water recycling (Section 2.5.2.8). As under Alternatives A and B, the water for Alternative C would be supplied by 71 existing water supply wells controlled or appropriated by the operators, and 50 additional new wells would be drilled to meet the demand. Also as under Alternative B, another 30 new disposal wells would be constructed to handle increased production resulting from Alternative C.

As described in Section 2.5.2.8, Alternative C would require implementation of an incremental water recycling plan that would require 10 percent of the well pads to implement this requirement in the first year, 20 percent in the second year, and continuing up to 50 percent of the pads in years 5 through 10. This would result in 40 percent of the proposed water use under Alternative C being recycled.

<u>Groundwater Drawdown</u>

The impacts due to drawdown of groundwater under Alternative C would be less than under Alternative B because of the expected reduction in water use through water recycling. This would result in an estimated consumption of approximately 4,200 acre-feet (32.6 million barrels) per year under Alternative C compared to ***14,000*** acre-feet (***108,000*** million barrels) per year under Alternative B. It is not possible to calculate the absolute volume of water use that would be reduced because of the variability in types of wells (horizontal vs. vertical), numbers of fracturing stages per well, and types of non-water fracturing fluids that could be used (e.g., nitrogen, carbon dioxide, liquefied petroleum gas).

Recycling of water used in hydraulic fracturing has increased as hydraulic fracturing demand for water has increased (Barnes et al. 2015). However, efforts to reduce the consumption of fresh water for hydraulic fracturing have led the oil and gas industry to increasingly turn to the treatment of flowback and produced water to provide hydraulic fracturing water. The treatment process need not result in fresh water, but water that meets the operational requirements and the tolerances of oil and gas reservoirs in a given area. Recycled fracturing water and produced water also could be mixed with largely unusable moderately saline to highly saline groundwater (i.e., total dissolved solids of 3,000 to 35,000 mg/L) (Godsey 2015; National Ground Water Association 2010). Higher concentrations of total dissolved solids could be problematic, but may not be as much of a limitation as the presence of certain constituents such as boron, barium, strontium, iron, phosphate, and other substances. An important limitation for recycling would be that the cost of treatment must be competitive with the cost of fresh water. However, the costs of treatment for recycling of fracturing water also could be mitigated by the economic benefits in that the costs for purchasing freshwater and ultimate disposal would be reduced or eliminated (Barnes et al. 2015). For example, in the Piceance and Uintah basins in Colorado and Utah, respectively, the use of recycled water has been reported to be as high as 90 to 100 percent (Chidsey 2015; USEPA 2015e).

Even if a high rate of recycling of hydraulic fracturing water were achieved, there would be a demand for freshwater to be used in drilling operations, excluding hydraulic fracturing. Cementing operations and drilling fluids would require freshwater to prevent interactions between contaminants in the water and constituents in the drilling muds and cements. Dust abatement also would require the use of freshwater. The amount of water that would be used for drilling would vary because water-based muds may be used for all or only portions of individual wells. However, drilling operations may require less than five and up to 10 percent of the total water demand per well (Nicot et al. 2011; USEPA 2015e). Based on this range, the freshwater drilling demand per year would be between 350 acre-feet (2.7 million barrels) to 700 acre-feet (5.4 million barrels).

***A 46 percent increase in permitted water use occurred during the four years since the initial analysis in 2014. Since the beginning of 2018, 35 new oil and gas groundwater well permits were issued in the project area at an average appropriation rate of 180 gallons per minute (17,420 acre-feet per year). A larger estimate of total water use required by the project, alongside a measurable increase in permitted oil and gas water uses in the CCPA, raise questions about water use and availability. However, any new water use will be subject to interference considerations as they apply to existing water rights within the project area. As such, the WSEO retains statutory authority to declare a groundwater control area and place a cap on water permitting and production, or exercise other means of regulation for both surface water and ground water uses, should any impacts to existing water rights be demonstrated in association with the project*.**

The modeled groundwater pumping scenarios indicate that water demand under Alternative C would not cause widespread drawdown and the effects of pumping would have minor impact to groundwater resources. Combined with recycling, the overall demand would be less with a corresponding reduced impact on groundwater resources. If recycling rates were to reach 90 to 100 percent, impacts would be negligible.

Groundwater Depletion

As discussed under Alternatives A and B, recoverable groundwater resources were estimated to be 1.4 billion acre-feet in the Wasatch/Tongue River sandstones, Lebo Confining Layer sandstones, and the Tullock aquifers in the Wyoming portion of the Powder River Basin (BLM 2002b). Based on the aerial extent of these aquifers in the county, there is a potential recoverable water resource of approximately 261 million acre-feet of groundwater in the Wasatch/Lower Tertiary aquifers in Converse County. The estimated consumption of groundwater by development of Alternative C and other groundwater uses would represent a small portion (less than 0.08 percent) of the groundwater resource. Therefore, consumption under Alternative C would have a negligible impact on groundwater resources.

Groundwater Contamination from Surface Spills and Leaks of Fuels and Chemicals

Under Alternative C, the impacts of surface spills to groundwater would be the same as described for Alternative B but to a lesser degree of magnitude; impacts would be minor to negligible.

Lease Notice 1 would contain a COA for development on federal minerals that would require a setback of 0.25 mile near occupied dwellings or structures. Domestic water supply wells would be closely associated with occupied structures; therefore, this COA would provide setbacks from domestic wells without applying additional mitigation measures.

Contamination of Usable Waters from Hydraulic Fracturing

As discussed under Alternative B, impacts to usable waters due to hydraulic fracturing would be negligible under Alternative C.

Contamination of Usable Waters from Subsurface Injection of Wastewater

Under Alternative C, impacts to usable waters due to injection of wastewater would be the same as described for Alternative B; impacts would be negligible.

Disposal of Produced Water

Under Alternative C, the volume of wastewater generation and disposal capacity would be the same as under Alternative B (or 1.2 acre-feet or 9,125 barrels per year); however, the assumption of water recycling under Alternative C would result in a reduction in the volume of wastewater that requires disposal. As discussed in Section 2.5.2.8, 50 percent of all completion (i.e., flowback) and produced water would be recycled by year 10 of the drilling process, which would reduce the volume of wastewater requiring disposal to 4,875 acre-feet (half of 9,750 acre-feet). This volume of wastewater could be accommodated if the wastewater injection capacity is estimated using the injection rate assumed by the OG (2014). However, the numbers in **Table 4.16-4** and an assumed injection capacity of 1,113 barrels per day (2,460 acre-feet per year) suggest a potential shortage of injection capacity to handle the projected wastewater volume requiring disposal at year 10 assuming that all wastewater is disposed of via injection wells. Uncertainty regarding disposal capacity Alternative C increased disposal capacity.

As discussed for Alternatives A and B, increased disposal well capacity could be added without additional disturbance by converting under-performing production wells to water disposal wells, although it is not possible to predict the actual number of production wells that could be converted to disposal wells. Capacity of commercial evaporation ponds and additional Class I well injection capacity also would affect the number of Class II disposal wells that would be needed. Evaporation ponds could provide excess disposal capacity as well***, but the current estimated evaporative disposal capacity of 1,371 acre-feet would not substantially contribute to disposal capacity***.

Induced Seismicity

As discussed for Alternatives A and B, a detailed discussion regarding the hazard of felt or damaging induced seismicity associated with oil and gas activity is provided in Section 4.3, Geologic Hazards.

Impacts to Groundwater from Soil Compaction

Groundwater quantity impacts may result from construction of road networks, pads, pipelines, and other Project-related activity that would reduce infiltration due to compaction of soil. The total amount of new disturbance under Alternative C would be 3.5 percent of the CCPA, and disturbance would be directly related to compaction and reduction in infiltration; therefore, the impact of soil disturbance and compaction would be 3.5 percent of the CCPA.

Impacts to Public Water Supply

As shown on **Figure 3.16-7**, there are several public water supplies in the CCPA. The largest public water supply is for the Town of Rolling Hills, which has a wellhead protection program in force that would restrict the siting of potential contamination sources.

4.16.3.3 Mitigation and Mitigation Effectiveness

Mitigation measures WR-1 ***and*** WR-2 as discussed under Alternative B also would apply to Alternative C, and the effectiveness for these mitigations also would be the same as discussed under Alternative B.

4.16.3.4 Residual Impacts

Residual impacts are defined as unavoidable adverse impacts to a resource that remain assuming implementation of proposed mitigation. Although implementation of BLM and USFS water avoidance, minimization, and mitigation as well as additional mitigation measures would minimize impacts to water resources during construction, impacts to water quality from erosion and sedimentation would still be expected until completion of successful reclamation in these areas. Risk of leaks or spills of hazardous materials from oil and gas production and processing facilities would be minimized, but would still remain during transport of produced water or petroleum product by truck or pipeline.

As with Alternative B, there may be residual impacts with respect to groundwater drawdown because actual water levels may not return to pre-existing conditions after 20 or more years of no pumping. However, recycling of some portion of the hydraulic fracturing water would lessen overall demand for water, and residual effects due to drawdown would be less than Alternative B.

Impacts to the groundwater resource would be negligible; therefore, there would be no residual impacts due to depletion of the resource. Additionally, no mitigation is proposed for potential impacts associated with increases in wastewater disposal capacity; therefore, these impacts would constitute residual impacts.

Compensatory mitigation for residual impacts to ground and surface water is not warranted because state and federal regulations provide the regulatory framework to address contamination of these waters, and the residual impacts would not inhibit the ability to achieve compliance with laws, policies, or land use objectives of other government agencies.

4.16.4 Relationship between Local Short-term Uses of the Human Environment and Maintenance and Enhancement of Long-term Productivity

The relationship between local short-term uses of the human environment and maintenance and enhancement of long-term productivity is the disclosure regarding whether the short-term use of a resource associated with a project affects the long-term sustainability of that resource. Increases in erosion and decreases in streamside bank vegetation during construction potentially could affect channel stability beyond the construction phase of the Project. If reclamation is effectively implemented, this would not affect the long-term productivity of the streams.

The short-term use of groundwater would facilitate the recovery of oil and gas resources. The withdrawal of groundwater for the Project would not prevent use of the aquifers, and drawdown may result in minor impairment and loss of productivity. Recharge would occur, but in the long term.

4.16.5 Irreversible/Irretrievable Commitment of Resources

Irreversible/irretrievable impacts are subsets of unavoidable adverse/residual impacts. Irreversible impacts are those that cannot ever be restored and would be lost forever. Irretrievable impacts are those for which the resource value would be irretrievably lost until restoration of that resource takes place. The application of environmental stabilization and reclamation measures would mitigate long-term effects from surface disturbance on water quality over time. Temporary reductions in water quality from erosion and sedimentation would be irretrievable, because the effect to water quality would move downstream. Impacts to water quality would be retrievable as mitigation would be applied, which would reduce and eventually elimiate the effect of accelerated erosion and sedimentation. Accidental releases of hazardous materials are difficult to remediate, and could cause an irretrievable effect to water resources.

The withdrawal of groundwater would be both an irretrievable and an irreversible commitment of resources. The withdrawal would be irretrievable because the groundwater is a finite resource and not replaceable in the immediate future. The impact of withdrawal would be irreversible because the rate of aquifer recharge is unknown.

4.17 Wetland and Riparian Areas

The analysis area for direct and indirect impacts to wetlands and riparian areas is the CCPA.

The methodology for analysis of impacts to wetlands/riparian communities included:

- Wetland and riparian communities were identified within the analysis area as described by LANDFIRE in Section 3.17, Wetland and Riparian Areas (LANDFIRE 2014).
- The total LANDFIRE-designated wetlands and total NWI-designated wetlands both equal approximately 0.7 percent of the total vegetation communities within the CCPA. Therefore, to be consistent with the analysis of impacts for other vegetative communities (Section 4.14), only LANDFIRE-designated wetlands were carried forward for analysis.
- Due to the programmatic nature of this Project, exact locations of impacts have not been defined (i.e., no site-specific disturbance could be determined). Therefore, proportional disturbance impacts to wetland and riparian resources were estimated by multiplying the percent of wetland/riparian area present in the CCPA by the disturbance for each alternative/parameter being analyzed.

Wetlands and riparian areas are managed according to the management goals and objectives from the BLM ROD for the CFO RMP (BLM 2007b) and the USFS TBNG LRMP (USFS 2001). Wetlands and riparian resources are afforded more protections than other vegetation communities in that except as provided under Section 404(b)(1) of the CWA, no discharge of dredged or fill material shall be permitted that will cause or contribute to significant degradation of the waters of the United States. If an alternative does not exist that avoids jurisdictional wetlands, these wetlands must be mitigated for under compensatory mitigation guidelines of Section 404(b)(1) of the CWA.

Assumptions for the analysis of impacts to wetland and riparian areas include:

- LANDFIRE data are the most accurate information available concerning wetland and riparian resources at the scale of the Project.
- Similar to the analysis for other vegetation communities (Section 4.14), wetland and riparian community impacts were assumed to be proportional to the amount of surface disturbance (i.e., increased surface disturbance would result in a corresponding increase in impacts).
- Erosion from disturbed areas would be minimal once vegetation or other surface stabilization has been re-established.
- Noxious weeds and invasive plant species are present within the CCPA.

4.17.1 Impacts to Wetland and Riparian Areas from Alternative A – No Action

Under Alternative A, new development would continue within the CCPA as disclosed under previous NEPA (Section 2.3.2). An estimated 10,253 acres of disturbance would result from new development under Alternative A (**Table 2.3-1**).

Table 4.17-1 displays estimated new disturbance that could occur to wetland and riparian areas based on impacts per linear component (roads, pipelines, and electrical lines) for Alternative A and total impact including linear and all other development. Approximately 9,108 acres (0.7 percent) of the CCPA has been identified as wetland and riparian areas (Section 3.17). The wetland and riparian areas within the CCPA are displayed in **Figure 3.14-1**.

Table 4.17-1 Estimated Wetland and Riparian Disturbance Under Alternative A

Vegetation Cover Type	Estimated Impacted per Construction Phase (acres)[1]	
	Linear Facilities[2]	Total
Wetlands/riparian	33	67

[1] Totals among tables may vary due to rounding.

[2] Includes roads, pipelines, and electrical lines.

Of the 9,108 acres of wetland and riparian areas within the CCPA, an estimated 67 acres could be disturbed by new development under Alternative A. Linear facilities would cause an estimated 53 percent of the disturbance to wetlands and riparian areas. Linear components would be more likely to impact wetland/riparian areas where pipelines and roads would cross creeks or other waterbodies. Cuts-and-fills at streams associated with road construction or other Project features would affect the extent and cross-sectional geometry of drainages, affecting both soil and subsurface hydrology within wetlands and riparian areas. Approximately 7,676 acres (79 percent) of wetland and riparian areas in the CCPA are located on private lands with approximately 874 acres (9 percent) on state-administered lands, 486 acres (5 percent) on USFS-administered lands, and 97 acres (1 percent) on BLM-administered lands. The remaining wetlands, 583 acres (6 percent), are classified as open water within GIS ownership analysis. Class 1 and 2 waters are subject to the WDEQ water quality standards that apply to No Surface Occupancy within 500 feet and Controlled Surface Use from 500 feet to 0.25 mile of these waters. The Controlled Surface Use stipulation requires the use of best available technology and/or BMPs to minimize impacts (BLM 2007b). Impacts to jurisdictional wetlands on all lands, regardless of ownership, would be subject to the CWA and consultation with the USACE or USEPA. As directed under Section 404(1)(b) of the CWA, practicable alternatives to avoid wetland areas must first be pursued, and if removal or fill of jurisdictional wetlands would occur, mitigation for these impacts would be the responsibility of the applicant. For this reason, it would be likely that jurisdictional wetlands would be avoided; therefore, direct removal of wetland vegetation would not be expected under Alternative A.

Other impacts from development activities besides the permanent conversion of wetland/riparian areas could result from trampling/crushing of hydrophytic vegetation by equipment, erosion and sedimentation, hazardous spills from vehicles and equipment, noxious weeds and invasive plant species, and disturbance of soil and subsurface hydrology. Erosion and sedimentation on upland areas would have the potential to impact nearby wetland and riparian vegetation, affect wildlife habitat and water quality, and would have effects on downstream vegetation.

As with general vegetation, surface disturbing activities and vehicular travel on unpaved roads typically would produce fugitive dust that could settle on wetland and riparian vegetation. Fugitive dust that settles on vegetation can affect photosynthesis, respiration, transpiration, water use efficiency, and allow the penetration of phytotoxic pollutants. Factors that would determine the degree and extent of effects from fugitive dust emissions include wind speed, precipitation events, and the application and effectiveness of dust suppression techniques. The USFS has adopted guidelines that require energy developers to partner with the USFS as well as state and local agencies to create dust control plans for unpaved roads within the TBNG (USFS 2001).

Extensive networks of roads and utility corridors could provide passageways for invasion of noxious weeds and invasive plant species to become established in wetlands and riparian communities. Also, any changes to the physical and chemical characteristics of wetland and riparian areas could favor the introduction of non-native plant species. Noxious weeds and invasive plant species would compete with native wetland and riparian vegetation, leading to the degradation of these communities. The proliferation of roads within the CCPA also would increase access to wetlands, which would increase the chance of collection and crushing/trampling of sensitive wetland and riparian vegetation.

The extent of impacts to these resources would depend on presence of water at the time of construction, channel crossing methods, and erosion control measures.

4.17.2 Impacts to Wetland and Riparian Areas from Alternative B – Proposed Action

Under Alternative B, approximately 5,000 new oil and gas wells would be drilled on 1,500 multi-well pads over a period of 10 years (500 new wells per year) with the ability to request exceptions to timing limitation stipulations. Additional surface disturbance would result from the construction of other service well pads, access roads, pipelines, electrical power lines, and ancillary facilities (**Table 2.4-1**).

4.17.2.1 Impacts to Wetlands and Riparian Resources

The total estimated surface disturbance from Alternative B would be approximately 52,667 acres or 3.5 percent of the CCPA. **Table 4.17-2** displays estimated new disturbance to wetland and riparian areas based on impacts per linear component for Alternative B and total impact including linear and all other development.

Table 4.17-2 Estimated Wetland and Riparian Disturbance Under Alternative B

Vegetation Cover Type	Estimated Impacted per Construction Phase (acres)[1]	
	Linear Facilities[2]	Total
Wetlands/riparian	184	345

[1] Totals among tables may vary due to rounding.

[2] Includes roads, pipelines, and electrical lines.

Of the 9,108 acres of wetland and riparian areas within the CCPA, an estimated 345 acres could be disturbed under Alternative B. Linear facility development would impact approximately 184 acres of wetland/riparian areas, which would account for 57 percent of the total disturbance to these habitats. The types of impacts to wetland and riparian resources under Alternative B would be the same as discussed under Alternative A (Section 4.17.1).

Impacts to surface water under Alternative B could have indirect impacts on wetland and riparian areas. Assuming an even distribution of the additional disturbance under Alternative B, disturbance to watersheds would increase by approximately 2.5 percent across the CCPA and would range from less than 0.1 percent to approximately 3.7 percent per watershed analyzed within the CCPA (Section 4.16, Water Resources). Potential impacts to surface water resources would include the reduction of available surface water quantities; the reduction of water quality from sedimentation or spills of fuel, lubricants, drilling fluids, or water containing elevated levels of salinity or other constituents; and deterioration of existing channel network conditions due to accelerated runoff and drainage from well pads, roads, or pipelines. The BLM and USFS would continue to manage these areas toward proper functioning condition. As under Alternative A, water would be needed for use during well development, production, road compaction, and dust abatement. Water would be obtained from existing permitted surface and groundwater sources, as well as proposed new groundwater supply wells. WSEO procedures and agency permit requirements would limit the consumptive use of surface water to current (existing) or approved levels, and no new surface water sources would be used. Therefore, wetlands or riparian areas likely would not be impacted from the quantity of surface water used, but could be impacted by effects to surface water quality.

Groundwater withdrawal likely would not impact seep and spring areas or associated wetland habitat within the CCPA because seep and spring areas are above the bedrock aquifers.

The BLM Casper Office RMP (BLM 2007b) and the TBNG LRMP (USFS 2001) have several standards, guidelines, objectives, and management decisions that would reduce impacts to wetland and riparian communities. Additionally, the operator group has committed to design features that would mitigate impacts to wetlands under Alternative B as further discussed in Section 2.4 and Chapter 6.0.

4.17.2.2 Mitigation and Mitigation Effectiveness

No additional mitigation measures have been identified for wetland and riparian areas under Alternative B.

4.17.2.3 Residual Impacts

Residual impacts are defined as unavoidable adverse impacts to a resource that remain assuming implementation of proposed mitigation. Residual impacts to wetland and riparian areas resulting from the Alternative B would include the following:

- Loss/conversion of wetland and riparian areas within the CCPA.
- Compromised health of wetland/riparian vegetation due to the settling of fugitive dust on plants.
- Continued potential threat of invasion and spread of noxious weed and invasive plant species as adherence to the BLM IM No. WY-2012-032 (BLM 2012i) would not completely eliminate such threats; this would remain as a potential impact throughout construction, production, decommissioning, and reclamation.

4.17.3 Impacts to Wetland and Riparian Areas from Alternative C

Under Alternative C, 5,000 new oil and gas wells would be drilled from 938 new multi-well pads over a 10-year period. This would be approximately 37 percent fewer pads than under Alternative B. This would proportionately reduce the surface impact from well pads (including other service well pads), access roads, pipelines, electrical power lines, and ancillary facilities. The total estimated construction surface disturbance from Alternative C would be approximately 37,267 acres, or approximately 2.5 percent of the CCPA (**Table 2.5-1**). This alternative would not include changes to any of the proposed construction/production facilities discussed under Alternative B.

Certain areas in the CCPA would contain timing stipulations that would restrict or preclude development; however, timing stipulations would not stop disturbance in other portions of the CCPA.

4.17.3.1 Impacts to Wetland and Riparian Areas

The impacts to wetland and riparian areas would be similar to Alternative B except less acreage would be disturbed from activities under Alternative C, resulting in less impact. **Table 4.17-3** displays estimated new disturbance to wetland and riparian areas based on impacts from linear component for Alternative C as well as the total impact including linear and all other development.

Table 4.17-3 Estimated Wetland and Riparian Disturbance Under Alternative C

	Estimated Impacted per Construction Phase (acres)[1]	
Vegetation Cover Type	**Linear Facilities[2]**	**Total**
Wetlands/riparian	139	244

[1] Totals among tables may vary due to rounding.

[2] Includes roads, pipelines, and electrical lines.

Of the 9,108 acres of wetland and riparian areas within the CCPA, an estimated 244 acres could be disturbed under Alternative C, which would be approximately 23 acres less than under Alternative B. The types of impacts to wetland and riparian areas under Alternative C would be the same as discussed for

Alternatives A and B. OG-committed design features under Alternative C would be the same as under Alternative B.

4.17.3.2 Mitigation and Mitigation Effectiveness

As under Alternative B, no additional mitigation measures have been identified for wetland and riparian areas under Alternative C.

4.17.3.3 Residual Impacts

Residual impacts are defined as unavoidable adverse impacts to a resource that remain assuming implementation of proposed mitigation. Residual impacts to wetland and riparian areas resulting from Alternative C would be the same as under Alternative B. Under Alternative B, the BLM could recommend reclamation on private surface, while under Alternative C, reclamation would occur as required by the BLM on private surface underlain by federal mineral estate as well as on federal surface. However, wetlands would need to be mitigated for under either alternative, so residual impacts would be the same.

4.17.4 Relationship between Local Short-term Uses of the Human Environment and Maintenance and Enhancement of Long-term Productivity

The relationship between local short-term uses of the human environment and maintenance and enhancement of long-term productivity is the disclosure regarding whether the short-term use of resources associated with a project affects the long-term sustainability of that resource. Project construction could impact an estimated 62 acres of wetland/riparian communities in the CCPA under Alternative A, 320 acres under Alternative B, and 226 acres under Alternative C. Wetlands and riparian habitats would be diminished due to local short-term and long-term uses until reclaimed areas in both upland and wetland areas return to pre-disturbed conditions. Non-successful upland reclamation could have impacts on wetland and riparian areas due to erosion and sedimentation.

Wetlands can take upwards of 100 years to recover the normal nutrient cycling that existed under pre-disturbance conditions (Moreno-Mateos et al. 2012; Schmitz 2012). For areas with low reclamation potential (i.e., slow revegetation rates and/or low revegetation success) such as wetlands, the Project could result in impacts that would extend beyond the life of the Project. This could affect long-term wetland and riparian habitat value (including special status plant habitat) and human uses of these areas.

The short-term use of wetland or riparian habitat may affect long-term productivity of the areas should there be alteration or loss of wetland/riparian communities, modification of these habitats, direct mortality of wetland/riparian vegetation, or increased disturbance to these sensitive communities from human activity. Decreases of wetland and riparian areas could impact livestock, wildlife grazing, and recreation activities in and around the areas of disturbance.

Water withdrawals could affect wetlands and riparian communities on a short-term basis, but these impacts would not affect the long-term productivity of these resources.

4.17.5 Irreversible/Irretrievable Commitment of Resources

Irreversible/irretrievable impacts are subsets of unavoidable adverse/residual impacts. Irreversible impacts are those that cannot ever be restored; they would be lost forever. Irretrievable impacts are those for which the resource value would be irretrievably lost until restoration of that resource takes place. Wetlands have low reclamation potential; therefore, the inability to revegetate with suitable native species and restore wetlands and riparian areas to pre-disturbance condition would be considered irreversible. Wetland and riparian areas would take decades to reestablish and some may never return to their pre-disturbance condition. Additionally, the introduction of noxious weeds and invasive plant species to wetlands and riparian areas could permanently alter the community, which would be an irreversible commitment of resources.

Construction and operation of any of the Project alternatives would result in the irretrievable commitment of wetlands and riparian areas during the life of the Project until decommissioning and the completion of reclamation. Unlike other vegetative communities, jurisdictional wetlands are afforded extra regulatory protection, and the removal or impacts to such wetland areas on private lands would need to be mitigated for by the applicant.

4.18 Wildlife and Aquatic Biological Resources

The analysis areas for direct and indirect impacts to wildlife species (including terrestrial wildlife, migratory birds, special status wildlife species, aquatic biological resources, and special status aquatic species) were chosen to represent the combination of geographic areas containing contiguous habitat that may be impacted by the Project as well as the management regimes for this habitat. The analysis area for direct and indirect impacts to most wildlife species includes the HUC-12 units that intersect the CCPA, with some exceptions as defined below:

- Big Game: The WGFD herd units (based on pronghorn herd units) that intersect the CCPA.
- Preble's Meadow Jumping Mouse: The WYNDD-modeled habitat within the CCPA buffered by 1 mile.
- Greater Sage-grouse: The CCPA buffered by 4 miles. In addition, impacts to leks and breeding habitats were analyzed using the DDCT assessment areas developed for the Project that includes a 4-mile buffer around all occupied leks within 4 miles of the CCPA and clipped to BLM/USFS PHMAs and WGFD Core Areas.
- Aquatic Biological Resources: Perennial streams, ponds, and lakes/reservoirs within the HUC-12 watersheds that overlap the CCPA.
- Special Status Aquatic Species: Perennial streams, ponds, and lakes/reservoirs within the HUC-12 watersheds that overlap the CCPA as well as the Platte River in Nebraska for the purpose of analyzing water withdrawals from the North Platte subbasin and subsequent potential water depletions on the Platte River.

Potential direct and indirect impacts to wildlife species include those that would eliminate, reduce, compromise, or fragment associated habitat, avoidance of areas by wildlife due to noise and human activity, and activity that causes stress, injury, or death to wildlife.

Exact locations of surface disturbance and resulting impacts have not been defined at this time. To estimate impacts from surface disturbance, the fraction of the CCPA containing each species habitat or range was determined by dividing the acreage of each habitat or range by the total acreage within the CCPA. This fraction was then multiplied by the total acreage of surface disturbance for each alternative. Thus, all acreages reported represent a proportional estimate that is used to assess impacts and compare the extent of impacts across all alternatives. The methodology for analysis of impacts to terrestrial wildlife species included the following key steps:

- Identify and estimate the acres of direct impact from each alternative to wildlife species and habitat located within the CCPA using GIS data (LANDFIRE data, designated habitat [i.e., greater sage-grouse habitat areas], and species occurrence data) and published information or internet sites.
- Identify and estimate the acres of direct impact from each alternative to high-value big game ranges that occur within the CCPA using WGFD data.
- Acreages of direct impacts to wildlife habitats (including migratory birds) are presented within the context of all available suitable habitats in the CCPA or appropriate analysis area.
- Specific estimates of indirect impacts from project components are not possible due to the programmatic nature of this EIS. Indirect impacts to wildlife species and habitats are qualitatively described.
- Estimate the ratio of Project features per square mile for use as a metric to represent the degree of wildlife habitat fragmentation resulting from each alternative. Co-located linear features

(e.g., roads, electric distribution lines, pipelines) were not included because the installation of a new feature along an existing feature would not add-to existing habitat fragmentation.

- Estimate the average number of well pads to be placed within greater sage-grouse 2-mile lek buffers as a measure of the degree of impact.
- Calculate existing acres and percent of existing disturbance within greater sage-grouse potential DDCT assessment areas.

The methodology for analysis of impacts to aquatic habitat and species included the following key steps:

- Identify the number of perennial waterbodies with gamefish and special status aquatic species that could be disturbed under each alternative.
- Identify the areas where habitat alteration would occur including loss of streamside vegetation (i.e., riparian vegetation removal or loss), water quality changes (e.g., sedimentation and potential contaminant input to streams such as herbicides and fuels), and flow reductions on aquatic habitat and fish species and discuss qualitatively.

Wildlife resources are managed according to the management goals and objectives contained in the BLM ROD and Approved Casper RMP (BLM 2007b), the USFS TBNG (USFS 2001), BLM Manual 6840 for Special Status Species Management, Record of Decision, and the Approved Resource Management Plan Amendment for the Wyoming Greater Sage-grouse (Attachment 4 to BLM 2015b), the Land Management Plan Amendment for TBNG (Attachment B to USFS 2015b), the State of Wyoming EO ***2019-3*** (Greater Sage grouse Core Area Protection) that replaced EO 2011-5, and Wyoming Statutes 23-1-101, 23-1-103, 23-1-302, 23-3-108, 23-3-102, and 23-3-103.

Assumptions used in the analysis of impacts to wildlife and aquatic species include:

- Wildlife and aquatic species were considered as having potential to occur within the analysis area if:
  - Occurrence has been documented for the species;
  - The species predicted distribution currently exists within the analysis area; and
  - Suitable habitat is present.
- Surface disturbance and habitat fragmentation adversely impact wildlife species.
- Disturbance during sensitive periods (e.g., breeding seasons) and within high-value habitats adversely impacts wildlife species.
- Project surface disturbance could occur anywhere within the CCPA aside from areas designated as NSO.
- For analysis of impacts to aquatic habitats and species, the National Hydrography Dataset was used to define the occurrence and location of perennial waterbodies (i.e., streams, reservoirs/lakes/ponds, and springs). Surface disturbance activities within approximately 0.25 mile and upgradient of perennial streams could result in sediment or contaminant input to the streams.
- Water withdrawals from water sources connected to surface flows could adversely affect game fish and special status fish species that occur in perennial streams.

4.18.1 Impacts to Terrestrial Wildlife

4.18.1.1 Impacts to Terrestrial Wildlife from Alternative A – No Action

Under Alternative A, new development would continue within the CCPA as disclosed under previous NEPA documents (Section 2.3.2). Approximately 10,253 acres of new disturbance would occur over a 15-year period from construction of 386 new well pads (including other service well pads), 386 miles of roads, 362 miles of gas-gathering pipelines (181 miles co-located with roads), and 362 miles of electrical distribution lines (181 miles co-located with roads), and ancillary facilities (**Table 2.3-3**).

Types of Impacts Common to All Species

Construction-related impacts primarily would include habitat loss, conversion, degradation, and fragmentation as well as potential wildlife mortalities resulting from vehicle and facility collisions and crushing of nests/burrows. Construction impacts would account for all disturbances during construction including vegetation treatment and removal, increased human activity, and increased noise levels.

Impacts during production would last at least for the life of the Project. During decommissioning, a portion of habitat disturbed during construction and production would be reclaimed as required by federal and state regulations. The vegetation composition to be reclaimed on private land would be dependent on landowner agreements. In areas where suitable wildlife habitat is not reclaimed on non-federal lands, impacts would be indeterminate, potentially continuing beyond the life of the Project. Examples of such impacts include habitat loss in areas that are not reclaimed following disturbance or are not reclaimed to native conditions, establishment of noxious weeds and invasive plant species, increased risk of wildland fire, wildlife mortalities during production activities, increased predation of local prey, increased noise and human activity in and around the disturbance areas, and increased habitat fragmentation.

Direct impacts to wildlife would include habitat loss or conversion toward an unsuitable state and mortalities resulting from vehicle and facility collisions and crushing of nests/burrows. Individuals and habitats could be impacted in the event of spills or releases of harmful chemicals during construction and production. Prevention and treatment of spills and releases of harmful chemicals are discussed in detail in Section 4.4.1, Hazardous Materials and Solid Waste.

Indirect impacts would be further removed by time and/or space and include wildlife avoidance (displacement) of otherwise suitable habitat in and around the disturbance areas during construction and production, spread of noxious weeds and invasive plant species, and increase in predatory animals (e.g., coyotes and ravens). The most common wildlife responses to noise and human activity include avoidance or accommodation. Avoidance would result in displacement and stress of individuals from an area larger than the actual disturbance area. Displacement of wildlife causes increased competition, lower survival rates, lower reproductive success, lower recruitment, and lower carrying capacity that ultimately would result in population-level impacts (WGFD 2010a). Following avoidance of human activity and noise-producing areas during construction, certain species could acclimate to the activity and begin to return to areas that formerly were avoided. ***However, as observed for several avian species, chronic noise may have long-term impacts on overall species fitness (Kleist et al. 2018). Artificial light at night introduced to areas currently without lighting could adversely impact wildlife behaviors including mating, foraging, sleeping, and migratory behaviors (International Dark-sky Association [IDA] 2008). These behaviors are determined by the length of nighttime lighting. Crepuscular and nocturnal species may lose the nighttime ecosystem they depend on for food and protection against predators.*** Occurrence of noxious weeds and invasive plant species could cause a shift in vegetation communities, potentially making them less suitable for some wildlife species, and could change frequency, intensity, and patterns of local wildlife. These impacts associated with noxious weeds and invasive plant species could lead to indirect alteration and loss of habitats otherwise suitable for wildlife.

Long-term habitat loss, degradation, and fragmentation would occur due to the presence of Project facilities on the landscape. Permanent habitat loss could occur if reclamation does not result in pre-disturbance conditions. Species that require large intact landscapes would be vulnerable to changes in local habitat conditions as well as to the compounding of multiple threats across the landscape. Other species may not have large home ranges but are most abundant in areas where large habitat tracts remain intact.

Herbaceous plant-dominated habitats would require 2 to 5 years to establish adequate ground cover to provide forage for wildlife species. Woody-dominated shrubland habitats would require at least 10 to 100 years for the shrubs to recolonize the area and for re-establishment of mature woodlands (Avirmed et al. 2015; ***Hild 2009;*** WGFD 2017d). In areas with soil reclamation constraints, low regional annual precipitation rates, and the invasion and spread of noxious weeds and invasive plant species, successful reestablishment of native vegetation may require additional measures, and require more time for wildlife habitat to be restored.

Habitat fragmentation is an ecological principle that relates to the modification of habitat homogeneity, connectivity, and effectiveness at the landscape level. Habitat fragmentation implies a loss of habitat effectiveness, reduced patch size, and an increasing distance between patches of similar habitat, but also an increase of new habitat (Andren 1994). Impacts would be more pronounced in high quality habitats, such as the Rochelle Hills IBA, reproduction habitats, or crucial winter range (WGFD 2010a). Habitat fragmentation would be minimized in the TBNG through adherence to USFS Standards and Guidelines that require the minimization and proper siting of road disturbance, facility size minimization, and road surface reclamation after the end of use (USFS 2001). However, habitat fragmentation from oil and gas construction and operation still would result in the direct loss of potential habitat from the development of roads, well pads, pipelines, and electrical distribution lines. Other fragmentation effects such as increased noise, elevated human presence, dispersal of noxious weeds and invasive plant species, and dust deposition from unpaved road traffic would extend beyond the boundaries of the wellfield facilities. These effects would result in overall changes in habitat quality, habitat loss, increased animal displacement and stress, reductions in local wildlife populations, and changes in species composition.

The density of well pads and associated facilities provides a general metric for the intensity of well field development and associated wildlife disturbance from stress and avoidance (WGFD 2010a). The greater the density of development, the less effective habitat function would become until the habitat is no longer suitable. Construction and upgrades to the road network would impact wildlife species to varying degrees depending on the geographic location, type of habitat disturbed, and wildlife species present. Impacts to wildlife typically associated with roads include: increased mortality from road construction; increased mortality from collisions with vehicles; modification of wildlife behavior (i.e., avoidance behavior leading to displacement and stress); alteration of the physical environment; alteration of the chemical environment; spread of invasive and exotic species; increased availability of travel corridors for terrestrial mammalian predators (Gelbard and Belnap 2003; SAIC 2001); and increased alteration and use of habitats by humans (Trombulak and Frissell 2000). All species and ecosystems would not be equally impacted by roads, but overall the presence of roads highly correlates with changes in species composition, population sizes, and hydrologic and geomorphic processes that shape aquatic and riparian habitats (Trombulak and Frissell 2000).

Fragmentation can be considered at a range-wide scale, a population scale, and a home-range scale. Fragmentation at the range-wide scale could affect dispersal between populations, at the population scale it could alter local population dynamics, and at the home range scale it could affect individual survival and reproduction (Franklin et al. 2002). At the home-range scale, the consequences of habitat loss, alteration, degradation, and fragmentation include increased predation rates and decreased reproductive success (Great Basin Bird Observatory 2010). Habitat fragmentation due to development under Alternative A would be greatest in areas with no existing roads and where infrastructure for new powerlines and pipelines would be constructed.

Wildlife Habitats

Disturbances and impacts to vegetation communities that represent the associated terrestrial wildlife habitats for Alternative A are provided on **Table 4.14-1** in Section 4.14.1. The majority of impacts to associated wildlife habitat under this alternative would occur within grassland and sagebrush shrubland habitats, which constitute 66 and 22 percent of habitat within the CCPA, respectively.

WGFD Strategic Habitats

Crucial Habitat and Enhancement Areas are supportive of important life stages needed for maintaining game species, sensitive native non-game species, unique species assemblages and ecologically important species or communities. Therefore, impacts to wildlife as a result of any development would be magnified in these habitats. In addition, impacts in Crucial Habitat and Enhancement areas likely would impede WGFD's ability to meet their management goals for these areas by degrading wildlife habitat and prohibiting wildlife use of these areas. See Section 3.18.1.1 for a description of these areas. Crucial Habitat and Enhancement Areas overlapping the CCPA are presented in **Figure 3.18-1**. Direct impacts as a result of surface disturbance to these areas under Alternative A are listed in **Table 4.18-1**.

Table 4.18-1 Impacts to WGFD Designated Strategic Habitats as a Result of Alternative A

WGFD Strategic Habitat	Total Acres in CCPA	Acres Impacted[1]
Thunder Basin Crucial Habitat and Enhancement Area	56,012	***393***
Sand Hills Enhancement Area	10,897	7***7***

[1] Estimated values calculated as approximately 0.7 percent of the Strategic Habitats within the CCPA.

Source: WGFD 2015c.

Big Game

The types of impacts to big game species (pronghorn, mule deer, elk, and white-tailed deer) under Alternative A would be similar to those discussed under Impacts Common to All Species and include the loss of potential forage from surface disturbance, displacement and stress on individuals, direct mortality from vehicle collisions, and the increase of habitat fragmentation resulting from surface disturbance and the construction of well pads and associated facilities, new roads, pipelines, fences, and electrical distribution lines. Impacts to big game species resulting from new fencing would be minimized through implementation of the BLM Fencing Handbook 1741-4 (BLM 1989) and USFS Guidelines (USFS 2001), which require adherence to specific measures designed to allow big game access and movement through habitats in the CCPA and to reduce risk of injury or death from collisions and entanglement with hazardous fence types.

Table 4.18-2 presents impacts to wildlife species from development under Alternative A, including big game, from habitat fragmentation caused by Project components. Habitat fragmentation affects different wildlife species to varying degrees, but it is assumed for this analysis that adverse impacts to wildlife would increase with increasing habitat fragmentation.

The primary potential indirect impact to big game would be avoidance (displacement) of otherwise suitable habitat in the vicinity of the disturbance areas due to increased noise and human activity. Displacement of big game species as a result of direct habitat loss and indirect reduction in habitat quality has been widely documented (Irwin and Peek 1983; Lyon 1983, 1979; Rost and Bailey 1979***; Sawyer et al. 2009***). Studies have demonstrated that big game species tend to move away from areas of human activity and roads, thereby reducing habitat utilization near disturbance areas (Cole et al. 1997;

Sawyer et al. 2006***, 2017***). Persistent road-induced disturbance may lead to permanent shifts in habitat use by elk away from roads (Rowland et al. 2000). Both elk and deer have been observed avoiding active roads at distances varying between 200 and 1,000 meters (Gaines et al. 2003; Trombulak and Frissell 2000). Impacts from roads and associated motorized disturbance have been shown to affect elk movements and behavior to a greater extent than deer (Rowland et al. 2000; Wisdom et al. 2005). Mule deer and pronghorn appear to be more tolerant of human activity than elk. For mule deer, displacement distances from new roads ranged from 330 feet to 0.6 mile, depending on the presence of vegetative cover (Rost and Bailey 1979). Research in Wyoming indicates that pronghorn appear to avoid intensive development (i.e., 1 well per 0.09 square miles) but did not avoid human activities in less intensive development (i.e., 1 well per 0.19 acre) (Berger et al. 2008).

Table 4.18-2 Impacts to Wildlife from Habitat Fragmentation under Alternative A

	Existing		New Disturbance		Total	
Project Component	**Miles/ Number**	**Density (miles/ number per square mile)**	**Miles/ Number**	**Density (miles/ number per square mile)**	**Miles/ Number**	**Density (miles/ number per square mile)**
Linear Components (miles)						
Roads	1,822	0.78	386	0.16	2,208	0.94
Pipelines (non-co-located)	1,722	0.73	181	0.08	1,903	0.81
Overhead Electrical Distribution Lines (non-co-located)	911	0.39	181	0.08	1,092	0.47
Linear Subtotal	**4,455**	**1.90**	**748**	**0.32**	**5,203**	**2.22**
Other Components (number)						
Pads	1,449	0.62	386	0.16	1,835	0.78
Construction / Production Facilities	32	0.01	26	0.01	58	0.02
Other Subtotal	**1,481**	**0.63**	**412**	**0.18**	**1,893**	**0.81**

Big game species have demonstrated the ability to acclimate to a variety of activities as long as human harassment levels do not increase substantially (Forman et al. 2003). ***However, a recent study from 2017 found that mule deer did not habituate to human disturbance over a 15-year period of energy development.*** In addition to an avoidance response, increased human activity intensifies the potential for wildlife/human interactions ranging from increased collisions and harassment of big game species to illegal harvest or poaching. Big game species also could be injured or killed as the result of illegal poaching attributable to an increase in roads associated with development. Further, according to the WGFD (2010), studies have documented increased physiological stress within big game species exposed to varying degrees of human activity despite the presence of animals on disturbed sites near human activity.

While disturbance is not expected to have a critical effect on individual health or survivorship for most big game species, disturbance occurring during periods of high stress, including parturition and winter survival, and within high value habitats would negatively affect already weakened individuals. Human presence and activity, as well as habitat alteration and loss may displace ungulates from otherwise suitable habitats. Displaced animals would face increased pressure to maintain individual health and fitness if other unaffected habitats are not available and if displacement occurs during periods of high stress. Impacts to winter ranges would include the loss of potential cover and long-term (greater than 25 years) forage consisting primarily of woody/shrubby vegetation such as sagebrush and winterfat.

Indirect impacts would occur most intensely in time and space during construction but would be expected to continue at lower levels of intensity through production for the life of the Project (estimated at 50 years). Based on the density of new well pads of 0.16 pads per square mile (or 0.3 percent of the CCPA), new roads (0.16 mile per square mile; **Table 4.18-2**), and noise-related impacts, big game species would be subject to indirect disturbance in most of the CCPA under Alternative A. However, the extent of indirect impacts would vary geographically across the CCPA and would depend on the exact locations of well pads and roads, with the greatest impacts occurring in areas where roads and/or well pads would be most densely situated, or where development would be located in high value habitat. More abundant species such as pronghorn and mule deer would experience a greater degree of indirect impacts due to a higher probability that these animals would occur in close proximity to disturbance. According to WGFD (2010a), the increase in densities of project components would result in the habitat becoming progressively less effective until most animals would no longer use these areas or would be subjected to increased physiological stress. Areas with greater density or human activity would become a barrier when animals cannot or will not move through it to use otherwise suitable habitat (WGFD 2010a).

Impacts to pronghorn, mule deer, elk, and white-tailed deer seasonal ranges from new surface disturbance under Alternative A are provided on **Table 4.18-3**. No crucial winter range or parturition areas are located in the CCPA that require seasonal timing restrictions. Indirect impacts are described under Big Game.

Table 4.18-3 Impacts to Big Game Ranges within the CCPA for Alternative A

Species	Range Type		
	Yearlong	**Winter/Yearlong**	**Severe Winter Relief**
Pronghorn			
Available range in analysis area (acres)	3,336,981	1,862,614	94,991
Estimated surface disturbance (acres)	7,329	2,781	44
Percent of available range disturbed	0.22	0.15	0.05
Mule Deer			
Available range in analysis area (acres)	3,646,668	1,479,234	0
Estimated surface disturbance (acres)	7,661	2,556	0
Percent of available range disturbed	0.17	0.14	0.00
White-tailed Deer			
Available range in analysis area (acres)	1,522,735	268,371	0
Estimated surface disturbance (acres)	349	13	0
Percent of available range disturbed	<0.01	<0.01	0.00
Elk			
Available range in analysis area (acres)	1,018,926	0	0
Estimated surface disturbance (acres)	269	0	0
Percent of available range disturbed	0.03	0.00	0.00

Source: WGFD 2012c.

Pronghorn

Three seasonal pronghorn ranges mapped by WGFD potentially would be impacted by new surface disturbing activities under Alternative A including yearlong, winter/yearlong, and severe winter relief. Direct impacts would include estimated surface disturbance in the big game analysis area as shown on **Table 4.18-3**. Impacts would be more pronounced within high value pronghorn habitat including severe winter relief and winter/yearlong range; however, less than 0.1 percent of the available 94,991 acres of severe winter relief range and approximately 0.2 percent of the available 1,862,614 acres of winter/yearlong range would be impacted by the Project. Impacts to these ranges would include the loss of potential cover and forage consisting primarily of woody/shrubby vegetation such as sagebrush and winterfat. Loss of available forage (e.g., woody shrubs, such as sagebrush) would result in a long-term (greater than 25 years) impact to wintering pronghorn. Indirect impacts are described under Big Game, above.

Mule Deer

Two seasonal mule deer ranges mapped by WGFD would be impacted by new surface disturbing activities under Alternative A including yearlong and winter/yearlong. Direct impacts would include estimated surface disturbance in the big game analysis area as shown on **Table 4.18-3**. Impacts to winter range would include the loss of potential cover and forage consisting primarily of woody/shrubby vegetation such as sagebrush and winterfat. Loss of available forage (e.g., woody shrubs, such as sagebrush) would result in a long-term (greater than 25 years) impact to wintering mule deer. Indirect impacts are as described previously under Big Game.

White-tailed Deer

White-tailed deer occurrence in the CCPA is limited to 51,297 acres of WGFD-mapped yearlong range and 1,922 acres of WGFD-mapped winter/yearlong range located along the North Platte River near the southern boundary of the CCPA. However, there are 1,522,735 acres of yearlong and 268,371 acres of winter/yearlong range available in the big game analysis area. Direct impacts associated with Alternative A would include estimated surface disturbance in the big game analysis area as shown on **Table 4.18-3**. Impacts to winter range would include the loss of potential winter cover consisting primarily of woody riparian vegetation. Indirect impacts are as described previously under Big Game.

Elk

WGFD has mapped a total of 1,018,926 acres of elk yearlong range in the big game analysis area. Direct impacts associated with Alternative A would include estimated surface disturbance of this elk range as shown on **Table 4.18-3**. Indirect impacts are as described previously under Big Game.

Small Mammals

Effects on small mammals resulting from new construction under Alternative A would be similar to impacts discussed above under Impacts Common to All Species including injury and mortality, disturbance, displacement, and habitat loss. Injury or mortality to small mammals may occur during the construction and production phases of the Project. During the construction phase, the use of heavy equipment and various vehicles could lead to crushing or entrapment of wildlife. Vehicle use and traffic during production also could lead to similar injury or mortality. In addition, small mammals could become entrapped in pits, trenches, or other enclosed areas if left open. Small mammal species and individuals most susceptible to direct injury or mortality would be those not able to avoid disturbance based on their size, age, form of mobility, or life stage. A variety of small mammals occupying all habitats within the CCPA either occur or have the potential to occur in the wildlife analysis area; therefore, Alternative A would result in surface disturbance to approximately 10,253 (0.46 percent) of the available 2,206,155 acres of suitable habitat within the wildlife analysis area.

Small mammals also could be disturbed or displaced by development activities within the CCPA. Wildlife disturbance could be caused by human presence, activity, light, and noise. These effects could alter an individual animal's behavior, resulting in reductions in overall fitness and health, reproductive success, and survivorship. Project activities occurring during metabolically stressful periods (reproduction, winter, drought) could reduce fitness and health of an individual, and if effects occurred with sufficient duration and intensity, these could lead to death. Potentially disruptive Project activities (e.g., habitat removal; long periods of human presence and activity; ***artificial light during normal periods of darkness;*** or sustained noise from construction activities or drilling during an animal's courtship, reproduction, or maturation stages) could reduce reproductive success and fecundity. Human presence and activity in suitable and occupied habitats could cause animals to avoid affected habitats, as wells as other habitats immediately surrounding the disturbance indirectly affected by Project-related activities. The degree to which displacement and avoidance would affect individuals would vary based on the species, time of year, and the availability of other suitable habitat. For example, bat species typically forage for insects over a wide variety of habitats and open water and are potentially more limited by breeding and roosting habitats. Bats are insectivores; therefore, these species would be more susceptible to potential impacts from insecticide use than other small mammals. Small rodents typically are granivorous and at least partially fossorial. These species are less mobile than larger mammal species or bats and are more susceptible to mortality from crushed burrows during vegetation disturbance. Predators typically are more wide-ranging than smaller species due to their foraging behavior. Although these species are restricted during the breeding season by breeding habitat (dens) locations, they also require larger home ranges than other small mammal species to obtain adequate prey. Predators may experience a greater level of both inter- and intra-specific competition in limited habitat.

Displacement effects could have measurable and detrimental effects on locally occurring small mammals if habitats are at maximum carrying capacity. Small mammals could experience short-term and long-term displacement effects. Short-term displacement effects may be realized in the form of flushing an individual from cover or altering an individual's daily hunting or foraging behavior. Long-term displacement effects could occur in instances when suitable and occupied habitats are removed or altered, thereby precluding occupation by mammals. In the case of habitat disturbance, individuals would be expected to find other less affected and available habitats, which could be of marginal quality.

Potential indirect effects to small mammals include habitat alteration and loss and effects associated with habitat fragmentation. Habitat alteration and loss would occur in a variety of vegetation community types and would have the greatest effect on small mammals with relatively small home ranges or limited mobility. For many small mammals, habitat requirements are general or broad. Their occurrence and distribution within the analysis area is in response to the availability and suitability of common habitat conditions. Habitat fragmentation would be minimized in the TBNG based on implementation of USFS Standards and Guidelines requiring the minimization and proper siting of road disturbance, facility size minimization, and road surface reclamation after the end of use (USFS 2001).

As discussed in Sections 3.18.1.6, 3.18.3.5, and 3.18.3.6, a number of bat species are known to occur in the wildlife analysis area. Those considered either BLM, USFS, or WGFD sensitive are discussed in detail in Section 4.18.3. Occurrence information for the location of communal roosts (e.g., hibernacula, nursery colonies, bachelor roosts) is unknown for the wildlife analysis area, but suitable roost trees, rock crevices, and buildings likely exist. However, cave habitat used as hibernacula does not exist within the CCPA (Epstein 2005). Habitat loss, modification, fragmentation, roost disturbance, and pesticide use have been cited as threats to bat populations throughout the U.S. (Buseck and Keinath 2004). The use of herbicides, especially those formulated with organochlorines, also would pose a threat to bats if such compounds are used for noxious weed treatments. Pesticides and herbicides may reduce the abundance of bat prey (insects) or accumulate in prey and then become concentrated in bat tissues upon consumption. However, artificial lighting associated with Project facilities could attract and concentrate insects to unnatural areas where bats could forage. Bioaccumulation of chemicals could lead to reduced reproductive success or mortality (Keinath 2004b). Construction of new roads associated with Alternative A would result in increased access to potential roost sites and subsequently increase recreation and vandalism, which could adversely affect special status bat species. On the TBNG, impacts to bat day roost areas and wintering sites would be minimized by implementation of USFS Guidelines (USFS 2001) that maintain a 0.25-mile no surface use buffer in any areas identified as occupied, and a 0.5-mile no-spray buffer for herbicide treatments around roost sites.

Furthermore, bats are known to rely heavily on riparian and wetland areas for foraging. The Casper RMP prohibits surface disturbance within 500 feet of riparian areas in proximity to Class 1 and 2 waters. Setbacks from waters other than Class 1 and Class 2 would be considered on a case-by-case basis. These restrictions would reduce impacts to these habitats on BLM surface estate split estate; however, vehicle traffic at stream crossings and creation of new stream crossings still would result in impacts to foraging habitat for these species on non-BLM surface. In addition, surface disturbance impacts to riparian habitat on non-BLM surface could still occur. In total, estimated surface disturbance under Alternative A would result in approximately 75 acres or 0.3 percent of the available 21,593 acres of suitable riparian and wetland foraging habitat within the wildlife analysis area and 0.8 percent of the 9,108 acres within the CCPA.

Game Birds

The types of impacts to game birds (i.e., species identified in Section 3.18.1.7) under Alternative A would be the same as those previously discussed under Impacts Common to All Species. Surface disturbing activities associated with the construction of new well pads, roads, and other facilities, as well as vehicle use on local and well pad access roads in the CCPA could result in injury or mortality to upland game birds. Individuals unable to avoid harm, including eggs, nestlings, and tending adults would be at greatest risk for injury and mortality. Birds could be injured or killed by entrapment, physical collision or crushing by construction equipment, and collision with vehicle and truck traffic on local and public roads. New infrastructure could provide raptors with new and widespread perching sites. Grouse have been shown to abandon leks if raptors repeatedly perch nearby (Ellis 1985). Additionally, increased human activity in the analysis area could lead to an increase in the frequency of poaching and harassment and may increase hunter access and success, although this impact would be minimal due to the relatively small percentage of public lands in the CCPA and the closure of the sage-grouse hunt area that overlaps with the CCPA. In total, estimated surface disturbance under Alternative A would result in approximately 10,253 acres or 0.46 percent of the available 2,206,155 acres of suitable habitat within the wildlife analysis area.

Increased human presence and activity that occurs during the nesting period has the potential to cause a decrease in nesting attempts, increase frequency of nest abandonment, and ultimately a reduction in reproductive success for upland game birds. However, current management restricts or prohibits surface occupancy within 0.25 mile of sharp-tailed grouse strutting/dancing ground and does not allow surface use within 1.25 miles of the 0.25-mile protection zone between March 1 and June 15. Exceptions may be granted to these restrictions.

4.18.1.2 Impacts to Terrestrial Wildlife from Alternative B – Proposed Action

Under Alternative B, approximately 5,000 new oil and gas wells would be drilled on 1,500 multi-well pads over a period of 10 years (500 new wells per year) with the ability to request exceptions to certain timing limitation stipulations. Additional surface disturbance would result from the construction of other service well pads, access roads, pipelines, electrical distribution lines, and ancillary facilities (**Table 2.4-1**). The types of impacts to wildlife species and habitat under Alternative B would be the same as under Alternative A, but to a greater extent. For example, there would be more surface disturbance to wildlife habitats, more habitat fragmentation, greater potential for direct mortalities of individual animals, and greater potential for indirect impacts over those described under Alternative A. These impacts would include wildlife avoidance from human activity and noise, increased potential for spread of noxious weeds and invasive plant species, and increased predation on prey populations. The majority of impacts would occur during the first 10 years while construction and development activities would be occurring and, to a lesser extent, after the production phase during decommissioning.

Under Alternative B, ***relief from timing limit stipulations*** would be requested in the vicinity of ***non-eagle raptor nests according to one of the land use plan amendment options described in Section 2.4.9. Relief from timing stipulations generally would not be requested on lands administered by the USFS. Where exceptions would not be granted, drilling and completion of wells would be scheduled to occur outside of the stipulation windows.***

Under Alternative B exceptions would be requested for greater sage-grouse leks outside PHMAs ***according to the sage-grouse land use plan amendment currently in force (BLM 2015b)***. Where exceptions would not be granted, drilling and completion of wells would be scheduled to occur outside of the stipulation windows. This would result in an on-and-off cycle scheduled around variable timing stipulations designed to protect sensitive wildlife resources including greater sage-grouse leks, seasonal wildlife habitats, mountain plover nests, swift fox dens, and occupied raptor nests. ***Relief from timing limit stipulations*** could adversely impact sensitive wildlife species by causing nest abandonment, reduced reproductive success, a reduction in lek attendance, and displacements of animals from other sensitive seasonal ranges ***as a result of increased human presence and activity***.

A wildlife review of federal APDs for 2012-2017 conducted by the BLM determined that approximately ***50*** percent of APDs were subject to timing limitation stipulations. Applying that ***50*** percent coverage to the approximately 64 percent of the CCPA that is under federal mineral ownership would yield an estimated ***one-third*** of the CCPA that ***c***ould be subject to timing limitation stipulations. Additionally, not all raptor nests and greater sage-grouse leks are ***occupied*** every year. Several raptor species utilize alternate nests that are not used annually, further reducing the timing limitation area.

WGFD Strategic Habitats

The types of impacts to WGFD Strategic Habitat Areas would be the same as described under Alternative A; however, surface disturbance under Alternative B would be greater in these areas as detailed in **Table 4.18-4**.

Table 4.18-4 Estimated Impacts to WGFD Designated Strategic Habitats under Alternative B

WGFD Strategic Habitat	Total Acres in CCPA	Acres Impacted[1]
Thunder Basin Crucial Habitat and Enhancement Area	56,012	1,960
Sand Hills Enhancement Area	10,897	381

[1] Estimated values calculated as approximately 3.5 percent of the Strategic Habitats within the CCPA.

Source: WGFD 2009.

Big Game

The types of impacts to big game species (pronghorn, mule deer, elk, and white-tailed deer) under Alternative B would be the same as those discussed under Impacts Common to All Species and under Alternative A; however, the degree of impact would be greater than Alternative A. **Table 4.18-5** presents impacts to wildlife species, including big game, from development under Alternative B from habitat fragmentation caused by Project components.

As under Alternative A, the primary potential indirect impact from Alternative B would be avoidance (displacement) of otherwise suitable habitat in the vicinity of Project disturbance areas due to increased noise and human activity. Based on the density of well pads of 0.83 pads per square mile (or 1.4 percent of the CCPA), new roads (0.84 mile per square mile; **Table 4.18-5**), and the noise-related impacts, big game species would be subject to indirect disturbance in most of the CCPA and at a comparatively greater degree than under Alternative A. However, the extent of indirect impacts would vary geographically across the CCPA and would depend on the exact locations of well pads and roads. The greatest impacts would occur in areas where roads and/or well pads would be most densely situated or where development is located in limited or high quality habitat. More abundant species such as pronghorn and mule deer would experience a greater degree of indirect impacts due to a higher probability that these animals would occur in close proximity to disturbance.

Impacts to pronghorn, mule deer, elk, and white-tailed deer seasonal ranges from new surface disturbance under Alternative B are provided on **Table 4.18 6**. Indirect impacts are described under Big Game.

Table 4.18-5 Impacts to Wildlife from Habitat Fragmentation under Alternative B

	Existing		New Disturbance		Total	
Project Component	**Miles/ Number**	**Density (miles/ number per square mile)**	**Miles/ Number**	**Density (miles/ number per square mile)**	**Miles/ Number**	**Density (miles/ number per square mile)**
Linear Components (miles)						
Roads	1,822	0.78	1,970	0.84	3,792	1.62
Pipelines (non-co-located)	1,722	0.73	2,150	0.92	3,872	1.65
Overhead Electrical Distribution Lines (non-co-located)	911	0.39	150	0.06	1,061	0.45
Linear Subtotal	**4,455**	**1.90**	**4,270**	**1.82**	**8,725**	**3.72**
Other Components (number)						
Pads	1,449	0.62	1,995	0.85	3,444	1.47
Construction / Production Facilities	32	0.01	108	0.05	140	0.06
Other Subtotal	**1,481**	**0.63**	**2,103**	**0.90**	**3,584**	**1.53**

Table 4.18-6 Impacts to Big Game Ranges within the Big Game Analysis Area for Alternative B

	Range Type		
Species	**Yearlong**	**Winter/Yearlong**	**Severe Winter Relief**
Pronghorn			
Available range in analysis area (acres)	3,336,981	1,862,614	94,991
Estimated surface disturbance (acres)	37,648	14,288	228
Percent of available range disturbed	1.13	0.77	0.24

Table 4.18-6 Impacts to Big Game Ranges within the Big Game Analysis Area for Alternative B

Species	Range Type		
	Yearlong	**Winter/Yearlong**	**Severe Winter Relief**
Mule Deer			
Available range in analysis area (acres)	3,646,668	1,479,234	0
Estimated surface disturbance (acres)	39,354	13,128	0
Percent of available range disturbed	1.08	0.89	0.00
White-tailed Deer			
Available range in analysis area (acres)	1,522,735	268,371	0
Estimated surface disturbance (acres)	1,795	67	0
Percent of available range disturbed	0.12	0.02	0.00
Elk			
Available range in analysis area (acres)	1,018,926	0	0
Estimated surface disturbance (acres)	1,380	0	0
Percent of available range disturbed	0.14	0.00	0.00

Source: WGFD 2012c.

Small Mammals

The types of effects on small mammals, including bats, resulting from Alternative B would be the same as those discussed under Alternative A and include injury and mortality, disturbance, displacement, and habitat loss. A variety of small mammals occupying all habitats within the CCPA either occur or have the potential to occur in the wildlife analysis area; therefore, Alternative B would result in surface disturbance to approximately 52,667 acres (2.39 percent) of the available 2,206,155 acres of suitable habitat within the wildlife analysis area. Habitat fragmentation would be minimized in the TBNG based on implementation of USFS Standards and Guidelines requiring the minimization and proper siting of road disturbance, facility size minimization, and road surface reclamation after the end of use (USFS 2001).

Alternative B could result in an estimated surface disturbance to approximately 320 acres (1.48 percent) of the available 21,593 acres of suitable riparian and wetland foraging habitat for bat species within the wildlife analysis area. The Casper RMP prohibits surface disturbance within 500 feet of riparian areas in proximity to Class 1 and 2 waters, which would reduce impacts to these habitats on BLM surface estate; however, vehicle traffic at stream crossings and creation of new stream crossings would result in impacts to foraging habitat for these species on non-federal surface. In addition, surface disturbance impacts to riparian habitat on non-federal surface could occur. On the TBNG, impacts to bat day roost areas and wintering sites would be minimized by implementation of the same USFS Guidelines (USFS 2001) described under Alternative A that provide protection buffers from surface disturbance and vegetation treatments around roost sites.

In addition, the following OG-committed design features would reduce impacts to wildlife species that use wetlands and riparian areas, including foraging bats in the CCPA:

- Streams, wetlands, and riparian areas disturbed during construction will be restored to as near pre-Project conditions as practical, and if impermeable soils contributed to wetland formation, soils would be compacted to reestablish impermeability.

Game Birds

The types of effects on game birds resulting from Alternative B would be the same as those discussed under Alternative A and include injury and mortality, disturbance, displacement, and habitat loss. Surface disturbing activities associated with the construction of new well pads, roads, and other facilities, as well as vehicle use on local and well pad access roads in the CCPA could result in injury or mortality to upland game birds. In total, Alternative B would result in estimated surface disturbance to approximately 52,667 acres (2.39 percent) of the available 2,206,155 acres of suitable game bird habitat within the wildlife analysis area.

The following OG-committed design features would minimize impacts associated with power lines:

- Unless otherwise agreed to by the AO in writing, power lines shall be constructed in accordance with the Avian Power Line Interaction Committee (APLIC) Suggested Practices for Avian Protection on Power Lines—The State of the Art in 2006 (APLIC 2006) or equivalent based on Avian Protection Plans from the third-party power providers.

4.18.1.3 Mitigation and Mitigation Effectiveness – Alternative B

Under Alternative B, the following mitigation measures would be applied to further minimize impacts to wildlife species related to Alternative B.

WLF-1: Surface disturbance will be avoided at wildlife water ***(excluding freshwater pits)*** developments during final siting and development. If avoidance is not possible, the loss of any permanently impacted wildlife water developments will be offset by installing new developments of equal capacity, in coordination with the appropriate state wildlife agency and federal land management agencies.

WLF-2: ***In accordance with BLM, USFS, and USFWS BMPs for preventing wildlife mortality as a result of fluid mineral practices, a***ll stacks, trenches, and other open structures (including water tanks) will be covered with wildlife enclosure covers and/or wildlife escape ramps will be installed in pits, trenches, and tanks to prevent entrapment and/or drowning. Any existing or proposed open poles or fence posts will be covered or filled with sand, soil, or gravel to prevent entrapment. “Bird cones” will be installed on open-vent stacks.

WLF-3: If reserve pits or other open pits for storage of fluids ***(except fresh water)*** are used, they will be fenced and covered with netting (properly installed, monitored, and maintained).

WLF-4: New power lines, roads, pipelines, and other structures will be collocated with other existing disturbance (e.g., roads, pipelines, railroads), where possible. Additionally, new power lines will be buried where feasible.

WLF-5: Noise reduction mufflers will be used on construction equipment, drilling equipment, and other motors/compressor used during drilling and production. Also, temporary walls and distance will be considered for use to reduce sound levels in important habitats.

WLF-6: New structures, including fences, will be designed and built to reduce hazards to big game and to allow big game ***seasonal*** movement throughout the year. This will not include fences designed to specifically exclude wildlife.

Mitigation measure WLF-1 would ensure continued wildlife access to existing wildlife water developments. Mitigation measure WLF-2 and WLF-3 would reduce mortalities or injuries to wildlife species. The use of bird cones (WLF-2) would keep bats and birds from roosting, nesting, or sleeping on open-vent stacks, and the use of netting (WLF-3) would prevent access by bats, small mammals, and birds to eliminate exposure to potentially toxic drilling fluids. Mitigation measure WLF-4 would reduce habitat fragmentation impacts to wildlife species. Additionally, burying new powerlines would reduce potential for collision and electrocution of birds and bat species, as well as eliminate potential perch sites for avian predators.

Noise could deter wildlife from using an area and increase physiological stress; therefore, mitigation measure WLF-5 would reduce the degree of wildlife avoidance in areas near construction and in areas where noise would be generated during drilling and production. Mitigation measure WLF-6 would reduce hazards and injuries to big game and would reduce the effects of habitat fragmentation by improving big game movement through the CCPA throughout the year.

4.18.1.4 Residual Impacts – Alternative B

Residual impacts are defined as unavoidable adverse impacts to a resource that remain assuming implementation of proposed mitigation. Implementation of agency wildlife avoidance, minimization, and mitigation measures (e.g., spatial avoidance buffers and seasonal restrictions as required by applicable land and resource management plan stipulations) would reduce impacts to wildlife species and habitats on BLM- and USFS-administered lands and split estate lands, which comprise approximately 64 percent of the CCPA. Approximately 36 percent of the CCPA is state-owned or privately owned land and mineral estate lands that would not be subject to BLM and USFS wildlife protection measures as required on agency surface estate and split estate lands. Approximately 7 percent of the CCPA is Wyoming state land, and state mitigation measures would be applied to reduce impacts in those areas.

Under Alternative B, agency reclamation standards would be implemented to BLM and USFS surface lands only, which comprise approximately 10 percent of the CCPA. Within the CCPA, 83 percent is privately owned surface estate on which reclamation standards would be specified in private landowner agreements. Therefore, an increased potential exists for residual impacts to wildlife species and habitat from development on state and privately owned lands.

Depending on land ownership, residual impacts to wildlife species and their habitats that would remain even after the implementation of additional mitigation measures would include:

- Habitat loss, alteration, or fragmentation due to surface disturbance and associated aboveground structures.
- Increased number of vehicle/wildlife collisions due to the increased number and density of roads and increased traffic.
- Decrease in carrying capacity, fitness, and population numbers for big game species due to habitat fragmentation, surface disturbance, human activity, and noise.
- Increased predation pressure on game birds due to increased perches for birds of prey.
- Potential abandonment of roosts or impacts to individual bats resulting from increased access to sensitive roosting areas and noise impacts that would cause behavioral changes.

The primary impacts to wildlife resources from Alternative B would be surface disturbance, habitat fragmentation, and human presence and activity. This alternative includes ***six land use plan amendment options (described in Raptor subsection below) to address relief from timing limit stipulations*** for raptor nests and ***the utilization of the 2015 ARMPA (BLM 2015b) for exceptions for*** greater sage-grouse breeding habitat that otherwise provide protection to other seasonal wildlife habitats. ***The impacts would be minimized through*** the application of ***option specific*** avoidance and minimization mitigation, OG-committed design features, and the additional mitigation measures (Section 4.18.1.3).

4.18.1.5 Impacts to Terrestrial Wildlife from Alternative C

The types of impacts to wildlife species and habitat under Alternative C would be the same as under Alternative A. Compared to Alternative B, surface disturbance and related impacts would be reduced based on the assumption that a higher average number of wells would be drilled from each pad (WGFD 2010a). The same number of oil and gas wells (5,000) would be drilled under the same drilling rate (500 wells per year) as Alternative B, but under Alternative C there would be only 938 well pads (562 less than under Alternative B), which subsequently would reduce the miles of access roads, pipelines, and overhead electrical lines needed (**Table 2.5-1**). Alternative C would require 376 miles (1,821 acres) each for oil gathering and water supply/disposal pipelines that would not be required under Alternative B. Surface disturbance for Alternative C would be 37,267 acres; 15,400 acres less than Alternative B.

For detail regarding other alternative-specific activities under Alternative C, refer to Section 2.5.2. Under Alternative C, other activities that would change the impacts to wildlife that would result from development under Alternative B include the following:

- A single water supply and disposal pipeline could be used for water supply and the pumping direction could be reversed after all wells were completed to pump water back to the facilities for disposal. This process would reduce the number of pipelines required for production, as well as reduce traffic and the resulting impacts to wildlife.
- Upon completion of construction activities, all disturbed areas not necessary for production would undergo interim reclamation to minimize environmental impacts. On federally managed lands and lands above federal minerals, interim reclamation would be required to meet the BLM or USFS requirements for suitable wildlife habitat. This would equate to approximately 65 percent of the CCPA.
- Timing limit stipulations would continue to be required as outlined in the BLM Casper RMP (BLM 2007b) and USFS TBNG LRMP (USFS 2001) (**Table 2.5-2**). This would mean that exceptions to timing limit stipulations would not be granted on approximately 15 to 20 percent of the CCPA, which would eliminate some of the adverse impacts described under Alternative B.

WGFD Strategic Habitats

The types of impacts to WGFD Strategic Habitat Areas would be the same as described under Alternatives A and B; however, Alternative C would result in approximately 1 percent less disturbance in each of the areas compared to Alternative B (**Table 4.18-7**).

Table 4.18-7 Impacts to WGFD Designated Strategic Habitats as a Result of Alternative C

WGFD Strategic Habitat	Total Acres in CCPA	Acres Impacted[1]
Thunder Basin Crucial Habitat and Enhancement Area	56,012	1,400
Sand Hills Enhancement Area	10,897	272

[1] Estimated values calculated as approximately 2.5 percent of the Strategic Habitats within the CCPA.

Source: WGFD 2009.

Big Game

The types of impacts to big game species (pronghorn, mule deer, elk, and white-tailed deer) under Alternative C would be the same as those discussed under Types of Impacts Common to all Species as well as impacts discussed under Alternatives A and B; however, the degree of impact would be greater than under Alternative A and less than under Alternative B. **Table 4.18-8** presents impacts to wildlife species, including big game, from development under Alternative C from habitat fragmentation caused by Project components.

Based on the density of 0.53 well pads per square mile (or 0.9 percent of the CCPA), new roads (0.54 mile per square mile; **Table 4.18-8**), and the noise-related impacts, big game species would be subject to a lesser degree of indirect impacts under Alternative C compared to Alternative B.

Table 4.18-8 Impacts to Wildlife from Habitat Fragmentation under Alternative C

Project Component	Existing		New Disturbance		Total	
	Miles/ Number	Density (miles/ number per square mile)	Miles/ Number	Density (miles/ number per square mile)	Miles/ Number	Density (miles/ number per square mile)
Linear Components (miles)						
Roads	1,822	0.78	1,262	0.54	3,084	1.31
Pipelines (non-co-located)	1,722	0.73	1,160	0.49	2,882	1.23
Overhead Electrical Distribution Lines (non-co-located)	911	0.39	94	0.04	1,005	0.43
Linear Subtotal	**4,455**	**1.90**	**2,516**	**1.07**	**6,971**	**2.97**
Other Components (number)						
Pads	1,449	0.62	1,254	0.53	2,703	1.15
Construction / Production Facilities	32	0.01	108	0.05	140	0.06
Other Subtotal	**1,481**	**0.63**	**1,362**	**0.58**	**2,843**	**1.21**

Impacts to pronghorn, mule deer, elk, and white-tailed deer seasonal ranges from new surface disturbance under Alternative C are provided on **Table 4.18-9**. Indirect impacts are described under Big Game.

Table 4.18-9 Impacts to Big Game Ranges within the Big Game Analysis Area for Alternative C

Species	Range Type		
	Yearlong	Winter/Yearlong	Severe Winter Relief
Pronghorn			
Available range in analysis area (acres)	3,336,981	1,862,614	94,991
Estimated surface disturbance (acres)	26,640	10,110	161
Percent of available range disturbed	0.80	0.54	0.17
Mule Deer			
Available range in analysis area (acres)	3,646,668	1,479,234	0
Estimated surface disturbance (acres)	27,847	9,290	0
Percent of available range disturbed	0.76	0.63	0.00

Table 4.18-9 Impacts to Big Game Ranges within the Big Game Analysis Area for Alternative C

Species	Range Type		
	Yearlong	**Winter/Yearlong**	**Severe Winter Relief**
White-tailed Deer			
Available range in analysis area (acres)	1,522,735	268,371	0
Estimated surface disturbance (acres)	1,282	48	0
Percent of available range disturbed	0.01	<0.01	0.00
Elk			
Available range in analysis area (acres)	1,018,926	0	0
Estimated surface disturbance (acres)	976	0	0
Percent of available range disturbed	0.10	0.00	0.00

Source: WGFS 2012.

Small Mammals

The types of effects on small mammals, including bats, resulting from Alternative C would be the same as under Alternative B and include injury and mortality, disturbance, displacement, and habitat loss. A variety of small mammals occupying all habitats within the CCPA either occur or have the potential to occur in the wildlife analysis area; therefore, Alternative C would result in surface disturbance to 37,267 acres (15,400 acres less than Alternative B), or 1.69 percent of the available 2,206,155 acres of suitable habitat within the wildlife analysis area. Habitat fragmentation would be minimized in the TBNG based on implementation of USFS Standards and Guidelines requiring the minimization and proper siting of road disturbance, facility size minimization, and road surface reclamation after the end of use (USFS 2001).

Alternative C could result in an estimated surface disturbance to approximately 226 acres (1.05 percent) of the available 21,593 acres of suitable riparian and wetland foraging habitat for bat species within the wildlife analysis area. As with Alternative B, the BLM Casper RMP prohibits surface disturbance within 500 feet of riparian areas in proximity to Class 1 and 2 waters, which would reduce impacts to these habitats on BLM surface estate; however, vehicle traffic at stream crossings and creation of new stream crossings would result in impacts to foraging habitat for these species on non-federal surface. In addition, surface disturbance impacts to riparian habitat on non-federal surface still occur. On the TBNG, impacts to bat day roost areas and wintering sites would be minimized by implementation of the same USFS Guidelines (USFS 2001) as described under Alternative A that provide protection buffers from surface disturbance and vegetation treatments around roost sites.

Game Birds

The types of effects on game birds resulting from Alternative C would be the same as under Alternative B and include injury and mortality, disturbance, displacement, and habitat loss. Surface disturbing activities associated with the construction of new well pads, roads, and other facilities, as well as vehicle use on local and well pad access roads in the CCPA could result in injury or mortality to upland game birds. In total, Alternative C would result in estimated surface disturbance to approximately 37,267 acres (approximately 15,400 less acres than Alternative B), or 1.69 percent of the available 2,206,155 acres of suitable game bird habitat within the wildlife analysis area.

4.18.1.6 Mitigation and Mitigation Effectiveness – Alternative C

With the exception of WLF-3, all mitigation measures and mitigation effectiveness under Alternative C for terrestrial wildlife would be the same as for Alternative B. Under Alternative C, the entire CCPA would require strictly closed-loop drilling (i.e., no pits would be used and all fluids would be contained in tanks) on federal minerals. This design would prevent access to pits by bats, small mammals, and birds, which would eliminate exposure to potentially toxic drilling fluids; therefore, mitigation measure WLF-3 would not be necessary.

4.18.1.7 Residual Impacts – Alternative C

Residual impacts are defined as unavoidable adverse impacts to a resource that remain after implementation of proposed mitigation. The types of residual impacts to wildlife resources resulting from Alternative C would be similar to those discussed for Alternative B but to a lesser degree. Alternative C also would result in impacts to wildlife resources associated with surface disturbance, habitat fragmentation, and human presence. However, fewer miles of roads, pipelines, and electrical distribution lines would incrementally reduce habitat fragmentation and fewer well pads would reduce impacts resulting from surface disturbance and human presence. In addition, there would be no exceptions granted for timing stipulations for raptor nests and greater sage-grouse leks in ***GHMA***, which would reduce impacts during sensitive seasons and in sensitive areas.

Under Alternative C, the BLM would require reclamation to suitable wildlife habitat for all federal surfaces and split estate over federal mineral estate, which would include approximately 64 percent (compared to 10 percent under Alternative B) of the CCPA. Therefore, as much as 36 percent of the CCPA would have the potential to result in the residual impacts associated with wildlife habitat loss or alteration based on the uncertainty of reclamation on private land. This alternative would result in an increase of lands where BLM and USFS reclamation standards would be applied by approximately ***55*** percent compared to Alternative B. The actual amount of habitat to be reclaimed on private mineral estate would be dependent on landowner agreements.

Impacts identified under Alternative C would be minimized through the application of avoidance and minimization mitigation, OG-committed design features, and the additional mitigation measures (Section 4.18.1.6).

4.18.1.8 Relationship between Local Short-term Uses of the Human Environment and Maintenance and Enhancement of Long-term Productivity

The relationship between local short-term uses of the human environment and maintenance and enhancement of long-term productivity is the disclosure regarding whether the short-term use of a resources associated with a project affects the long-term sustainability of that resource. Project construction would impact approximately 0.7 percent of available habitats in the CCPA under Alternative A, 3.5 percent under Alternative B, and 2.5 percent under Alternative C. Wildlife habitat would be diminished due to local short-term and long-term uses until reclaimed areas return to pre-disturbed vegetation communities. As discussed above, these temporal losses could vary in the time required to return to pre-construction conditions. This range of temporal loss generally would be between 5 and 50 years, depending on the vegetation community.

This short-term use of habitat may affect long-term productivity of terrestrial species should there be alteration, loss, modification, or fragmentation of habitat; direct mortality of individuals; or increased disturbance from human activity. Wildlife habitat would be reduced due to local short-term uses until reclaimed areas return to mature vegetation communities that provide suitable habitat. Under Alternative B, the BLM could only recommend reclamation on most private surface (i.e., up to 83 percent of the CCPA), while under Alternative C, reclamation would occur as recommended by the BLM on federal surface estate as well as private surface underlain by federal mineral estate (i.e., approximately 65 percent of the CCPA). This would increase the likelihood of habitat reclamation to BLM and USFS suitable wildlife habitat standards under Alternative C, which would increase the likelihood of long-term habitat restoration for terrestrial wildlife species. Oil and gas development activities would have localized impacts on wildlife populations during development, particularly during the construction, drilling, and completion phases.

4.18.1.9 Irreversible/Irretrievable Commitment of Resources

Irreversible/irretrievable impacts are subsets of unavoidable adverse/residual impacts. Irreversible impacts are those that cannot ever be restored; they would be lost forever. Irretrievable impacts are those for which the resource value would be irretrievably lost until restoration of that resource takes place. Construction and production under any of the Project alternatives would result in the irretrievable commitment of both wildlife and potential suitable habitats during the life of the Project. Interim reclamation under Alternative C would not reduce impacts to wildlife species because it would be minimal and in very close proximity to Project components. After the end of the life of the Project (i.e., following decommissioning), a portion of habitat disturbed during construction and production would be reclaimed on state and federal lands, as required by applicable regulations. The actual amount of area to be reclaimed on private land (approximately 83 percent of the CCPA) generally would be dependent on landowner agreements under Alternative B and to BLM and USFS suitable wildlife habitat standards on federal surface estate as well as private surface underlain by federal mineral estate (approximately 65 percent of the CCPA) under Alternative C.

Depending on the selection of alternatives, the amount of wildlife habitat irretrievably committed would range from 10,253 acres under Alternative A to 52,667 acres under Alternative B. Some vegetation communities would be expected to return to a native state within a relatively short period of time (i.e., 5 years). Other more sensitive habitats, such as sagebrush shrublands, may require up to 50 years or longer to return to pre-construction conditions. Regardless of timeframes, wildlife habitat impacted during construction could return to pre-disturbance conditions, which would avoid any irreversible commitments of wildlife habitat.

4.18.2 Impacts to Migratory Bird Species

4.18.2.1 Impacts to Migratory Birds from Alternative A – No Action

Under Alternative A, new development would continue within the CCPA as disclosed under previous NEPA documents (Section 2.3.2). Approximately 10,253 acres of new disturbance would occur over a 15-year period from construction of 386 new well pads (including other service well pads), 386 miles of roads, 362 miles of gas-gathering pipelines as well as electrical distribution lines (181 miles co-located with roads for both components), and ancillary facilities (**Table 2.3-3**).

Impacts to migratory birds analyzed for the Project would be similar to those listed under Types of Impacts Common to All Species in Section 4.18.1.1. Additional potential impacts would include avian collision and electrocution risk to migratory birds from electrical distribution lines and mortality from contact with burners.

The primary impacts to migratory birds associated with power lines and associated facilities would include avian injuries and mortalities as a result of electrocution or collision, and the creation of nesting substrata for some species and perches for avian predators. Collision potential would be dependent upon variables such as the location of power lines in relation to high-use habitat areas (e.g., nesting, foraging, and roosting), line orientation to flight patterns and movement corridors, species composition and previous experience with power lines, visibility and localized weather conditions (fog increases collision potential), and line design (APLIC 2012, 2006). Avian loss often would be greatest where power lines cross migratory paths, bisect feeding and nesting-roosting sites, or occur adjacent to major avian use areas (Savereno et al. 1996). Topographic features that funnel birds through power line corridors also would present higher risks (Bevanger 1990; Faanes 1987). Raptors, particularly juveniles, and other large species are particularly susceptible to collision with power lines (APLIC 2012). Electrocution is primarily associated with smaller (i.e., 60-kV or less) power lines, due to the size of towers and spacing of the wires (APLIC 2006). Avian predators, particularly raptors and corvids, are attracted to overhead power lines because they provide perches for various activities, including hunting (APLIC 2006). Raptors and corvids nest and perch on transmission towers and distribution poles, which create vertical structure in generally treeless shrub-steppe habitats (Knight and Kawashima 1993; Steenhof et al. 1993).

Venting and flaring would occur throughout the drilling and production phases. Earthen pits are often constructed below flare stacks and collect precipitation and other fluids that mix with oils and other contaminants in small ponds. These exposed fluids would pose chemical contamination risk to migratory birds (Ramirez 2002). Flaring would be used during well production testing. Testing duration would depend on well performance but typically would only be conducted long enough for fluid rates to drop to a level that production equipment could safely process. Flaring also would be used in emergency situations where equipment or piping is in danger of being over-pressurized. In such instances, valves on the equipment would automatically release gas to flare stacks (Section 2.2.2.3).

Migratory Bird Habitats

Suitable nesting, foraging, and winter habitats for the various migratory bird species consist of one or more of the vegetation types present in the CCPA as discussed in detail in Sections 3.14 and 4.14. Estimated disturbance to these various vegetation types from Alternative A is provided on **Table 4.18-10**. An estimated 13.29 acres of surface disturbance would occur within the Rochelle Hills IBA. As described in Section 3.18.2.4, the IBA provides critically important habitat for grassland, shrubland, and wetland/riparian avian species. Disturbance to limited or high-quality habitat would result in impact to migratory birds. Surface disturbance and habitat fragmentation resulting from the construction of new well pads, roads, pipelines, and powerlines would be the same as for terrestrial wildlife as presented in **Table 4.18-2**.

Table 4.18-10 Estimated Disturbance to Migratory Bird Species Habitats from Alternative A

Habitat Type	Habitat in CCPA (acres)		Habitat in Migratory Bird Analysis Area	
	Total	Estimated Disturbance[1]	Total Acres	Percent Impacted
Grassland	995,706	6,***970***	1,370,493	***0.50***
Sagebrush shrubland	330,463	2,***314***	531,791	0.4***3***
Barren/sparsely vegetated	126,016	8***83***	180,050	0.4***9***
Conifer forest	11,239	7***9***	20,266	0.3***9***
Agriculture	10,274	7***2***	31,966	0.2***3***
Developed	10,320	7***3***	27,070	0.2***7***
Wetland/riparian	9,108	6***4***	21,593	0.***30***
Mixed shrubland	7,417	5***2***	19,916	0.***25***
Open water	1,838	0	2,970	0
Deciduous	0	0	39	0
Total	**1,502,381**	**10,*507***	**2,206,155**	***0.47***

[1] Due to the programmatic nature of this EIS, actual disturbance values were not available; therefore, a quantitative estimate was calculated as a percentage of the new surface disturbance for Alternative A (0.7 percent) multiplied by the acres of habitat within the CCPA.

Migratory Bird Species

This analysis focuses on potential impacts to raptors as well as migratory game birds, waterfowl, avian species listed as BCC, and SGCN. The types of potential impacts to these species are described under the above discussion regarding Types of Impacts Common to All Species. Species that are year-round residents in the CCPA would be more at risk from Project disturbance than those that migrate. Species that require large expanses of intact habitat would be more at risk from habitat fragmentation than those more tolerant of disturbance and human-modified landscapes. Species typically associated with only one habitat type (e.g., upland sandpiper, sagebrush sparrow, American bittern) would be more at risk from habitat fragmentation than species generalists (e.g., golden eagle, logger head shrike, mourning dove).

Raptors

Table 4.18-11 presents potential impacts to raptor species and habitats from Alternative A. The number of raptor nests shown in the table includes those within the CCPA as well as those within 1 mile of the CCPA to account for any nests requiring a 1-mile buffer that could intersect with the CCPA. In addition to the species-specific nests reported in **Table 4.18-11**, a total of four nests of unknown owl species and 343 nests of unknown raptor species are known to occur within the CCPA and up to 1 mile outside the CCPA. A total of 1,124 raptor nests (an average of <0.01 nests per acre within CCPA) are known to occur within the CCPA and up to 1 mile outside the CCPA.

Table 4.18-11 Estimated Impacts to Raptor Species and Habitats from Alternative A

Species Common Name	Nests/Roosts in CCPA plus a 1-mile buffer	Potential Habitat in CCPA[1] (acres)	Estimated Impacts to Potential Habitat in CCPA[2] (acres)
American kestrel	None documented	26,799	***188***
Bald eagle[4]	2,498 acres of BLM designated winter roost habitat	9,108	***64***
Burrowing owl[3,4]	2	1,469,876	***10,289*** Prairie dog colonies and small mammal burrows required for nesting
Cooper's hawk	None documented	30,621	***214***
Ferruginous hawk[4]	402	1,469,876	***10,289*** Black-tailed prairie dog colonies, cliff and rock outcrop habitat required for nesting
Flammulated owl[4]	None documented	11,239	***79***
Golden eagle[4]	135	1,469,876	***10,289*** Cliff habitat ***and trees*** required for nesting
Great gray owl[4]	None documented	11,239	***79***
Great horned owl	34	368,501	***2,580*** Mature trees required for nesting
Long-eared owl	None documented	30,621	***214*** Trees, tall shrubs, or shelterbelts required for nesting
Merlin[4]	None documented	1,026,327	***7,184***
Northern goshawk[4]	None documented	11,239	***79*** Specific forest microhabitats required for nesting
Northern harrier[3]	None documented	19,382	***136***
Osprey	None documented	9,108	***64***

Table 4.18-11 Estimated Impacts to Raptor Species and Habitats from Alternative A

Species Common Name	Nests/Roosts in CCPA plus a 1-mile buffer	Potential Habitat in CCPA[1] (acres)	Estimated Impacts to Potential Habitat in CCPA[2] (acres)
Peregrine falcon[4]	None documented	483,278	***3,383*** Cliff habitat required for nesting
Prairie falcon[5]	None documented	1,469,876	***10,289*** Cliff habitat required for nesting
Red-tailed hawk	177	1,352,968	***9,471***
Sharp-shinned hawk	None documented	30,621	***214***
Short-eared owl[4]	None documented	1,015,088	***7,106***
Swainson's hawk[4]	22	1,343,860	***407***

[1] Based on associated habitat descriptions found in **Tables 3.18-4** and **3.18-5**.

[2] Estimated values calculated as approximately 0.7 percent of potential habitat present in CCPA.

[3] The species is identified as special status (BLM and/or USFS Sensitive).

[4] The species is identified as a sensitive species (BCC or SGCN).

Migratory Game Birds and Waterfowl

A variety of migratory game bird and waterfowl species are documented to occur in the CCPA (**Table 3.18-3**). The types of impacts to these species would be the same as described under Types of Impacts Common to All Species. Another source of risk to migratory game birds and waterfowl would be an incremental increase in the potential for wildlife harassment and poaching on public lands. As discussed for terrestrial wildlife (Section 4.18.1), increased human activity could lead to an increase in hunter access to public lands, resulting in increased poaching and harassment.

<u>Waterfowl</u>

For the purposes of this analysis, waterfowl are associated with habitats defined as wetland/riparian communities. Although Project facilities likely would not be sited directly in waterfowl habitat, the other types of impacts described under Impacts Common to All Species (Section 4.18.1.1) would be applicable to waterfowl species. ***Indirect impacts to habitats for these species could occur as a result of development related to water depletions in the Platte River system in Wyoming. However, it is assumed that water use under Alternative A has been evaluated in previous NEPA analyses and Section 7 consultations have been completed for this development; therefore, any new water sources under Alternative A would have been reviewed by the Wyoming State Engineer to confirm that there were no new depletions.*** Population numbers for waterfowl species vary annually based on available habitat and weather patterns. In addition, waterfowl are subject to collision with electrical distribution lines due to their low flight patterns, rapid flight, and high wing loading (i.e., the combination of heavy body and small wings), which restricts swift reactions to unexpected obstacles (Bevanger 1998).

Under Alternative A, a conservative estimate of approximately ***64*** acres (0.7 percent) of the available 9,108 acres of suitable habitat in the CCPA of waterfowl habitat and wetland/riparian habitats would be impacted by surface disturbance.). However, the BLM Casper RMP and TBNG LRMP require protection of riparian habitats; therefore, disturbance to these habitats would be less on BLM and USFS surface estate and split estate lands within the CCPA compared to private lands.

BCC and Avian SGCN

A total of 65 BCC and avian SGCN (non-raptor) are documented or have potential to occur in the CCPA (**Table 3.18-5**). The types of potential impacts to these species are described under Impacts Common to All Species. **Table 4.18-12** presents potential impacts to BCC and avian SGCN and habitats in the CCPA from Alternative A.

Table 4.18-12 Estimated Disturbance to Non-raptor BCC and Avian SGCN Habitats from Alternative A

Species Common Name	Potential Habitat in CCPA[1] (acres)	Estimated Impacts to Potential Habitat in CCPA[2] (acres)
American bittern	9,108	***64***
American white pelican	9,108	***64***
Ash-throated flycatcher	11,239	7***9***
Baird's sparrow	995,706	6,7***70***
Black tern	9,108	6***4***
Black-billed cuckoo	9,108	6***4***
Black-crowned night-heron	9,108	6***4***
Black rosy-finch	1,121,722	7,***853***
Black-throated gray warbler	11,239	7***9***
Blue-gray gnatcatcher	20,347	14***3***
Blue grosbeak	9,108	6***4***
Bobolink	995,706	6,***970***
Brewer's sparrow	330,463	2,***314***
Calliope hummingbird	20,347	14***3***
Canyon wren	126,016	8***83***
Caspian tern	9,108	6***4***
Cattle egret	19,382	13***6***
Chestnut-collared longspur	995,706	6,7***70***
Clark's grebe	9,108	6***4***
Clark's nutcracker	11,239	7***9***
Common loon	9,108	6***4***
Common nighthawk	1,344,825	9,***414***
Common yellowthroat	9,108	6***4***
Dickcissel	995,706	6,***970***
Forster's tern	9,108	6***4***
Franklin's gull	19,382	13***6***
Grasshopper sparrow	995,706	6,7***70***
Great blue heron	9,108	6***4***
Greater sage-grouse	330,463	See Section 4.18.3
Harlequin duck	9,108	6***4***
Horned grebe	9,108	6***4***
Lewis's woodpecker	20,347	14***3***
Loggerhead shrike	357,262	2,***501***
Long-billed curlew	1,015,088	***7,106***

Table 4.18-12 Estimated Disturbance to Non-raptor BCC and Avian SGCN Habitats from Alternative A

Species Common Name	Potential Habitat in CCPA[1] (acres)	Estimated Impacts to Potential Habitat in CCPA[2] (acres)
MacGillivray's warbler	9,108	6***4***
Marbled godwit	9,108	6***4***
McCown's longspur	995,706	6,7***70***
Mountain plover	1,121,722	7,***853***
Pinyon jay	11,239	7***9***
Pygmy nuthatch	11,239	7***9***
Red crossbill	11,239	7***9***
Red-eyed vireo	9,108	6***4***
Red-headed woodpecker	20,347	14***3***
Rufous hummingbird	1,023,470	***7,165***
Sagebrush sparrow	330,463	2,***314***
Sage thrasher	337,880	2,3***66***
Snowy egret	9,108	6***4***
Trumpeter swan	9,108	6***4***
Upland sandpiper	995,706	6,***970***
Virginia rail	9,108	6***4***
Virginia's warbler	18,656	13***1***
Western grebe	9,108	6***4***
White-faced ibis	9,108	6***4***
Williamson's sapsucker	11,239	7***9***
Willow flycatcher	9,108	6***4***
Yellow-billed cuckoo (eastern)	16,525	1***16***

1 Based on associated habitat descriptions found in **Table 3.18-5**.

2 Estimated values calculated as approximately 0.7 percent of potential habitat present in CCPA.

Forest and Woodland Species

Forest and woodland species are those that use this habitat type for nesting, foraging, migration, or winter habitat. BCC and avian SGCN species that use grassland habitat are listed in Section 3.18.2.5. The types of potential impacts to forest and woodland species are described under Impacts Common to All Species. A variety of impacts influence forest habitat and forest obligate species including but not limited to fire, insect and disease outbreaks, timber harvest, and habitat fragmentation.

Under Alternative A, approximately 77 acres of conifer forest would be disturbed (i.e., 0.7 percent of the available 11,239 acres of suitable conifer forest habitat within the CCPA). Each of the conifer forest species described in Section 3.18.2, Migratory Bird Species, uses other habitats to varying degrees as described in **Table 3.18-5** and would be subjected to additional impacts where they would occur in these other habitat types.

Grassland Species

Grassland avian species are those that use this habitat type for nesting, foraging, migration, or winter habitat. BCC and avian SGCN species that use grassland habitat are listed in Section 3.18.2.5. The types of potential impacts to grassland species are described under Types of Impacts Common to All Species. Grassland birds are among the fastest and most consistently declining species in North America; 48 percent are of conservation concern and 55 percent are in decline (North American Bird Conservation Initiative, U.S. Committee 2009).

Under Alternative A, an estimate of approximately 6,799 acres of grassland habitat would be disturbed (i.e., 0.7 percent of the available 995,706 acres of suitable grassland habitat within the CCPA). Each of the grassland species described in Section 3.18.2, Migratory Bird Species, uses other non-grassland habitats to varying degrees as described in **Table 3.18-5** and would be subjected to impacts where they would occur in these other habitat types.

Sagebrush Shrubland Species

Sagebrush shrubland avian species are those that use this habitat type for nesting, foraging, migration, or winter habitat. BCC and avian SGCN species that use grassland habitat are listed in Section 3.18.2.5. The types of potential impacts to sagebrush shrubland species are described under Impacts Common to All Species. A variety of impacts influence sagebrush shrubland species and habitat including but not limited to fire, agriculture, and encroachment of non-native invasive plants.

Under Alternative A, an estimated 2,254 acres of sagebrush shrubland would be disturbed (i.e., 0.7 percent of the available 330,463 acres of suitable sagebrush shrubland habitat within the CCPA). Each of the three sagebrush shrubland species described in Section 3.18.2, Migratory Bird Species, use other habitats to varying degrees as described in **Table 3.18-5** and would be subjected to additional impacts where they would occur in these other habitat types. However, impacts to these species would be disproportionately greater in sagebrush shrubland habitats.

Wetland/Riparian Species

Wetland/riparian species are those that use this habitat type for nesting, foraging, migration, or winter habitat. BCC and avian SGCN species that use grassland habitat are listed in Section 3.18.2.5. The types of potential impacts to wetland/riparian species are described under Impacts Common to All Species ***and within Section 4.17, Wetland and Riparian***. A variety of impacts influence wetland and riparian habitats and species, including but not limited to recreation, flood control and irrigation, and encroachment of non-native plant species.

Under Alternative A, an estimate of approximately ***64*** acres of wetland/riparian habitat would be disturbed (i.e., 0.07 percent of the available 9,108 acres of suitable riparian/wetland habitat within the CCPA). The riparian and wetland species described in Section 3.18.2, Migratory Bird Species, uses other habitats to varying degrees as described in **Table 3.18-5** and would be subjected to additional impacts where they would occur in these other habitat types. However, impacts to these species would be disproportionately greater in riparian and wetland habitats than in other areas. The BLM Casper RMP and TBNG LRMP require protection of riparian habitats; therefore, disturbance to these habitats would be less on BLM and USFS surface and mineral estate within the CCPA.

Species Associated with Prairie Dog Colonies

As described in Section 3.18.2.5, migratory bird species including mountain plover, burrowing owl, ferruginous hawk, and golden eagle use prairie dog colonies. Management direction in both the BLM Casper RMP and the TBNG LRMP provide protective measures that would minimize impacts to prairie dog colonies on BLM and USFS lands by requiring avoidance of prairie dog colonies and the establishment of new prairie dog colonies when applicable. However, additional impacts to the species would still occur, especially on non-federal lands. Impacts to prairie dog colonies would include surface disturbance to an estimated ***111*** acres (0.7 percent) of existing prairie dog colonies within the CCPA (15,825 acres) and 0.22 percent of the existing prairie dog colonies within the entire analysis area (48,672 acres).

4.18.2.2 Impacts on Migratory Bird Species from Alternative B – Proposed Action

Under Alternative B, approximately 5,000 new oil and gas wells would be drilled on 1,500 multi-well pads over a period of 10 years (500 new wells per year) with the ability to request ***relief from*** timing limitation stipulations for ***non-eagle*** raptor nests and greater sage-grouse leks in ***GHMA***. Additional surface disturbance would result from the construction of other service well pads, access roads, pipelines, electrical distribution lines, and ancillary facilities (**Table 2.4-1**). The types of impacts to migratory bird species and habitats under Alternative B would be the same as under Alternative A but the extent of the impacts would be greater under Alternative B. For example, there would be more surface disturbance to migratory bird habitats, more habitat fragmentation, greater potential for direct mortalities of individual birds, and greater potential for indirect impacts over those described under Alternative A. Surface disturbance and habitat fragmentation resulting from the construction of new well pads, roads, pipelines, and power lines would be as presented in **Table 4.18-5**. Under Alternative B, to the extent possible, drilling and development operations within the CCPA would be conducted on a year-round basis. ***The LUP existing raptor timing stipulations require that surface disturbance or occupancy would be avoided within a 0.5-mile buffer of raptor nests, except for nine species (red-tailed hawk, Swainson's hawk, American kestrel, osprey, great-horned owl, long-eared owl, northern saw-whet owl, common barn owl, and western screech owl), for which a 0.25-mile buffer would be required. The seasonal restriction would be February 1 to July 31, or until young birds have fledged (TLS).***

Option 1 (Existing Raptor Timing Stipulations from the Casper RMP, Decision No. 4047) and the five raptor amendment Options 2 through 6 are analyzed under Alternative B. Options 2 through 6 would allow relief from TLS for non-eagle raptors.

Adherence to timing limitation stipulations would still apply for eagle nests, NSO areas, ***and*** on the TBNG. Seasonal timing limitations would be adjusted to match the habitat types and species of concern for proposed activities and yearly climatic variation that could change nesting periods. For Wyoming, the USFWS identifies migratory bird nesting periods to occur between February 1 and August 31 for species protected by the MBTA. Where seasonal migratory bird stipulations are required and ***relief from TLS*** are not ***granted***, operators would schedule drilling and completion of wells outside of the stipulation windows. Granting of exceptions to timing limit stipulations could adversely impact or increase the likelihood of a take of migratory bird species and populations by causing raptor or other species nest abandonment, reduced reproductive success, ***the destruction of nests,*** and displacement from otherwise suitable seasonal habitat. These impacts temporarily or permanently would reduce or limit growth of local populations. In addition, species distribution and abundance would change depending on a variety of factors related to development and reclamation, species-specific tolerance of disturbance, and resilience.

Drilling activities would require large machinery and would result in an increase in noise and human activity. Migratory birds and habitats could be impacted in the event of spills or releases of harmful chemicals during construction and production. Site-specific SPCC plans would be developed during the APD process to address these potential impacts. Hazardous materials are discussed in detail in Section 4.4.1, Hazardous Materials and Solid Waste.

Under Alternative B, closed loop or semi-closed loop technology would be used for storage and treatment of production and flowback water; however, lined reserve pits for flowback water could be constructed based on site-specific conditions. Seven existing commercial evaporation ponds exist within a 15-mile buffer of the CCPA. If reserve pits are used, a variety of impacts could occur to migratory birds that are attracted to these facilities. Potential impacts would include ingestion of toxic substances while preening as well as decreased thermoregulatory and buoyancy properties of feathers that become covered in salt crystals or surfactants. These alterations in feather properties could lead to hypothermia or drowning of affected individuals (Ramirez 2009).

Freshwater make-up ponds would be constructed to store fresh water necessary for production. These ponds would be lined and constructed in such a manner as to not create shallow water shoreline habitat and to prevent usage by breeding mosquitos. These factors would reduce the attraction to birds for use ***of*** these ponds to rest or forage because they would provide no prey or cover. The fresh water make-up ponds also would be fenced to prevent entry by land.

Migratory Bird Habitats

Suitable nesting, foraging, and winter habitats for the various migratory bird species consist of one or more of the vegetation types present in the CCPA as discussed in detail in the vegetation sections (Sections 3.14 and 4.14). Estimated disturbance to these various vegetation types from Alternative B are provided on **Table 4.14-13**. An estimated 66.4 acres of surface disturbance would occur within the Rochelle Hills IBA. Impacts to avian species that use habitats within the IBA would be similar to those listed under Types of Impacts Common to All Species in Section 4.18.1.1. However, these impacts would be greater in high quality habitats present in the IBA than in other habitats. Surface disturbance and habitat fragmentation resulting from the construction of new well pads, roads, pipelines, and powerlines would be the same as for terrestrial wildlife as presented in **Table 4.18-5**.

Migratory Bird Species

The types of potential impacts to migratory bird species and habitats would be the same as those described for Impacts Common to All Species (Section 4.18.1.1) and Impacts to Migratory Birds from Alternative A (Section 4.18.6.1).

Table 4.18-13 Estimated Disturbance to Migratory Bird Species Habitats from Alternative B

Habitat Type	Habitat in CCPA (acres)		Habitat in Migratory Bird Analysis Area	
	Total	Estimated Disturbance[1]	Total Acres	Percent Impacted
Grassland	995,706	34,***850***	1,370,493	***2.55***
Sagebrush shrubland	330,463	11,5***67***	531,791	2.1***8***
Barren/sparsely vegetated	126,016	4,41***1***	180,050	2.45
Conifer forest	11,239	394	20,266	1.94
Agriculture	10,274	360	31,966	1.13
Developed	10,320	362	27,070	1.34
Wetland/riparian	9,108	3***19***	21,593	***1.48***
Mixed shrubland	7,417	2***60***	19,916	1.***31***
Open water	1,838	0	2,970	0
Total	**1,502,381**	**52,*523***	**2,206,155**	**2.3*8***

[1] Due to the programmatic nature of this EIS, actual disturbance values were not available; therefore, a quantitative estimate was calculated as a percentage of the new surface disturbance for Alternative B approximately (3.5 percent) multiplied by the acres of habitat within the CCPA.

Raptors

If exceptions are granted to timing limitation stipulations for raptor nests, it potentially would disrupt breeding activities and success for species that inhabit the CCPA and increase the likelihood of a take occurring from oil and gas activities. These impacts likely would result in reduced nesting attempts and breeding success for multiple species, reduced recruitment, and incremental reductions in overall local population health and sustainability. ***The level of impact would be determined on a site-specific basis and depend on factors such as topography, vegetation community, and intensity of development activities.*** Long-term changes in migratory bird species occurrence and diversity could occur as a result of changes in habitat composition, quality, continuity, and breeding success.

The types of impacts to raptor species and habitats under Alternative B would be the same as those described under Alternative A, but would occur at a greater magnitude relative to the increase in oil field development. **Table 4.18-14** presents estimated disturbance to habitat for raptor species from Alternative B. Other species-specific information pertinent to the CCPA (i.e., number of nests/roosts and definition and acres of potential habitat) would be the same under Alternative B as presented for Alternative A on **Table 4.18-11**.

Table 4.18-14 Estimated Impacts to Raptor Species and Habitats from Alternative B

Species Common Name	Potential Habitat in CCPA[1] (acres)	Estimated Impacts to Potential Habitat in CCPA[2] (acres)
American kestrel	26,799	***938***
Bald eagle[4]	9,108	***319***
Burrowing owl[3,4]	1,469,876	***51,446*** Prairie dog colonies and small mammal burrows required for nesting
Cooper's hawk	30,621	***1,072***
Ferruginous hawk[4]	1,469,876	***51,446*** Black-tailed prairie dog colonies, cliff and rock outcrop habitat required for nesting
Flammulated owl[4]	11,239	***393***
Golden eagle[4]	1,469,876	51,564 Cliff ***and tree*** habitat required for nesting
Great gray owl[4]	***11,239***	***393***
Great horned owl	368,501	***12,898*** Mature trees required for nesting
Long-eared owl	30,621	***1,072*** Trees, tall shrubs, or shelterbelts required for nesting
Merlin[4]	1,026,327	***35,921***
Northern goshawk[4]	11,239	***393*** Specific forest microhabitats required for nesting
Northern harrier[3]	19,382	***678***
Osprey	9,108	***319***
Peregrine falcon[4]	1,478,984	***51,764*** Cliff habitat required for nesting

Table 4.18-14 Estimated Impacts to Raptor Species and Habitats from Alternative B

Species Common Name	Potential Habitat in CCPA[1] (acres)	Estimated Impacts to Potential Habitat in CCPA[2] (acres)
Prairie falcon[4]	1,469,876	***51,446*** Cliff habitat required for nesting
Red-tailed hawk	1,352,968	***47,354***
Sharp-shinned hawk	30,621	***1,072***
Short-eared owl[4]	1,015,088	***35,528***
Swainson's hawk[4]	1,343,860	***47,035***

[1] Based on associated habitat descriptions found in **Tables 3.18-4** and **3.18-5**.

[2] Estimated values calculated as approximately 3.5 percent of potential habitat present in CCPA.

[3] The species is identified as special status (BLM and/or USFS Sensitive).

[4] The species is identified as a sensitive species (BCC or SGCN).

Source: BLM 2002a.

Under all land use plan amendment Options considered within Alternative B the operators propose to develop 1,500 well pads over a ten-year period. Since the specific location of the well pads is not known at this time, there is a potential for a well pad to be located within the typical 0.5-mile timing limit stipulation buffer for any of the 1,475 nests currently mapped within the CCPA (see Section 3.18). However, since non-eagle raptor nests and their timing stipulation buffers cover a limited portion of the CCPA it is likely that only a portion of the 1,500 well pads have the potential to be located within a nest buffer. The BLM developed an estimate of the portion of well pads within nest buffers by placing the 1,500 well pads evenly in a grid pattern throughout the entirety of the CCPA area and overlaying this grid with non-eagle raptor nest buffers. Using this grid as a basis for spatial analysis the BLM estimated that 497 well pads would fall within stipulation buffers. Of these, 4 percent (or 20 well pads) would be on USFS land and 36 percent (or 179 well pads) would be on private or state land.

As summarized in Section 1.4.3 the BLM does not have management authority over the entire CCPA. Approximately 4 percent (20 of the 1,500) well pads of the CCPA is managed by the USFS. While the USFS LRMP includes provisions for stipulation relief (exceptions) the USFS does not typically grant exceptions. Hence, raptor timing limit stipulations would be applied to the USFS portion of the CCPA under any of the options considered in this analysis.

Approximately 60 percent (298 of the 497 well pads potentially located within nest buffers) of the CCPA (6 percent BLM surface plus 54 percent split estate; see section 1.4.3) is under BLM management authority. Based on the analysis of nest use rate presented in Section 3.18.2.5 (Raptor Species subsection) only a portion of nests would be expected to be occupied at any given time. Therefore, the BLM estimates that 33 percent of the 298 well pads under BLM management authority, or 98 well pads, would be expected to be located within the stipulation buffer for an occupied nest.

Approximately 36 percent of the CCPA (179 well pads potentially located within nest buffers) is not under BLM management authority. These lands are comprised of private and state surface estate with non-federal minerals where BLM's raptor timing stipulations do not apply. Therefore, none of the Options analyzed below provide for the application of raptor stipulations for this portion of the CCPA.

While the total nests impacted were quantified based on the available historic nest data, there are unknowns associated with the historic data that could change the actual number of nests impacted. The dataset used to approximate impacts was developed by multiple sources (BLM, other governmental agencies, operators, and private consultants) in multiple areas within the CCPA. There has not been a comprehensive survey for the entirety of the CCPA creating the likelihood that unidentified nests occur within the CCPA. The quantitative estimate of well pad/nest buffer impact assumed equal spacing of the proposed 1,500 well pads throughout the CCPA area. Depending upon the actual placement and spacing of well pads it may be that the number of nests impacted could increase or decrease.

The following subsections discuss the relative impact of each option for the 60 percent of the CCPA under BLM management authority.

Option 1

Under this Option the BLM would not amend Decision #4047 of the RMP and the raptor stipulations would apply to any raptor nest in the CCPA. Exceptions would be granted on a case by case basis. When requesting an exception, operators typically provide monitoring data to show the location of nearby raptor nests along with an APD. The BLM then would apply a timing limit stipulation to non-eagle raptor nests regardless of usage or occupancy.

Option 2

Under this raptor amendment, timing limit stipulations would not apply to non-eagle raptor nests within the CCPA. As a result, development could occur at anytime and anywhere without limitations associated with non-eagle raptor nests in the 60 percent of the CCPA under BLM jurisdiction. Well construction and drilling activity could be initiated during the nesting period for a non-eagle raptor under this option. In addition, there would be no limitation on the number of nests impacted by drilling activity. Portions of the CCPA have not been surveyed for non-eagle raptor nests and additional surveys would not take place under this option resulting in impacts to an unknown number of nests. Given that drilling would occur through a timing limitation and within buffer stipulations for non-eagle raptor nests without application of any additional mitigative measures, this option potentially would result in effects such as disruption of breeding activities and success, reduced nesting attempts and breeding success for multiple species, reduced recruitment, and incremental reductions in overall local population health and sustainability.

The BLM notes that this option requires modification of oil and gas leases to remove timing limit stipulations from non-eagle raptors. While the BLM is able to analyze the impacts of this option in this EIS, the modification of leases would require an additional step that would be completed under the rules and guidelines for lease modification.

Option 3

Under this option, the timing limit stipulations for non-eagle raptors would not apply within the CCPA if the applicant applies conservation measures set forth in Appendix G1. Well pad construction and drilling activity would not be initiated during timing stipulations for an active nest but could be initiated for an occupied nest that is not active (i.e., no eggs or chicks). Drilling activity initiated prior to a stipulation period would continue even if a nest becomes active during the stipulation period. Allowing for continuous drilling would provide a more

constant level of disturbance for non-eagle raptors, allowing for habituation to the drilling activity. While some non-eagle raptors may habituate to drilling activity, the birds may still be stressed by the ongoing activity. Under this option raptor nesting survey data would be collected on a voluntary basis, likely resulting in inconsistent implementation of nest surveys. The annual meeting between the BLM and operators would occur after the drilling season and may not provide for BLM review of plans before implementation, resulting in a loss of opportunity to avoid impacts to known nests.

Under this option there would be no limit on the number of nests for which stipulation relief would be applied. The mitigation provided in the features under Option 3 contain uncertainty regarding their effectiveness in reducing impacts to known active nests as well as uncertainty in how many unknown nests could be impacted.

Option 4

Under Option 4 the process for allowing relief from timing limit stipulations would require the implementation of a raptor management plan. The site-specific raptor management plans would present a framework for identifying and implementing actions to avoid and minimize impacts to migratory birds. This adaptive management plan would provide the BLM flexibility to accommodate for future drilling technology or updates in raptor mitigation strategies. Since the specifics of this is currently unknown, it is assumed that this option would provide at least the same level of protection to non-eagle raptors as Option 3. There is a potential that this option could provide a greater level of protection than Option 3 but this would not be known until development of a site-specific raptor management plan.

Option 5

Under Option 5 the process for allowing relief from timing limit stipulations would require the implementation of a migratory bird conservation plan. This plan would be developed in coordination with the USFWS and would provide a framework for identifying and implementing actions to avoid and minimize impacts to migratory birds. Since the specifics of this is currently unknown, it is assumed that this option would be provide at least the same level of protection to non-eagle raptors as Option 3. There is the potential for this option to provide a greater level of protection than Option 3 but this would not be known until development of a migratory bird conservation plan.

Option 6

Under this option, operators would receive timing limit stipulation relief for 98 well pads within the CCPA if the applicant applies conservation measures set forth in Appendix G4. Well pad construction and drilling activity would not be initiated during timing stipulations for an occupied nest. Drilling activity initiated prior to a stipulation period for 98 well pads would continue even if a nest becomes occupied during the stipulation period. Allowing for continuous drilling would provide a more constant level of disturbance for non-eagle raptors, allowing for habituation to the drilling activity. While some non-eagle raptors may habituate to drilling activity, the birds may still be stressed by the ongoing activity. Under this option raptor nesting surveys would be required, as opposed to voluntary, allowing for consistent implementation of nest surveys and the certainty that data would be collected to identify new nests. The annual meeting between the BLM and operators would occur before the drilling season and allow for the BLM to review and verbally approve timing limit stipulation relief before implementation, thereby providing opportunities to avoid impacts to known nests.

Under this option there is an upper limit to the number of nests for which stipulation relief would be applied. The mitigation required by the features under Option 6 would provide greater certainty regarding the collection of data and confirmation of effectiveness in reducing impacts to known occupied nests as well as reduce uncertainty in how many unknown nests could be impacted.

Migratory Game Birds and Waterfowl

The types of impacts to migratory birds and waterfowl under Alternative B would be the same as described under Alternative A, but would occur at a greater magnitude relative to the increase in oil field development.

Waterfowl

Under Alternative B, approximately 384 acres of waterfowl habitat (open water and wetland/riparian habitat) would be impacted by surface disturbance (i.e., 3.5 percent of the available 10,946 acres of suitable habitat in the CCPA). ***Under Alternative B, new groundwater withdrawals in this area could result in flow reductions in the North Platte River and some of its tributaries, which could reduce the amount of available habitat for these species. Under the Platte River Recovery Implementation Program, all new water sources are subject to limitations, and mitigation could be required to offset new depletions to benefit species that utilize associated habitats.*** Similar to Alternative A, the BLM Casper RMP and TBNG LRMP require protection of riparian habitats; therefore, impacts to these habitats would be less on BLM and USFS surface estate and split estate lands relative to private lands within the CCPA.

BCC and Avian SGCN

The types of impacts to BCC and avian SGCN under Alternative B would be the same as described under Alternative A, but would occur at a greater magnitude relative to the increase in oil field development. **Table 4.18-15** presents estimated disturbance impacts to BCC and avian SGCN habitats in the CCPA from Alternative B. Other species-specific information specific to the CCPA (i.e., definition and acres of potential habitat) would be the same under Alternative B as presented for Alternative A on **Table 4.18-12**. ***Impacts to BCC and avian SGCN would be the same as discussed for migratory birds in relation to the five LUP non-eagle raptor amendment options. Potential disturbance impacts to non-eagle raptor species is provided in Table 4.18-14. The lowest level of impact to non-eagle raptors would occur under Option 1, whereas the highest level of non-eagle raptor impact would occur under Option 2. The impacts to non-eagle raptors under Option 3, 4, 5, and 6 would be less than those for Option 2 but greater than those for Option1.***

Table 4.18-15 Estimated Disturbance to Non-raptor BCC and Avian SGCN Habitats from Alternative B

Species Common Name	Potential Habitat in CCPA[1] (acres)	Estimated Impacts to Potential Habitat in CCPA[2] (acres)
American bittern	9,108	***319***
American white pelican	9,108	***319***
Ash-throated flycatcher	11,239	***394***
Baird's sparrow	995,706	***34,850***
Black tern	9,108	***319***
Black-billed cuckoo	9,108	***319***
Black-crowned night-heron	9,108	***319***

Table 4.18-15 Estimated Disturbance to Non-raptor BCC and Avian SGCN Habitats from Alternative B

Species Common Name	Potential Habitat in CCPA[1] (acres)	Estimated Impacts to Potential Habitat in CCPA[2] (acres)
Black rosy-finch	1,121,722	***39,261***
Black-throated gray warbler	11,239	***394***
Blue-gray gnatcatcher	20,347	***713***
Blue grosbeak	9,108	***319***
Bobolink	995,706	***34,850***
Brewer's sparrow	330,463	***11,567***
Calliope hummingbird	20,347	***713***
Canyon wren	126,016	***4,411***
Caspian tern	9,108	***319***
Cattle egret	19,382	***679***
Chestnut-collared longspur	995,706	***34,850***
Clark’s grebe	9,108	***319***
Clark’s nutcracker	11,239	***394***
Common loon	9,108	***319***
Common nighthawk	1,344,825	***47,069***
Common yellowthroat	9,108	***319***
Dickcissel	995,706	***34,850***
Forster’s tern	9,108	***319***
Franklin’s gull	19,382	***678***
Grasshopper sparrow	995,706	***34,850***
Great blue heron	9,108	***319***
Greater sage-grouse	330,463	***11,566***
Harlequin duck	9,108	***319***
Horned grebe	9,108	***319***
Lewis’s woodpecker	20,347	***712***
Loggerhead shrike	357,262	***12,504***
Long-billed curlew	1,015,088	***35,528***
MacGillivray’s warbler	9,108	***319***
Marbled godwit	9,108	***319***
McCown's longspur	995,706	***34,850***
Mountain plover	1,121,722	***39,260***
Pinyon jay	11,239	***394***
Pygmy nuthatch	11,239	***394***
Red crossbill	11,239	***394***
Red-eyed vireo	9,108	***319***
Red-headed woodpecker	20,347	***713***

Table 4.18-15 Estimated Disturbance to Non-raptor BCC and Avian SGCN Habitats from Alternative B

Species Common Name	Potential Habitat in CCPA[1] (acres)	Estimated Impacts to Potential Habitat in CCPA[2] (acres)
Rufous hummingbird	1,023,470	***35,821***
Sagebrush sparrow	330,463	***11,567***
Sage thrasher	337,880	***11,826***
Snowy egret	9,108	***319***
Trumpeter swan	9,108	***319***
Upland sandpiper	995,706	***34,850***
Virginia rail	9,108	***319***
Virginia's warbler	18,656	***653***
Western grebe	9,108	***319***
White-faced ibis	9,108	***319***
Williamson's sapsucker	11,239	***394***
Willow flycatcher	9,108	***319***
Yellow-billed cuckoo (eastern)	16,525	***579***

[1] Based on associated habitat descriptions found in **Table 3.18-5**.

[2] Estimated values calculated as approximately 3.5 percent of potential habitat present in CCPA.

Forest and Woodland Species

The types of impacts to forest and woodland species under Alternative B would be the same as described under Alternative A, but would be greater in magnitude relative to the increase in oil field development. Under Alternative B, an estimated 394 acres (approximately 3.5 percent) of the available 11,239 acres of suitable conifer forest habitat within the CCPA would be disturbed. Many of the 21 forest species described in Section 3.18.2, Migratory Bird Species, use other habitats to varying degrees as described in **Table 3.18-5** and would be subjected to additional impacts where they would occur in these other habitat types. However, impacts would be disproportionately greater to 17 of these species that primarily are associated with forest habitat.

Grassland Species

The types of impacts to grassland species under Alternative B would be the same as described under Alternative A, but would be greater in magnitude relative to the increase in oil field development. An estimated 34,***850*** acres (approximately 3.5 percent) of the available 995,706 acres of suitable grassland habitat within the CCPA would be disturbed under Alternative B. Many of the 22 grassland species described in Section 3.18.2, Migratory Bird Species, use other habitats to varying degrees as described in **Table 3.18-5** and would be subjected to additional impacts where they would occur in these other habitat types. However, impacts would be disproportionately greater to 15 of these species that primarily are associated with grassland habitat.

Sagebrush Shrubland Species

The types of impacts to sagebrush shrubland species under Alternative B would be the same as described under Alternative A, but would be of greater magnitude relative to the increase in oil field development. Under Alternative B, an estimated 11,5***67*** acres (approximately 3.5 percent) of the available 330,463 acres of suitable sagebrush shrubland habitat within the CCPA would be disturbed. Many of the 12 sagebrush shrubland species described in Section 3.18.2, Migratory Bird Species, use other habitats to varying degrees as described in **Table 3.18-5** and would be subjected to additional impacts where they would occur in these other habitat types. However, impacts would be disproportionately greater to four of these species that primarily are associated with sagebrush shrubland habitat.

Wetland/Riparian Species

The types of impacts to wetland and riparian species under Alternative B would be the same as described under Alternative A, but would be greater in magnitude relative to the increase in oil field development. Under Alternative B, an estimated 3***19*** acres (approximately 3.5 percent) of the available 9,108 acres of suitable wetland and riparian habitat within the CCPA would be disturbed. Many of the 42 wetland and riparian species described in Section 3.18.2, Migratory Bird Species, use other habitats to varying degrees as described in **Table 3.18-5** and would be subjected to additional impacts where they would occur in these other habitat types. However, impacts would be disproportionately greater in riparian and wetland to 33 of these species that primarily are associated with wetland and riparian habitat. Similar to Alternative A, the BLM Casper RMP and TBNG LRMP require protection of riparian habitats; therefore, disturbance to these habitats would be less on BLM and USFS surface estate within the CCPA.

Species Associated with Prairie Dog Colonies

The types of impacts under Alternative B to species associated with prairie dog colonies, including mountain plover, burrowing owl, ferruginous hawk, and golden eagle, would be the same as described under Alternative A. Similar to Alternative A, management direction in both the BLM Casper RMP and the TBNG LRMP provide protective measures that would minimize impacts to prairie dog colonies on BLM and USFS surface estate by requiring avoidance of prairie dog colonies and the establishment of new prairie dog colonies when applicable. However, additional impacts to the species still would occur, especially on non-federal lands. Impacts to prairie dog colonies would include surface disturbance to an estimated 55***4*** acres, or 3.5 percent of the prairie dog colonies within the CCPA and 1.14 percent of the existing 48,672 acres of known colonies within the analysis area.

4.18.2.3 Mitigation and Mitigation Effectiveness – Alternative B

Under Alternative B, the following additional mitigation measures would be applied to further minimize impacts to migratory birds and habitats.

MIG-1 When surface-disturbing activities must occur during the avian breeding season (February 1 to July 31), a qualified biologist will conduct nest searches no more than 7 days prior to these activities. ***Occupied active*** nests will be identified and protected in accordance with the applicable BLM, USFS, USFWS, and/or the WGFD guidance.

MIG-2 Disturbance within portions of the CCPA that are identified by federal or state wildlife management agency biologists as located in forest and woodland habitat areas will be avoided. ***At the time of development, the retention of snags, dead-topped trees, and live trees with cavities will be left in place if a safety concern is not present.***

The proposed mitigation measure MIG-1 would protect migratory birds, including raptors, during the breeding season, exclusive of possible exceptions that may be granted for raptor nests. Raptor nests must be identified prior to surface disturbing activities for exceptions to be requested and granted. Natural areas would be maintained between human activity and around the active nest (landscape buffer). Spatial avoidance buffers and seasonal restrictions would be applied ***during the APD***

permitting process as required by applicable land and resource management plan stipulations ***or in consultation with the USFWS under the MBTA and BGEPA*** unless exceptions are granted for raptor nests. **Table 4.18.16** presents raptor nest seasonal and spatial buffer stipulations according to the BLM Casper RMP and the USFS TBNG LRMP. ***These seasonal and spatial buffers may differ under USFWS guidance.***

Table 4.18-16 Raptor Seasonal and Spatial Buffer Stipulations

BLM Casper RMP	USFS TBNG LRMP
Avoid surface disturbance or occupancy within a 0.25-mile buffer for the following species: red-tailed hawk, Swainson's hawk, American kestrel, osprey, great horned owl, long-eared owl, northern saw-whet owl, barn owl, western screech owl. Avoid surface disturbance or occupancy within a 0.5-mile buffer of all other raptor nests. The seasonal restriction will be February 1 to July 31, or until young birds have fledged. Activities or surface use will not be allowed in special status raptor nesting habitats from February 1 through July 31 within certain areas, to be determined by the BLM authorized officer. Surface development is prohibited on any area 0.5 to 1 mile of known or discovered bald eagle nests. No surface occupancy or development is allowed near bald eagle roosts. To protect bald eagle feeding areas, surface disturbing activities are prohibited within 0.25 mile of the North Platte River on a year-round basis and within 0.5 mile from November 1 to March 31.	To help prevent abandonment, reproductive failure or nest destruction, prohibit development of new facilities within the minimum distances (line of sight) of active raptor nests and winter roost sites as follows: • Bald eagle nest – 1-mile buffer from February 1 through July 31 • Bald eagle winter roost – 1-mile buffer from November 1 through March 31 • Golden eagle nest – 0.25-mile buffer from February 1 through July 31 • Merlin nest – 0.25-mile buffer from April 1 through August 15 • Ferruginous hawk nest – 0.25-mile buffer from March 1 through July 31 • Swainson's hawk nest – 0.25-mile buffer from March 1 through July 31 • Burrowing owl nest – 0.25-mile buffer from April 15 through August 31 • Other raptors – 0.125-mile buffer from February 1 through July 31 To help reduce disturbances to nesting and wintering raptors, do not authorize construction (e.g., pipelines, utilities, fencing) or well workover operations for maintenance of oil and gas wells within the minimum distances (line of sight) of active raptor nests and winter roost areas as specified above.

Mitigation measure MIG-2 would reduce fragmentation of forest and woodland habitats and associated impacts to migratory birds. It also would provide habitat for insects, small mammals, and other small prey species, which are hunted by owls, raptors, and other predators.

4.18.2.4 Residual Impacts – Alternative B

Residual impacts are defined as unavoidable adverse impacts to a resource that remain after implementation of proposed mitigation. Implementation of agency stipulations and additional mitigation measures would reduce impacts to migratory bird species and habitats on federal surface and mineral estate, which comprise approximately 64 percent of the CCPA. Approximately ***36*** percent of the CCPA is ***not under BLM management authority***. These lands would not be subject to BLM or USFS wildlife protection measures, as required on agency surface or mineral estate. However, MBTA protections for birds, nests, and eggs are applicable regardless of land ownership. Additionally, approximately 7 percent of the CCPA is Wyoming state land, and state mitigation measures would be applied to reduce impacts in those areas.

Under Alternative B, agency reclamation standards would be implemented to BLM and USFS surface estate only, which comprise approximately 10 percent of the CCPA. Within the CCPA, 83 percent is private surface estate on which reclamation standards would be specified in private landowner agreements. Therefore, an increased potential exists for residual impacts to migratory birds and habitat on state and private surface estate.

Residual effects to raptors would vary depending on the raptor amendment option. All non-eagle raptor amendment options with the exception of Option 1 could result in residual impacts to nesting non-eagle raptors. Depending on land ownership, the types of residual impacts to migratory bird species and their habitats that could remain after the implementation of additional mitigation measures would include:

- Habitat loss, alteration, or fragmentation due to surface disturbance and associated aboveground structures.
- Abandonment of breeding territories/nest sites from increased noise and human presence.
- Increased number of vehicle collisions with individual birds or nests/eggs/juveniles due to the increased number and density of roads.

Alternative B would result in impacts to migratory birds associated with surface disturbance, habitat fragmentation, and human presence. Alternative B includes the potential for ***exceptions to timing limit stipulations*** in the vicinity of ***occupied*** raptor nests. Potential disturbance to nesting raptors would impact local raptor species and populations as a result of nest abandonment, dependent on the drilling schedule for each pad over the course of development. ***Relief from timing limit stipulations*** would not be requested for the remainder of migratory bird nests, which would be protected by MIG-1. and the application of avoidance and minimization mitigation, OG-committed design features and the additional mitigation measures (Section 4.18.2.3).

4.18.2.5 Impacts to Migratory Bird Species from Alternative C

The types of impacts to migratory bird species and habitats under Alternative C would be the same as described under Alternative A and Alternative B. Compared to Alternative B, surface disturbance and related impacts would be reduced under Alternative C because a higher average number of wells would be drilled from each pad (WGFD 2010a). The same number of oil and gas wells (5,000) would be drilled under the same drilling rate (500 wells per year) as Alternative B but under Alternative C there would be only 938 oil and gas well pads (562 less than under Alternative B), which subsequently would reduce the number of production pads, miles of access roads, pipelines, and overhead electrical lines needed (Section 2.5). Alternative C would require 376 miles (1,821 acres) each for oil gathering and water supply/disposal pipelines that would not be required under Alternative B. Surface disturbance for Alternative C would be 37,267 acres (**Table 2.5-1**), which would be 15,400 acres less than Alternative B.

For detail regarding other activities specific to Alternative C, see Section 2.5. Under Alternative C, other activities that would change the impacts to wildlife relative to those associated with Alternative B include the following:

- A single water supply and disposal pipeline could be used for water supply and the pumping direction could be reversed after all wells were completed to pump water back to the facilities for disposal. This process would reduce the number of pipelines required for production.
- Upon completion of construction activities, all disturbed areas not necessary for production would undergo interim reclamation to minimize environmental impacts. On federally managed lands and private lands above federal minerals, interim reclamation would be required to meet the BLM or USFS requirements for suitable wildlife habitat. This would equate to approximately 65 percent of the CCPA.

- Timing limit stipulations would continue to be required as outlined in the BLM Casper RMP and USFS TBNG LRMP (**Table 2.5-2**). This would mean that exceptions to timing limit stipulations would not be granted on approximately 15 to 20 percent of the CCPA, which would eliminate the impacts described under Alternative B ***and ensure that the majority of individuals within a species would continue to occupy an area. Potential impacts related to adhering to timing limitation stipulations could include longer development timelines for a lease area, delayed interim reclamation of temporary disturbance, and an increased presence of vehicular traffic in an area***.

Migratory Bird Habitats

Suitable nesting, foraging, and winter habitats for the various migratory bird species consist of one or more of the vegetation types present in the CCPA as discussed in detail in Sections 3.14 and 4.14, Vegetation. Estimated disturbance from Alternative C to these various vegetation types are provided on **Table 4.14-17**. An estimated 47.5 acres of surface disturbance would occur within the Rochelle Hills IBA. Surface disturbance and habitat fragmentation resulting from the construction of new well pads, roads, pipelines, and powerlines are shown in **Table 4.18-5**.

Table 4.18-17 Estimated Disturbance to Migratory Bird Species Habitats from Alternative C

Habitat Type	Habitat in CCPA (acres)		Habitat in Migratory Bird Analysis Area	
	Total	Estimated Disturbance[1]	Total Acres	Percent Impacted
Grassland	995,706	24,***893***	1,370,493	***1.80***
Sagebrush shrubland	330,463	8,***262***	531,791	1.5***5***
Barren/sparsely vegetated	126,016	3,1***51***	180,050	1.7***5***
Conifer forest	11,239	2***81***	20,266	1.38
Agriculture	10,274	25***7***	31,966	0.80
Developed	10,320	25***8***	27,070	0.95
Wetland/riparian	9,108	2***28***	21,593	1.***05***
Mixed shrubland	7,417	19***86***	19,916	***0.99***
Open water	1,838	0	2,970	0
Total	**1,502,381**	**37,*528***	**2,206,155**	**1.*70***

[1] Due to the programmatic nature of this EIS, actual disturbance values were not available; therefore, a quantitative estimate was calculated as a percentage of the new surface disturbance for Alternative C (2.5 percent) multiplied by the acres of habitat within the CCPA.

Migratory Bird Species

Raptors

The types of impacts to raptor species and habitats under Alternative C would be the same as those described under Alternatives A and B; however, impacts would be lower in magnitude because a greater number of wells would be drilled from each pad, resulting in fewer well pads (WGFD 2010b). **Table 4.18-18** presents estimated disturbance to habitat for raptor species from Alternative C. Other species-specific information pertaining to the CCPA (i.e., number of nests/roosts and definition and acres of potential habitat) would be the same under Alternative C as presented for Alternative A on **Table 4.18-11**.

Table 4.18-18 Estimated Impacts to Raptor Species and Habitats from Alternative C

Species Common Name	Potential Habitat in CCPA[1] (acres)	Estimated Impacts to Potential Habitat in CCPA[2] (acres)
American kestrel	26,799	***670***
Bald eagle[4]	9,108	***228***
Burrowing owl[3,4]	1,469,876	***36,747*** Prairie dog colonies and small mammal burrows required for nesting
Cooper's hawk	30,621	***766***
Ferruginous hawk[4]	1,469,876	***36,747*** Black-tailed prairie dog colonies, cliff and rock outcrop habitat required for nesting
Flammulated owl[4]	11,239	***281***
Golden eagle[4]	1,469,876	***36,747*** Cliff ***and tree*** habitat required for nesting
Great gray owl[4]	11,239	***281***
Great horned owl	368,501	***9,213*** Mature trees required for nesting
Long-eared owl	30,621	***766*** Trees, tall shrubs, or shelterbelts required for nesting
Merlin[4]	1,026,327	***25,658***
Northern goshawk[4]	11,239	***281*** Specific forest microhabitats required for nesting
Northern harrier[3]	19,382	***485***
Osprey	9,108	***228***
Peregrine falcon[4]	1,478,984	***36,975*** Cliff habitat required for nesting
Prairie falcon[4]	1,469,876	***36,747*** Cliff habitat required for nesting
Red-tailed hawk	1,352,968	***33,824***
Sharp-shinned hawk	30,621	***766***
Short-eared owl[4]	1,015,088	***25,377***
Swainson's hawk[4]	1,343,860	***33,597***

[1] Based on associated habitat descriptions found in **Tables 3.18-4** and **3.18-5**.

[2] Estimated values calculated as approximately 2.5 percent of potential habitat present in CCPA.

[3] The species is identified as special status (BLM and/or USFS Sensitive).

[4] The species is identified as a sensitive species (BCC or SGCN).

Source: BLM 2002a.

Migratory Game Birds and Waterfowl

The types of impacts to migratory birds and waterfowl under Alternative C would be the same as described under Alternative B; however, the impacts would be lower in magnitude because a greater number of wells would be drilled from each pad, resulting in fewer pads.

Waterfowl

Under Alternative C approximately 244 acres of waterfowl habitat (wetland/riparian habitat) would be impacted by surface disturbance (i.e., 2.5 percent of the available 9,108 acres of suitable habitat in the CCPA). Similar to Alternative A and Alternative B, the BLM Casper RMP and TBNG LRMP require protection of riparian habitats; therefore, disturbance to these habitats would be less on BLM and USFS surface estate within the CCPA. ***As described under Alternative B, any new water depletions in the North Platte River Basin would be subject to limitations under the Platte River Recovery Implementation Program.***

BCC and Avian SGCN

The types of impacts to BCC and avian SGCN under Alternative C would be the same as described under Alternative B; however, the impacts would be lower in magnitude because a greater number of wells would be drilled from each pad, resulting in fewer pads. **Table 4.18-19** presents estimated disturbance impacts to BCC and avian SGCN habitats in the CCPA from Alternative C. Other species-specific information pertaining to the CCPA (i.e., definition and acres of potential habitat) would be the same under Alternative C as presented for Alternative A, on **Table 4.18-12**.

Table 4.18-19 Estimated Disturbance to Non-raptor BCC and Avian SGCN Habitats from Alternative C

Species Common Name	Potential Habitat in CCPA[1] (acres)	Estimated Impacts to Potential Habitat in CCPA[2] (acres)
American bittern	9,108	2***28***
American white pelican	9,108	2***28***
Ash-throated flycatcher	11,239	2***81***
Baird's sparrow	995,706	24,***893***
Black tern	9,108	2***28***
Black-billed cuckoo	9,108	2***28***
Black-crowned night-heron	9,108	2***28***
Black rosy-finch	1,121,722	2***8,044***
Black-throated gray warbler	11,239	2***81***
Blue-gray gnatcatcher	20,347	5***09***
Blue grosbeak	9,108	2***28***
Bobolink	995,706	24,***893***
Brewer's sparrow	330,463	8,***262***
Calliope hummingbird	20,347	5***09***
Canyon wren	126,016	3,1***51***
Caspian tern	9,108	2***28***
Cattle egret	19,382	4***85***
Chestnut-collared longspur	995,706	24,***893***

Table 4.18-19 Estimated Disturbance to Non-raptor BCC and Avian SGCN Habitats from Alternative C

Species Common Name	Potential Habitat in CCPA[1] (acres)	Estimated Impacts to Potential Habitat in CCPA[2] (acres)
Clark's grebe	9,108	2***28***
Clark's nutcracker	11,239	2***81***
Common loon	9,108	2***28***
Common nighthawk	1,344,825	33,***621***
Common yellowthroat	9,108	2***28***
Dickcissel	995,706	24,***893***
Forster's tern	9,108	2***28***
Franklin's gull	19,382	4***85***
Grasshopper sparrow	995,706	24,***893***
Great blue heron	9,108	2***28***
Greater sage-grouse	330,463	See Section 4.18.3
Harlequin duck	9,108	2***28***
Horned grebe	9,108	2***28***
Lewis's woodpecker	20,347	5***09***
Loggerhead shrike	357,262	8,***932***
Long-billed curlew	1,015,088	2***7,628***
MacGillivray's warbler	9,108	2***28***
Marbled godwit	9,108	2***28***
McCown's longspur	995,706	24,***893***
Mountain plover	1,121,722	2***8,043***
Pinyon jay	11,239	2***81***
Pygmy nuthatch	11,239	2***81***
Red crossbill	11,239	2***81***
Red-eyed vireo	9,108	2***28***
Red-headed woodpecker	20,347	5***09***
Rufous hummingbird	1,023,470	25,***587***
Sagebrush sparrow	330,463	8,***262***
Sage thrasher	337,880	8,***447***
Snowy egret	9,108	2***28***
Trumpeter swan	9,108	2***28***
Upland sandpiper	995,706	24,***893***
Virginia rail	9,108	2***28***
Virginia's warbler	18,656	4***67***
Western grebe	9,108	2***28***
White-faced ibis	9,108	2***28***

Table 4.18-19 Estimated Disturbance to Non-raptor BCC and Avian SGCN Habitats from Alternative C

Species Common Name	Potential Habitat in CCPA[1] (acres)	Estimated Impacts to Potential Habitat in CCPA[2] (acres)
Williamson's sapsucker	11,239	2***81***
Willow flycatcher	9,108	2***28***
Yellow-billed cuckoo (eastern)	16,525	4***14***

[1] Based on associated habitat descriptions found in **Table 3.18-5**.

[2] Estimated values calculated as approximately 2.5 percent of potential habitat present in CCPA.

Forest and Woodland Species

The types of impacts to forest and woodland species under Alternative C would be the same as described under Alternative B; however, the impacts would be lower in magnitude because a greater number of wells would be drilled from each pad, resulting in fewer pads. Under Alternative C, an estimated 2***81*** acres (approximately 2.5 percent) of the available 11,239 acres of suitable conifer forest habitat within the CCPA would be disturbed. Many of the 21 forest and woodland species described in Section 3.18.2, Migratory Bird Species, use other habitats to varying degrees as described in **Table 3.18-5** and would be subjected to additional impacts where they would occur in these other habitat types. However, impacts would be disproportionately greater to 17 of these species that primarily are associated with forest habitat.

Grassland Species

The types of impacts to grassland species under Alternative C would be the same as described under Alternative B; however, the impacts would be lower in magnitude because a greater number of wells would be drilled from each pad, resulting in fewer well pads. An estimated 24,***893*** acres (approximately 2.5 percent) of the available 995,706 acres of suitable grassland habitat within the CCPA would be disturbed under Alternative C. Many of the 22 grassland species described in Section 3.18.2, Migratory Bird Species, use other habitats to varying degrees as described in **Table 3.18-5** and would be subjected to additional impacts where they would occur in these other habitat types. However, impacts would be disproportionately greater to 15 of these species that primarily are associated with grassland habitat.

Sagebrush Shrubland Species

The types of impacts to sagebrush shrubland species under Alternative C would be the same as described under Alternative B; however, the impacts would be lower in magnitude because a greater number of wells would be drilled from each pad, resulting in fewer pads. Under Alternative C, an estimated 8,***262*** acres (approximately 2.5 percent) of the available 330,463 acres of suitable sagebrush shrubland habitat within the CCPA would be disturbed. Each of the three sagebrush shrubland species described in Section 3.18.2, Migratory Bird Species, uses other habitats to varying degrees as described in **Table 3.18-5** and would be subjected to additional impacts where they would occur in these other habitat types. However, impacts to these species would be disproportionately greater in sagebrush shrubland habitats.

Wetland/Riparian Species

The types of impacts to wetland/riparian species under Alternative C would be the same as described under Alternative B; however, the impacts would be lower in magnitude because a greater number of wells would be drilled from each pad, resulting in fewer pads. Under Alternative C, an estimated 2***28*** acres (approximately 2.5 percent) of the available 9,108 acres of suitable riparian and wetland habitat within the CCPA would be disturbed. Many of the 42 wetland and riparian species described in Section 3.18.2, Migratory Bird Species, use other habitats to varying degrees as described in **Table 3.18-5** and would be subjected to additional impacts where they would occur in these other habitat types. However, impacts would be disproportionately greater to 33 of these species that primarily are associated with wetland and riparian habitat. Similar to Alternative B, the BLM Casper RMP and TBNG LRMP require protection of riparian habitats; therefore, disturbance to these habitats would be less on BLM and USFS surface disturbance within the CCPA.

Species Associated with Prairie Dog Colonies

The types of impacts under Alternative C to species associated with prairie dog colonies, including mountain plover, burrowing owl, ferruginous hawk, and golden eagle, would be the same as described under Alternative B. Similar to Alternative A and Alternative B, management direction in both the BLM Casper RMP and the TBNG LRMP provide protective measures that would minimize impacts to prairie dog colonies on BLM and USFS surface estate by requiring avoidance of prairie dog colonies and the establishment of new prairie dog colonies when applicable . However, additional impacts to the species still would occur, especially on non-federal lands. Impacts to prairie dog colonies would include surface disturbance to an estimated 39***6*** acres (approximately 285 acres less than Alternative B), or 2.5 percent of the CCPA and 0.81 percent of the existing 48,672 acres of known colonies in the analysis area.

4.18.2.6 Mitigation and Mitigation Effectiveness – Alternative C

Mitigation measures and mitigation effectiveness under Alternative C for migratory bird species would be the same as for Alternative B. Exceptions for timing restrictions applied to raptor nests would not be granted. The remainder of the migratory bird nests are protected by MBTA and applicable agency regulations under both Alternative B and Alternative C.

4.18.2.7 Residual Impacts – Alternative C

Residual impacts are defined as unavoidable adverse impacts to a resource that remain after implementation of mitigation measures. As under Alternative B, implementation of BLM and USFS migratory bird stipulations and additional mitigation measures and reclamation standards would reduce impacts to migratory bird species and habitats on BLM and USFS surface and mineral estate, which comprise approximately 64 percent of the CCPA. Approximately 36 percent of the CCPA is privately or state owned land and mineral estate. These lands would not be subject to BLM and USFS wildlife protection measures that would be required on agency surface and mineral estate. However, MBTA protections for birds, nests, and eggs are applicable regardless of land ownership. Additionally, approximately 7 percent of the CCPA is Wyoming state land, and state mitigation measures would be applied to reduce impacts to these areas.

The types of residual impacts under Alternative C would be the same as described for Alternative B; however, the impacts would be less because more wells would be drilled from each pad, resulting in fewer well pads. This would reduce the miles of access roads, pipelines, water pipelines, and overhead electrical lines needed, as well as the acreage encumbered by the well pads compared to Alternative B. Less surface disturbance under Alternative C would result in less habitat loss, alteration, and fragmentation relative to Alternative B. Under Alternative C, multiple timing stipulations would continue to be enforced as outlined in the BLM Casper RMP and USFS LRMP, which would not allow for exceptions to timing limit stipulations in areas where timing limit stipulations are enforced. Seasonal and spatial stipulations would add protection to breeding bird species and populations in the CCPA. The timing of surface disturbance and drilling on private surface estate would be determined during the APD process in coordination with private landowners.

Under Alternative C, the BLM would require reclamation to suitable wildlife habitat for all federal surface and split estate with federal minerals, which would include approximately 64 percent of the CCPA (Section 2.5.2.9) (compared to 10 percent under Alternative B). Under Alternative C, as much as 36 percent of the CCPA has the potential to result in the residual impacts associated with migratory bird habitat loss or alteration based on private land reclamation. This alternative would result in an increase of lands where BLM and USFS reclamation standards would be applied by approximately ***55*** percent compared to Alternative B. The actual amount of habitat to be reclaimed on private mineral estate would be dependent on landowner agreements. Alternative C would result in impact to migratory birds associated with surface disturbance, habitat fragmentation, and human presence.

Impacts identified under Alternative C would be minimized through the application of avoidance and minimization mitigation, OG-committed design features, and the additional mitigation measures (Section 4.18.2.6).

4.18.2.8 Relationship between Local Short-term Uses of the Human Environment and Maintenance and Enhancement of Long-term Productivity

The relationship between local short-term uses of the human environment and maintenance and enhancement of long-term productivity is the disclosure regarding whether the short-term use of a resources associated with a project affects the long-term sustainability of that resource. Construction and production under any of the Project alternatives would result in impacts to the short-term productivity of local migratory bird populations due to habitat loss and the avoidance of suitable habitats. This short-term use may affect long-term productivity of migratory bird species should there be loss, alteration, or fragmentation of habitat; direct mortality of individuals; nest abandonment; or habitat avoidance due to increased levels of human activity. Project construction would impact approximately 0.7 percent of available habitats in the CCPA under Alternative A, 3.5 percent under Alternative B, and 2.5 percent under Alternative C. Migratory bird habitat would be diminished due to local short-term and long-term uses until reclaimed areas return to pre-disturbed vegetation communities. These temporal losses can vary in the time required to return to pre-construction conditions; generally between 5 and 50 years, depending on the vegetation community. Under Alternative B, disturbed private land would be reclaimed according to landowner agreements. Under Alternative C, all disturbed land would be reclaimed to pre-disturbance condition.

4.18.2.9 Irreversible/Irretrievable Commitment of Resources

Irreversible/irretrievable impacts are subsets of unavoidable adverse/residual impacts. Irreversible impacts are those that cannot ever be restored; they would be lost forever. Irretrievable impacts are those for which the resource value would be irretrievably lost until restoration of that resource takes place. Construction and production under any of the Project alternatives would result in the irretrievable commitment of migratory bird species and habitats during the life of the Project as a result of habitat loss, alteration, fragmentation as well as disturbance from noise and human presence. These activities would result in mortalities that would be an irretrievable and irreversible loss of a portion of the population of migratory birds. Interim reclamation under Alternative C would not reduce impacts to wildlife species because it would be minimal and in very close proximity to Project components. After the end of the life of the Project (i.e., following decommissioning), a portion of habitat disturbed during construction and production would be reclaimed on state and federal lands, as required by applicable regulations. The actual amount of area to be reclaimed on private land (approximately 83 percent of the CCPA) generally would be dependent on landowner agreements under Alternative B and as recommended by the BLM and USFS on federal surface estate as well as on private surface underlain by federal mineral estate (approximately 65 percent of the CCPA) under Alternative C.

Depending on the alternative selected, the amount of migratory bird habitat that would be irretrievably committed would range from 10,252 acres Under Alternative A to 52,667 acres under Alternative B. These impacts would range from 0.5 percent to 3.5 percent, respectively, of the migratory bird analysis area. In addition, the amount of migratory bird habitat within the Rochelle Hills IBA that would be irretrievably committed would range from 13.3 acres under Alternative A (0.7 percent of the IBA within the CCPA) to 66.4 acres (3.5 percent of the IBA within the CCPA) under Alternative B.

Under Alternative B decommissioning, reclamation measures would be expected to result in the return of the impacted areas to native habitats on federal lands. On private lands, reclamation would occur according to the landowner agreements, potentially resulting in reclamation that would not return the area to suitable wildlife habitat or even pre-disturbance conditions. Under Alternative C, split estate lands would be required to be reclaimed to suitable wildlife habitat. Some vegetation communities would be expected to return to a native state within a relatively short period of time (i.e., 5 years). Other more sensitive habitats, such as sagebrush shrubland, could require up to 50 years or longer to be reclaimed to native conditions. Regardless of timeframes for vegetation reclamation, migratory bird habitat impacted during construction and production could return to pre-project conditions, thus avoiding any irreversible commitments of migratory bird habitat.

4.18.3 Special Status Wildlife Species

Special status species include those federally listed as threatened, endangered, candidate, and proposed species under the ESA; BLM sensitive and USFS sensitive or MIS; and SGCN. The basis for determining if a species was included in the impact analysis is described in assumptions in the introduction to Section 4.18. A total of 118 special status terrestrial species (37 mammals, 75 birds, and 6 invertebrates) were considered for analysis based on the location of the Project. The full list of special status species initially considered for analysis is contained in **Appendix F**. Of the 118 species considered, 97 have been carried forward for analysis as having a potential to be impacted by the Project. This includes two federally listed endangered species (interior least tern and whooping crane), two federally listed threatened species (Preble’s meadow jumping mouse and piping plover), and one species listed as a non-essential experimental population (black-footed ferret). Platte River species including interior least tern, piping plover, and whooping crane are not known to occur in the CCPA; however, they could be indirectly impacted by water withdrawals in the Platte River basin. The analysis also includes 23 BLM sensitive, 55 USFS sensitive, and 95 SGCN.

4.18.3.1 Impacts to Special Status Wildlife Species from Alternative A – No Action

Under Alternative A, new development would continue within the CCPA as disclosed under previous NEPA documents (Section 2.3.2). Approximately 10,253 acres of new disturbance would occur over a 15-year period from construction of 386 new well pads (including other service well pads), 386 miles of roads, 362 miles of gas-gathering pipelines (181 miles co-located with roads), 362 miles of electrical distribution lines (181 miles co-located with roads), and ancillary facilities (**Table 2.3-3**).

The types of impacts to special status wildlife would be similar to the types of impacts described for all terrestrial wildlife species in Types of Impacts Common to All Species (Section 4.18.1) and migratory birds (Section 4.18.2), including short-term impacts, long-term Impacts, direct and indirect impacts, and impacts relating to habitat fragmentation. However, special status wildlife species typically are more sensitive to disturbance than other more common wildlife species due to factors such as small geographic distributions, avoidance behavior, more specialized niches (common species tend to be generalists), small population size, and low reproductive rates. Therefore, impacts to each special status species has been addressed in each species’ respective section to account for these sensitivities and the unique biological and ecological requirements of each individual species.

Federally Listed Species

Preble's Meadow Jumping Mouse (Federally Threatened)

Impacts to Preble's meadow jumping mouse would be limited to a small area of WYNDD modelled habitat along the North Platter River and La Prele Creek located at the far southern extent of the CCPA. Development under Alternative A would result in surface disturbance to an estimated 31 acres, which would be approximately 0.7 percent of the 4,519 acres of modeled Preble's meadow jumping mouse habitat in the CCPA and approximately 0.4 percent of the 8,403 acres of habitat within the analysis area. Compliance with management direction from the BLM Casper RMP would minimize surface disturbance to riparian habitats on BLM surface estate. In addition the Casper RMP Biological Opinion requires surveys for Preble's meadow jumping mouse or an assessment of the potential for species presence before any potentially disturbing actions would begin.

Potential impacts would be similar to those described for small mammals (Section 4.18.1). Under Alternative A, Preble's meadow jumping mouse would be subjected to increased risk of direct impacts including vehicle crushing, loss of habitat, and habitat fragmentation. A decline in the extent of suitable habitat and habitat fragmentation has been cited by the USFWS as a primary factor impacting Preble's meadow jumping mouse (69 FR 29101). Therefore, additional habitat fragmentation (especially if access roads would cross streams with suitable habitat) and oil and gas field development under Alternative A potentially would impede dispersal movement, and could lead to localized contamination of watercourses. Under Alternative A, habitat fragmentation would increase from 1.90 miles/square mile of existing linear Project components (roads, pipelines, overhead powerlines) to 2.22 miles/square mile in the CCPA (**Table 4.18-2**). If these components were constructed in proximity to potential riparian habitats, this increase in habitat fragmentation would reduce the quality of habitat for Preble's meadow jumping mouse.

Due to compliance with required measures and the already low potential for Preble's meadow jumping mouse to occur in the CCPA, Alternative A ***has potential for minimal adverse impacts*** to Preble's meadow jumping mouse populations in the CCPA.

Black-footed Ferret (Non-essential Experimental Population)

No black-footed ferret populations currently are established in the analysis area. Until recently, the only established experimental population in Wyoming was in the Shirley Basin, which is located approximately 50 miles to the southwest of the CCPA boundary. A new reintroduction site has been added near Meeteetse, approximately 150 miles northwest of the CCPA. The USFWS establishes Areas of Influence to identify areas within which any project should be considered for potential effects to ESA listed species. The analysis area for this Project is outside of the Wyoming Area of Influence for the black-footed ferret.

Although black-footed ferrets are not known to occur in the analysis area, there is potential for the species to be reintroduced in suitable habitats where black-tailed prairie dog colonies exist. As detailed in Section 3.18.3.4, 15,825 acres of habitat for black-tailed prairie dog colonies exist within the CCPA. These areas could offer potential future habitat for reintroduced black-footed ferrets. Development under Alternative A would result in estimated surface disturbance to approximately 108 acres (0.7 percent) of existing prairie dog colonies within the CCPA and 0.22 percent of the existing prairie dog colonies within the entire analysis area (48,672 acres).

Based on the above information indicating there are no black-footed ferrets present in the vicinity of the CCPA combined with the application of USFS Standards protecting suitable habitats in prairie dog colonies within the TBNG, impacts to black-footed ferret would be expected to be minor based on the potential to impact prairie dog colonies located on private surface and mineral estate lands.

Platte River Species (Federally Listed; Interior Least Tern, Piping Plover, Whooping Crane)

The interior least tern, piping plover, and whooping crane are migratory bird species that are not known to occur in the CCPA, but are known to occur in downstream habitats in the North Platte River in Nebraska. It is unlikely that nesting piping plovers, least terns, or whooping crane would be present within the CCPA. Indirect impacts to habitats for these species could occur as a result of development–related water depletions in the Platte River system in Wyoming. However, it is assumed that water use under Alternative A has been evaluated in previous NEPA analyses and Section 7 consultations have been completed for this development; therefore, any new water sources under Alternative A would have been reviewed by the Wyoming State Engineer to confirm that there were no new depletions. Alternative A likely would not result in adverse impacts to the federally listed species in the Platte River, including interior least tern, piping plover, and whooping crane.

<u>BLM and USFS Sensitive Species</u>

Greater Sage-grouse

Many of the impacts to sage-grouse would be the same as described under Types of Impacts Common to All Species in Sections 4.18.1 and 4.18.2. Direct impacts to sage-grouse would include surface disturbance to breeding, nesting, brooding, and wintering habitats; mortality of birds resulting from collisions with vehicles, fences, powerlines, or construction equipment; and the destruction of nests and nest abandonment. Indirect impacts to sage-grouse would include increased habitat fragmentation, disturbance effects as a result of increased noise levels and human presence, dispersal of noxious weeds and invasive plant species, increased risk of wildfire, dust effects from unpaved road traffic, decreased recruitment, potential for the increased presence of West Nile virus, and increased predation by raptors, corvids, and coyotes.

Recent studies on sage-grouse have shown that oil and gas development can negatively impact populations as a result of increased noise and increased human disturbance (Holloran 2005; Walker et al. 2007). Sage-grouse have been observed to abandon lek sites in areas with increased road development (Braun 1986; Holloran 2005; Walker et al. 2007). Brooding female sage-grouse in Canada were shown to avoid areas with increased levels of visible oil wells, and chick survival decreased as oil well densities within 0.6 mile (1 km) of brooding locations increased (Aldridge 2005). In western Wyoming, brooding female sage-grouse avoided producing gas wells during the early brood-rearing period (Holloran 2005). Sage-grouse hens that used leks within approximately 2 miles of oil and gas development moved further away from leks to nesting areas and had lower nest initiation rates than hens near undisturbed leks (Lyon and Anderson 2003). Connelly et al. (2000) recommends that energy-related facilities be located more than 2 miles (3.2 km) from active lek sites under ideal habitat conditions, 3 miles (5 km) when habitat conditions are not ideal, and 11 miles (18 km) when sage-grouse populations are migratory. Furthermore, sage-grouse hens that used nesting habitats further from roads had greater brood survivorship than those hens utilizing habitat near roads (Lyon and Anderson 2003).

As detailed in Types of Impacts Common to All Species, impacts associated with roads would include modification of wildlife behavior (i.e., avoidance behavior leading to displacement and stress); alteration of the physical environment; alteration of the chemical environment; spread of invasive and exotic species; increased availability of travel corridors for terrestrial mammalian predators (Gelbard and Belnap 2003; SAIC 2001); and increased alteration and use of habitats by humans (Trombulak and Frissell 2000). Most active leks in western portions of the sage-grouse range were in areas with less than 1.6 miles per square mile of secondary roads and less than 0.1 mile per square mile of overhead power lines (Knick et al. 2013). Using information provided in occurrence models (Tack 2009), when road densities double within 2 miles of a lek, the probability of occurrence for a large lek (>25 males) decreased by an estimated 2-fold. Research indicates that sage-grouse avoid human activity, including road use, at the time that activity is experienced (Dzialak et al. 2012; Holloran et al. 2015). Road use within the CCPA would not be

isolated to the breeding season. Therefore, all seasonal habitats, including winter habitats, would be impacted by the development of roads within the CCPA.

Research also has shown that increased food sources associated within oil and gas developments (e.g., road kill or litter) generally resulted in increased population levels of predators, especially corvids, over time unless deterrents were used on gas field-related structures (Andren 1994; Avery and Genchi 2004). In addition, the construction of well pads and associated access roads would increase the availability of travel corridors for terrestrial mammalian predators (Gelbard and Belnap 2003; SAIC 2001). This development could increase predation rates of individual sage-grouse, nesting hens, and juvenile sage-grouse during brood–rearing periods.

Approximately 362 miles of new electrical distribution lines would be developed under Alternative A. Electrical distribution lines could cause sage-grouse to abandon otherwise suitable habitat or disrupt movement patterns among seasonal habitats (SAIC 2001) or could serve as barriers to movement as a result of avoidance behavior (Desholm and Kahlert 2005; Robel et al. 2004). Recent research in southern Wyoming has reported sage-grouse avoidance of brood–rearing habitats within 2.9 miles of electrical distribution lines (LeBeau et al. 2012). Knick et al. (2013) observed increased lek activity and persistence in areas of sage-grouse habitat characterized as having lower densities of electrical distribution lines compared to sage-grouse habitats with increased densities of electrical distribution lines and infrastructure.

The level of perching opportunity for avian predators within the CCPA would increase under Alternative A. Avian predators, particularly raptors and corvids, would be attracted to overhead utility lines because they provide perches for various activities, including hunting (APLIC 2006). Studies have suggested increased avoidance of electrical distribution lines and structures by sage-grouse as a result of increased abundance of avian predators, increased predator pressure, and nest predation by ravens (Coates et al. 2014; Howe et al. 2014; Lockyer et al. 2013). However, there is no observed evidence in the scientific literature that supports an association between increased predator pressures from electrical distribution lines and increased mortality of sage-grouse (Gibson et al. 2013; Lammers and Collopy 2007; Steenhof et al. 1993).

The CCPA is located near the eastern boundary of the sage-grouse range, where sagebrush densities and heights are naturally lower than in other areas within the range. In addition, habitats are naturally more fragmented and contain smaller sagebrush patches. Recent research conducted for the Sierra Pacific Power Company's Falcon Gondor electrical distribution line suggests that sage-grouse nests with more total shrub cover had a greater probability of success than nests with less cover, regardless of distance from the electrical distribution line (Blomberg et al. 2010; Kolada et al. 2009; Nonne et al. 2013) reported higher sage-grouse nest success in California as shrub cover increased. Therefore, this research suggests that the risk of increased raptor and corvid predation on sage-grouse could be mitigated by maintaining and restoring sagebrush canopy cover, particularly within important nesting and brood–rearing habitat.

Under Alternative A, interruption of or adjustments to sage-grouse migrations between seasonally important habitats could result from construction and production activities within occupied sage-grouse habitats. Depending on the season, displacement and avoidance of areas near well pads, roads, and other ancillary facilities could impact the behavior of birds on leks, nesting and brood–rearing hens, and birds on winter ranges. This potential shift in behavior would represent fragmentation of otherwise suitable sage-grouse habitat and could result in reduced breeding activity, nest initiation, brood–rearing success, and recruitment. The effects of fragmentation of sage-grouse habitat could further result in reduced gene flow between populations within the vicinity of the CCPA as the majority of gene flow likely is the result of movement of individuals between neighboring leks and populations, not the long distance migrations of individuals across larger portions of the species range (Oyler–McCance et al. 2005).

Connectivity amongst leks has been observed to be a major contributor to population stability and persistence (Knick and Hanser 2011; Knick et al. 2013).

Impacts to Greater Sage-grouse PHMAs

Impacts to PHMAs under Alternative A were assessed based on BLM and USFS PHMA and the Core Area Version 3 Maps as directed by the Approved Resource Management Plan Amendment for the Wyoming Greater Sage-grouse Sub-region (Attachment 4 to BLM 2015b). Any new surface disturbance in PHMAs and Core Areas within the CCPA would be subject to current WGFD, BLM, and USFS management regulations that would restrict surface disturbance and disruption in important sage-grouse habitats, including restrictions on surface disturbance exceeding the 5 percent disturbance threshold and 1 oil and gas or mining facility and associated infrastructure per 640 acres, on average (WY EO ***2019-3***, Attachment 4 to BLM 2015b, Attachment B to USFS 2015b).

Table 4.18-20 provides a summary of the analysis of existing and new surface disturbance within the DDCT assessment areas (**Figure 4.18-1**). As shown, existing disturbance within the DDCT assessment areas already exceeds the five percent disturbance cap for three of the five assessment areas as stipulated in WY EO ***2019-3***, the Approved Resource Management Plan Amendment for the Wyoming Greater Sage-grouse Sub-region (Attachment 4 to BLM 2015b), and the Land Management Plan Amendment for TBNG (Attachment B to USFS 2015b). Under Alternative A, an estimated 2,176 acres (0.7 percent) of PHMA within the DDCT assessment area would be subject to surface disturbance.

Table 4.18-20 Existing and New Surface Disturbance in Greater Sage-grouse PHMA under Alternative A

PHMA[1]	Size of DDCT Assessment Area (acres)	Surface Disturbance in the DDCT Assessment Area					
		Existing		New		Total	
		Acres	Percent	Acres	Percent	Acres	Percent
Bill	4,054	67	1.7	28	0.7	94	2.3
Douglas	88,195	23,328	26.5	602	0.7	23,930	27.1
M Creek	26,445	239	0.9	180	0.7	420	1.6
North Glenrock	118,201	12,129	10.3	807	0.7	12,936	10.9
Thunder Basin	81,953	7,967	9.7	559	0.7	8,527	10.4

[1] Based on BLM/USFS PHMA and Core Area Version 3 Maps.

Due to the current 5 percent disturbance cap being exceeded, further surface disturbance would be prohibited in three of the PHMAs (Douglas, North Glenrock, and Thunder Basin). However, the Bill and M Creek PHMAs are calculated as currently having approximately 2.3 and 1.6 percent total disturbance (existing and new), respectively; therefore, development could occur in these areas.

Impacts to Greater Sage-grouse Leks and Breeding Habitats

There are 46 known sage-grouse leks within the CCPA, and an additional 8 occur within the 2-mile buffer around the CCPA. Of the 54 leks within 2 miles of the CCPA, ***8*** are considered unoccupied, meaning no sage-grouse have been observed displaying at the sites for at least 10 years. The remaining ***46*** leks are considered either occupied or undetermined.

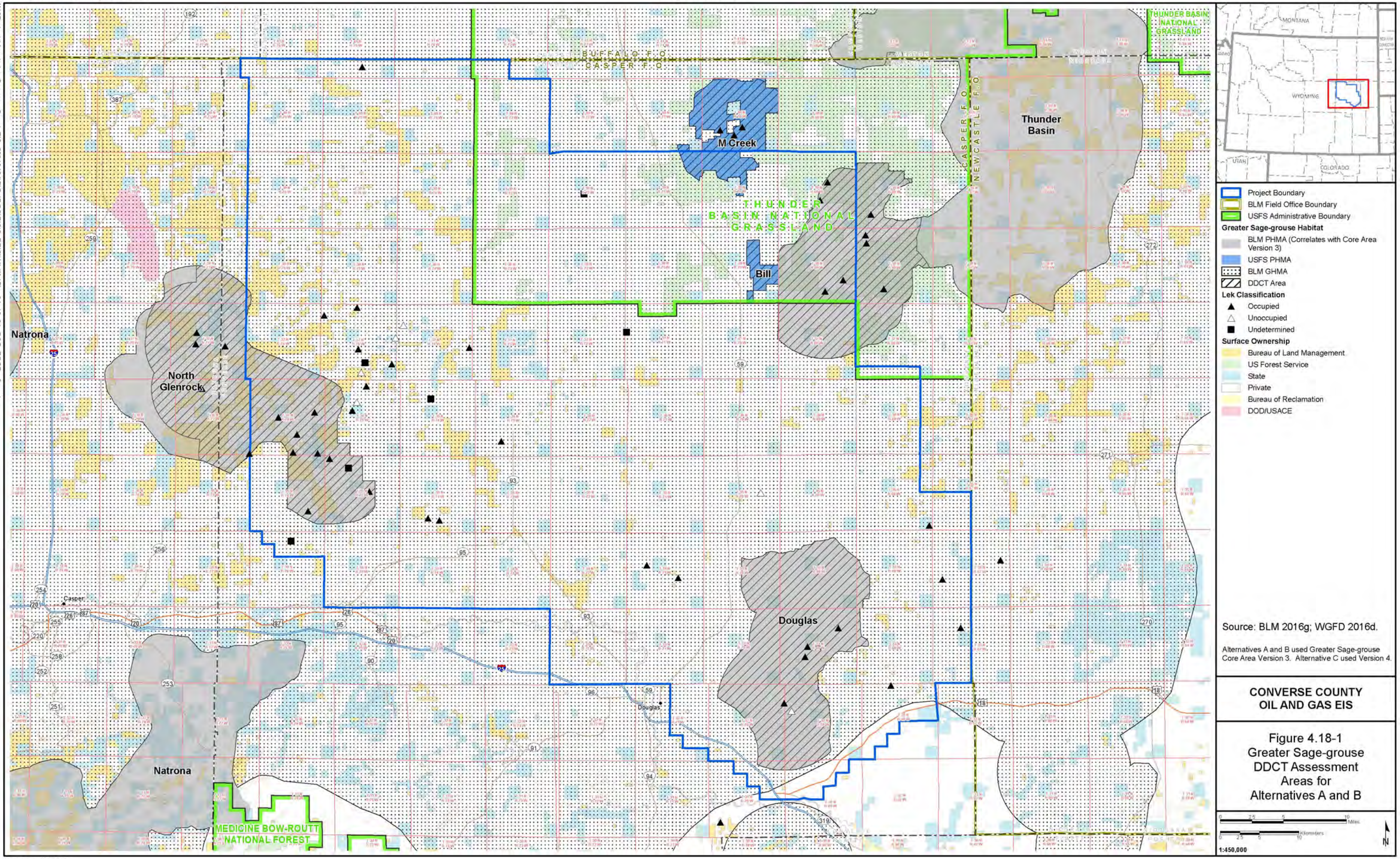


Figure 4.18-1
Greater Sage-grouse DDCT Assessment Areas for Alternatives A and B

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Table 4.18-21 Estimated Impacts from Alternative A to Occupied Leks with Well Pads within a 2-mile Radius

Lek ID	WGFD Status	Well Pads within CCPA and 2-mile Buffer			Degree of Impact[1]	Male Attendance 2006-2016	
		Existing	Estimated New	Estimated Total		Peak	Average Peak
55 Ranch 1	Occupied	9	1.8	10.8	Low	2	0.2
55 Ranch 3	Occupied	6	1.8	7.8	Low	48	13.5
55 Ranch 4	Occupied	4	1.8	5.8	Low	27	8.9
55 Ranch 5	Undetermined	9	1.8	10.8	Low	2	0.2
55 Ranch 8	Occupied	9	1.8	10.8	Low	8	1.9
Bill Hall	Occupied	10	1.8	11.8	Low	19	6.7
Bill Hall South	Occupied	16	1.8	17.8	Moderate	12	2.5
Blue Hill 1	Occupied	3	1.8	4.8	Low	40	16.3
Blue Hill 2	Occupied	9	1.8	10.8	Low	59	12.7
Blue Hill 3	Occupied	5	1.8	6.8	Low	2	0.2
Blue Hill 4	Occupied	24	1.8	25.8	Moderate	58	15.5
Cheyenne Divide 1	Occupied	2	1.8	3.8	Low	0	0.0
Cheyenne Divide 2	Occupied	3	1.8	4.8	Low	8	0.8
Clausen Ranch	Occupied	8	1.8	9.8	Low	40	10.0
Clausen Ranch 2	Occupied	6	1.8	7.8	Low	17	3.5
Cole Creek	Occupied	0	1.8	1.8	Low	25	3.7
Cow Creek Road	Occupied	25	1.8	26.8	Moderate	36	12.9
Downs	***Occupied***	0	1.8	1.8	Low	2	0.9
Dull Center	Occupied	16	1.8	17.8	Moderate	9	2.1
East Antelope #1	Occupied	2	1.8	3.8	Low	50	22.2
East Steckley Road[2]	Occupied	0	1.8	1.8	Low	34	8.8
Flat-Top	Occupied	11	1.8	12.8	Moderate	17	4.7
Highland	Occupied	2	1.8	3.8	Low	12	1.9
Iberlin	Occupied	0	1.8	1.8	Low	65	28.8
Lone Tree Gulch 1	***Occupied***	1	1.8	2.8	Low	2	0.2
Lone Tree Gulch 2	Occupied	2	1.8	3.8	Low	17	3.8

Table 4.18-21 Estimated Impacts from Alternative A to Occupied Leks with Well Pads within a 2-mile Radius

Lek ID	WGFD Status	Well Pads within CCPA and 2-mile Buffer			Degree of Impact[1]	Male Attendance 2006-2016	
		Existing	Estimated New	Estimated Total		Peak	Average Peak
Mai Tai	Occupied	3	1.8	4.8	Low	18	4.5
North 95	Occupied	0	1.8	1.8	Low	45	11.6
North 95 East	Occupied	0	1.8	1.8	Low	9	1.3
North Bobcat Road[2]	Occupied	13	1.8	14.8	Moderate	21	6.3
North Owens	Occupied	15	1.8	16.8	Moderate	4	0.9
North Shawnee	Occupied	6	1.8	7.8	Low	10	2.9
Ormsby Draw	Occupied	0	1.8	1.8	Low	43	8.6
Red Hills[2]	***Undetermined***	0	1.8	1.8	Low	4	0.5
Rocky Top	Occupied	14	1.8	15.8	Moderate	17	2.5
Sand Creek 1	Undetermined	0	1.8	1.8	Low	2	0.2
Sand Creek 2	Occupied	2	1.8	3.8	Low	88	19.3
South Jenny Trail	Undetermined	1	1.8	2.8	Low	0	0.0
South Poison Draw	Undetermined	1	1.8	2.8	Low	0	0.0
Steckley Road[2]	Occupied	0	1.8	1.8	Low	3	0.6
Suicide Hill	Occupied	5	1.8	6.8	Low	8	2.3
Tillards 1	Occupied	6	1.8	7.8	Low	10	0.9
Tillards 2	Occupied	2	1.8	3.8	Low	41	26.9
Turner Divide	Undetermined	9	1.8	10.8	Low	0	0.0
Upper Lake Creek[2]	Occupied	11	1.8	12.8	Moderate	41	15.8
West Harney Creek	Occupied	2	1.8	3.8	Low	16	1.9

[1] Degree of impact based on the following from Doherty et al. 2010:

Low: 1-12 well pads within 2 miles of lek.

Moderate: 12- 39 well pads within 2 miles of lek.

High: > 39 well pads within 2 miles of lek.

[2] Leks are outside of CCPA but within 2 miles.

Assuming an even distribution of 361 new well pads spread throughout the CCPA under Alternative A, an estimated average of approximately 2 of these pads could be placed within 2 miles of each of these leks. **Table 4.18-21** presents the existing well pads and estimated number of new well pads that would be developed under Alternative A within 2 miles of each lek.

According to a study conducted by Doherty et al. (2010) within the Powder River Basin north of the CCPA, impacts to sage-grouse lek attendance and persistence varied based on the number of well pads within 2 miles of the lek. Over a 10-year period, the number of leks with 1 to 12 well pads within a 2-mile radius declined by 0.7 percent, and a there was an observed decline in male lek attendance of 2.1 percent. The number of leks with 13 to 39 well pads within a 2-mile radius declined by 11.5 percent, and there was an observed decline in male lek attendance of 31.4 percent. The number of leks with 40 to 100 well pads within a 2-mile radius declined by 47.2 percent and there was an observed decline in male lek attendance of 32.6 percent (Doherty et al. 2010). Based on the Doherty et al. (2010) study, data presented in **Table 4.18-21** also provides an assessment of the degree of impact that could result from an increased number of well pads under Alternative A. For purposes of this analysis, leks with 1 to 12 well pads within 2 miles would be considered a low level of impact, leks with 12 to 39 well pads within 2 miles would be moderate, and leks with 39 to 100 well pads would be a high level of impact.

Based on analysis of existing and planned well pads within 2 miles of each lek, an estimated ***37*** leks would be subject to a low level of impact, and ***9*** leks would be subject to a moderate level of impact under Alternative A. No leks would be subject to a high level of impact under Alternative A. According to Wyoming EO ***2019-3***, occupied leks with greater than 11 well pads within a 2-mile radius would be in exceedance of the threshold, which restricts more than 1 well pad and associated infrastructure per 640 acres within Core Areas, on average. Assuming an even distribution of well pads, development under Alternative A would exceed this level of development for 12 of the ***46*** occupied or undetermined sage-grouse leks within 2 miles of the CCPA.

Table 4.18-21 also shows the peak and average peak male attendance from 2006 to 2016. These numbers, along with trend data presented in **Table 3.18-7**, provide a metric for understanding observed trends in sage-grouse attendance at leks within the CCPA. Overall, the 54 leks within the CCPA and the 2-mile buffer around the CCPA have experienced a reduction in peak male attendance of 83.9 percent between 2006 and 2016. Attendance at all leks in the CCPA has declined slightly since 2006; however, peak male attendance has been on an upward trend since its low in 2013. In 2013, no male sage-grouse were observed on at least 13 of the 54 leks in the sage-grouse analysis area, and this possibly could have been as high as 39 leks (some leks were not counted in 2013 or data is missing). Despite the recent upward trend in peak male attendance, all sage-grouse leks in the analysis area would be at risk of being abandoned as development would continue to increase in surrounding areas under Alternative A.

Mortalities of nesting sage-grouse potentially could result from the destruction of active nests due to the amount of habitat impacted. Research conducted in Colorado, Idaho, and Wyoming suggests that approximately 80 percent of sage-grouse nests are located within 4 miles of the lek where breeding occurs (Colorado Sage-grouse Steering Committee 2008). Sage-grouse display one of the lowest nest success rates of all upland game birds, and hens have been observed abandoning active nests due to human disturbance and ground disturbing activities within a certain proximity (Schroeder 1997). The potential for lek and nest abandonment could be decreased by adherence to NSO restrictions and seasonal timing restrictions for construction and production activities applied to sage-grouse nesting and brood-rearing habitats in PHMA and within 2 miles of occupied leks in GHMA.

Table 4.18-22 presents the total acres within the CCPA that would be impacted under Alternative A within sage-grouse lek buffers and timing restriction areas stipulated in WY EO ***2019-3***, the Approved Resource Management Plan Amendment for the Wyoming Greater Sage-grouse Sub-region (Attachment 4 to BLM 2015b), and the Land Management Plan Amendment for TBNG (Attachment B to

USFS 2015b). Surface occupancy would be prohibited within 0.25 mile of active sage-grouse leks outside of PHMA and within 0.6 mile of active leks inside PHMA.

Table 4.18-22 Estimated Surface Disturbance to Greater Sage-grouse Leks under Alternative A

Lek Buffer/Habitat type	Acres of Total Habitat within the CCPA	Estimated Acres of Surface Disturbance[1]
0.25-Mile Lek Buffer (NSO outside of PHMA)[2]	2,665	0
0.6-Mile Lek Buffer (NSO inside PHMA)[2]	13,751	0
2.0-Mile Lek Buffer (March 15 to July 14 Timing Restriction) outside of PHMA in CCPA[3]	118,619	810

[1] Due to the programmatic nature of this EIS, actual disturbance values were not available; therefore, a quantitative estimate was calculated as a percentage (0.7) of the new surface disturbance for Alternative A (10,253 acres) multiplied by each lek buffer/habitat within the CCPA.

[2] No surface disturbance is allowed within NSO buffers.

[3] Planned development under Alternative A would be subject to the no surface disturbance restriction within PHMA and within 2 miles of occupied leks outside of PHMA between March 15 and July 14.

Impacts to Greater Sage-grouse Habitat

Seasonal sage-grouse habitats have not been recently mapped in the analysis area; however, based on an analysis of LANDFIRE land cover data, there are approximately 330,463 acres of available sagebrush shrubland habitat in the CCPA. Alternative A would result in surface disturbance to approximately 2,***314*** acres (0.7 percent) of this habitat within the CCPA.

Due to the existing level of development in the CCPA, impacts to the sage-grouse under Alternative A could lead to the further decline of the population as a result of habitat disturbance and fragmentation in the CCPA. Under Alternative A, habitat fragmentation would increase from 1.90 miles/square mile of existing linear Project components (roads, pipelines, overhead powerlines) to 2.22 miles/square mile in the CCPA (**Table 4.18-2**). In total, 748 miles of new linear Project components would be constructed, which would reduce the quality of sage-grouse habitat in the CCPA.

Under Alternative A, construction activities could result in permanent habitat loss, fragmentation, and the temporary displacement of sage-grouse from construction areas due the removal of native sagebrush vegetation, noise, and increased human activity. Sage-grouse may avoid previously occupied areas due to noise and disturbance from increased vehicle traffic (Lyon and Anderson 2003). The disturbance and degradation of sagebrush could reduce the habitat carrying capacity for local breeding populations of sage-grouse, especially in areas where high quality sagebrush habitat is limited (Braun 1998; Connelly et al. 2000). Alternatively, sage-grouse could simply avoid otherwise suitable habitat as the density of roads, pipelines, and electrical distribution lines increases (Holloran 2005).

Summary of Effects to Greater Sage-grouse

Under Alternative A, habitat fragmentation would increase from 1.90 miles of linear Project components per square mile to 2.22 miles per square mile (**Table 4.18-2**). In addition, well pad density would increase from 0.61 well pads per square mile to 0.78 well pads per square mile due to the addition of 386 new well pads.

Based on existing disturbance in DDCT assessment areas that already exceed 5 percent disturbance for three of the five PHMAs, new surface disturbance could only be considered within the Bill and M Creek PHMAs. The estimated acreage of surface disturbance within 2 miles of occupied leks outside of PHMA would increase to 810 acres. In addition, the average number of new well pads installed within 2 miles of sage-grouse leks could be increased by approximately 2.

These impacts would be magnified due the slight downward trend in male lek attendance and the already low population level of sage-grouse in the CCPA as a result of a variety of factors, including habitat removal, fragmentation, and human presence and noise. The population of sage-grouse in the CCPA has experienced a drastic decline since 2006, but currently is on an upward trend since its low in 2013. Further development under Alternative A likely would have population level impacts and could contribute to the further decline of the sage-grouse population inhabiting the CCPA.

Bats (Fringed Myotis, Long-eared Myotis, Townsend's Big-eared Bat, and Hoary Bat)

Impacts to fringed myotis (BLM and USFS sensitive), long-eared myotis (BLM sensitive), Townsend's big-eared bat (BLM and USFS sensitive), and hoary bat (USFS sensitive) would be similar in nature to impacts described under Types of Impacts Common to All Species and Small Mammals. Three of the bats (fringed myotis, long-eared bat, and Townsend' big-eared bat) have been documented in the analysis area, but exact locations of roost sites are not known. All three species are known to use caves, mines, rock crevices, and abandoned buildings for roosting, and caves and mines as winter hibernacula (WGFD 2010a). The hoary bat roosts in the foliage of trees and does not hibernate in Wyoming (Abernethy et al. 2015). The fringed myotis and Townsend's big-eared bat also may roost in trees. Based on similar roosting habitats and lack of winter hibernacula, the types of impacts to these species would be similar in nature.

All four sensitive bats are known to rely heavily on riparian and wetland areas for foraging; therefore, impacts to these habitats would reduce the available foraging habitat for these species. However, the BLM Casper RMP and TBNG LRMP require protection of riparian habitats, so impacts to these habitats would be reduced on BLM- and USFS-administered lands within the CCPA. Additionally, artificial lighting used for construction and operation would attract insects, providing foraging benefits to bat species. However, vehicle traffic at stream crossings and new stream crossings still would result in impacts to foraging habitat for these species on non-BLM land. In addition, surface disturbance impacts to riparian habitat on non-federal lands still would occur.

In total, Alternative A would result in surface disturbance to approximately 62 acres (0.29 percent) of the available 21,593 acres of suitable riparian and wetland foraging habitat within the analysis area. Habitat loss, modification, fragmentation, roost disturbance, and pesticide use have been cited as threats to bat populations throughout the U.S. (Buseck and Keinath 2004). The use of herbicides, especially those formulated with organochlorines, also would pose a threat to special status bats if used for noxious weed treatments. Pesticides and herbicides could reduce the abundance of bat prey (insects) or accumulate in prey and then become concentrated in bat tissues upon consumption. Bioaccumulation of chemicals could lead to reduced reproductive success or mortality (Keinath 2004). Although public lands are a small portion of the CCPA (10 percent), new roads associated with Alternative A incrementally would result in increased access to potential roost sites and could subsequently increase recreation and vandalism that could adversely affect special status bats. On the TBNG, impacts to bat day roost areas would be minimized through adherence to USFS Guidelines that maintain a 0.25-mile no surface use buffer in any areas identified as occupied and a 0.5-mile no-spray buffer for herbicide treatments around roost sites.

Special Status Small Mammals (Black-tailed Prairie Dog, Northern River Otter, and Swift Fox)

Impacts to black-tailed prairie dog (BLM and USFS sensitive, MIS), northern river otter (USFS sensitive), and swift fox (BLM and USFS sensitive) would be similar in nature to impacts described under Types of Impacts Common to All Species and Small Mammals.

Management direction in both the BLM Casper RMP and the TBNG LRMP provide protective measures that would minimize impacts to prairie dog colonies on BLM and USFS surface and mineral estate by requiring avoidance of prairie dog colonies and the establishment of new prairie dog colonies when applicable. However, additional impacts to the species still would occur, especially on non-federal lands. Impacts to black-tailed prairie dog would include surface disturbance to approximately 1***11*** acres (0.7 percent) of existing prairie dog colonies within the CCPA (15,825 acres) and 0.22 percent of the existing prairie dog colonies within the entire analysis area (48,672 acres). Primary impacts to prairie dogs under Alternative A would include habitat alteration, direct mortality from vehicle collisions and crushing of burrows, increased predation, and effects associated with sylvatic plague. Increased habitat fragmentation on a regional level in the CCPA would lead to continued isolation of populations, which could disrupt gene flow and dispersal between colonies (Roach et al. 2001). Increased isolation of populations could increase the susceptibility of black-tailed prairie dog colonies to more devastating effects resulting from plague outbreaks (Wuerthner 1997). However, isolated populations also could be beneficial as disease could be unable to spread between isolated populations. Roads and other structures would increase predation pressure on prairie dogs from coyotes, badgers, and birds of prey by providing a means of more effective hunting. In addition, construction of new roads and well pads would reduce habitat suitability in some areas through soil compaction, changes in forage vegetation, and reduction in cover that would allow individuals to hide from predators.

Impacts to northern river otter would be limited to impacts to large water courses such as the North Platte River. While no riverine habitat would be impacted by construction, direct and indirect impacts to water quality from surface runoff and or changes in surface water flows could impact the species. Water pollution that would reduce or eliminate otter prey populations (fish and invertebrates) could adversely affect some otter populations or potential habitats. In addition, any alteration of surface water flow or reduction of flow would degrade potentially suitable otter habitats (Boyle 2006).

WYNDD has documented 57 swift foxes in the analysis area. The primary impacts to swift fox resulting from activities under Alternative A would include mortality from vehicle collisions; habitat loss, alteration, and fragmentation; and increased competition with coyotes. Under Alternative A, impacts to swift fox would include surface disturbance to approximately 6,***970*** acres (0.7 percent) of the available 995,706 acres of grassland habitat in the CCPA. This would be approximately 0.5 percent of the available 1,370,493 acres of grassland habitat within the entire wildlife analysis area. An increase in roads also would reduce habitat quality and increase the risk of vehicle collisions. A study in Kansas by Sovada et al. (1998) observed that 22 percent of swift fox mortalities were the result of vehicle collisions. Competition with other canids, primarily coyotes, is cited as the greatest threat to the swift fox (Stephens and Anderson 2005), and an increase in roads and traffic associated with oil field development could increase the availability of road-killed animals that provide a food supply for scavenging coyotes leading to an increase in coyote occurrences within the CCPA (BLM 2003). Several studies have reported an increase in fox numbers after coyotes were removed (Henke 1992; Kamler 2002 in Stephens and Anderson 2005; Kilgore 1969; Linhart and Robinson 1972). Impacts to breeding swift foxes on the TBNG would be minimized with adherence to USFS Standards and Guidelines (2001) that prohibit construction within 0.25 mile of dens sites March 1 to August 31.

Special Status Migratory Avian Species

Migratory avian species designated as BLM and/or USFS Sensitive analyzed as potentially occurring within the analysis area for the Project are listed in **Table 4.18-23**. The types of potential impacts to these species are described under Types of Impacts Common to All Species in Section 4.18.1. **Table 4.18-23** also provides a summary of potential surface impacts to special status migratory avian species habitat in the CCPA from Alternative A.

Table 4.18-23 Estimated Disturbance to BLM and USFS Sensitive Migratory Bird Species Habitats from Alternative A

Species Common Name	Potential Habitat in CCPA[1] (acres)[1]	Estimated Impacts to Potential Habitat in CCPA[2] (acres)
American three-toed woodpecker	11,329	***80***
American bittern	9,108	6***4***
Baird's sparrow	995,706	6,***9***7***0***
Bald eagle	9,108	6***4***
Black tern	9,108	6***4***
Brewer's sparrow	330,463	2,***314***
Burrowing owl	1,469,876	10,***290***
Chestnut-collared longspur	995,706	6,***970***
Ferruginous hawk	1,469,876	10,***290***
Flammulated owl	11,239	7***9***
Grasshopper sparrow	330,463	2,***314***
Lewis's woodpecker	20,347	14***3***
Long-billed curlew	1,015,088	***7,106***
Loggerhead shrike	11,239	7***9***
McCown's longspur	995,706	6,***970***
Mountain plover	1,121,722	7,***853***
Northern goshawk	11,239	7***9***
Northern harrier	19,382	13***6***
Olive-sided flycatcher	11,239	7***9***
Peregrine falcon	1,478,984	10,***353***
Sagebrush sparrow	330,463	2,***314***
Sage thrasher	337,880	2,3***66***
Short-eared owl	1,015,088	***7,106***
Trumpeter swan	9,108	6***4***
White-faced ibis	9,108	6***4***

[1] Potential habitat is described in **Appendix F** for each species.

[2] Estimated values calculated as approximately 0.7 percent of potential habitat present in CCPA.

Terrestrial Invertebrates (Ottoe Skipper, Regal Fritillary, Monarch Butterfly, and Western Bumble Bee)

The Ottoe skipper and regal fritillary have both been documented to occur within the CCPA, although they are both considered rare. Under Alternative A, the primary impacts to Ottoe skipper and regal fritillary would include grassland conversion that would result from surface disturbance, establishment of exotic/invasive plants that would out-compete native grassland plants used by these butterflies, and indirect effects associated with herbicides that could reduce important nectar sources (Selby 2007, 2005). In addition, the loss of host species plants would lead to reduced reproductive success in the CCPA. Under Alternative A, impacts to Ottoe skipper would include surface disturbance to approximately 6,***970*** of the available 995,706 acres (0.7 percent) of grassland habitat in the CCPA. This would be approximately 0.50 percent of the available 1,370,493 acres of grassland habitat within the wildlife analysis area. Impacts to regal fritillary would include surface disturbance to approximately ***7,034*** of the 1,004,814 acres (0.7 percent) of grassland and wetland/riparian habitats in the CCPA, which would be approximately 0.5 percent of the 1,392,086 acres of available suitable habitat in the analysis area. Impacts to monarch butterfly and western bumble bee would include surface disturbance to approximately 10,***517*** acres (0.7 percent) of the available 1,502,381 acres of suitable habitat within the CCPA and approximately 0.5 percent of the available 2,206,155 acres of suitable habitat in the analysis area.

Wyoming Species of Greatest Conservation Need

In general, impacts to SGCN mammals under Alternative A would include those identified under BLM and USFS Sensitive small mammal species as well as those discussed for small mammals in Section 4.18.1.1, Types of Impacts Common to All Species. **Table 4.18-24** presents impacts to associated habitat for each of the SGCN mammals with the potential to occur within the CCPA. SGCN avian species are analyzed in Section 4.18.2 and SGCN aquatic species are analyzed in Section 4.18.5.

Table 4.18-24 Disturbance to SGCN Mammal Species Habitats from Alternative A

Species	Potential Habitat in CCPA[1] (acres)	Estimated Impacts to Potential Habitat in CCPA[2] (acres)
Dwarf shrew	137,255	***961***
Eastern red bat	10,946	***77***
Eastern spotted skunk	7,417	***52***
Hayden's shrew	1,004,814	***7,034***
Little brown myotis	20,347	14***3***
Long-legged myotis	20,347	14***3***
Olive-backed pocket mouse	1,139,413	7,***976***
Pallid bat	1,470,841	10,***296***
Plains harvest mouse	1,326,169	9,***284***
Sagebrush vole	330,463	2,***314***
Sand Hills pocket gopher	995,706	6,***970***
Silky pocket mouse	1,121,722	7,***853***
Spotted ground squirrel	1,013,397	***7,094***
Western small-footed myotis	1,149,486	***8,047***

[1] Based on associated habitat descriptions found in **Table 3.18-5** and **Appendix F.**

[2] Estimated values calculated as approximately 0.7 percent of potential habitat present in the CCPA.

Summary of Impacts to Special Status Wildlife Species under Alternative A

Table 4.18-25 provides a summary of Impacts to special status terrestrial species under Alternative A.

Table 4.18-25 Summary of Impacts to Special Status Terrestrial Species under Alternative A

Species	Available Habitat in the Analysis Area (acres)	Surface Disturbance (acres)	Primary Effects
Preble's meadow jumping mouse	8,403	31	• Vehicle crushing • Loss and alteration of habitat • Habitat fragmentation
Black-footed ferret	48,672 (prairie dog colonies)	108 (prairie dog colonies)	• Loss of suitable prairie dog colonies
Greater sage-grouse	483,630 (sagebrush) 284,375 (PHMA) 118,619 (2-mile lek buffer GHMA)	2,254 (sagebrush) 393 (M Creek PHMA only) 810 (2-mile lek buffer GHMA)	• Loss and alteration of habitat • Noise impacts • Increased predation • Reduced breeding success due to disturbance near leks/ breeding areas
Bats	21,593	75	• Loss and alteration of foraging habitat • Herbicide effects on individual fitness
Black-tailed prairie dog	48,672 (colonies)	108	• Habitat loss and alteration • Crushing of burrows or vehicle strikes • Increased predation
Northern river otter	2,970 (open water)	0	• Habitat/water quality degradation
Swift fox	1,370,493	6,795	• Loss and alteration of grassland habitat • Increased competition with and predation from coyote • Vehicle strikes
Migratory avian species	2,206,155	10,253	• Loss and alteration of habitat • Noise impacts • Collision/electrocution with power lines • Reduced breeding success due to disturbance near nests • Crushing of nests or vehicle strikes
Ottoe skipper	1,370,493	6,795	• Grassland conversion • Invasive plants • Herbicide effects
Regal fritillary	1,392,086	6,857	• Grassland conversion • Invasive plants • Herbicide effects
Monarch butterfly and western bumble bee	2,206,155	10,253	• Habitat loss • Invasive plans • Herbicide effects

Table 4.18-25 Summary of Impacts to Special Status Terrestrial Species under Alternative A

Species	Available Habitat in the Analysis Area (acres)	Surface Disturbance (acres)	Primary Effects
SGCN Mammals	2,206,155	10,253	• Loss and alteration of habitat • Crushing of burrows or vehicle strikes • Herbicide effects on individual fitness

4.18.3.2 Impacts to Special Status Wildlife Species from Alternative B – Proposed Action

Under Alternative B, approximately 5,000 new oil and gas wells would be drilled on 1,500 multi-well pads over a period of 10 years (500 new wells per year) with the ability to request exceptions to timing limitation stipulations. Additional surface disturbance would result from construction of other service well pads, access roads, pipelines, electrical distribution lines, and ancillary facilities (**Table 2.4-1**). The types of impacts to special status wildlife species and habitat under Alternative B would be the same as under Alternative A but would be to a greater extent. For example, there would be more surface disturbance to wildlife habitats, more habitat fragmentation, greater potential for direct mortalities of individual animals, and greater potential for indirect impacts over those described under Alternative A including wildlife avoidance from human activity and noise, increased potential for spread of noxious weeds and invasive plant species, and increased predation on prey populations. The majority of impacts would occur during the first 10 years while construction activities would be occurring and, to a lesser extent, during decommissioning. In addition, implementation of management direction or requirements from the BLM Casper RMP (BLM 2007b) and USFS TBNG LRMP (USFS 2001) would minimize impacts to all wildlife species. These measures are the same as discussed under Alternative A. In addition, OG-committed design features (see Chapter 6.0, Mitigation) would further minimize impacts to all wildlife species under Alternative B.

Under Alternative B, exceptions to BLM timing limit stipulations would be requested in the vicinity of raptor nests and greater sage-grouse leks outside of PHMA. However, such exceptions generally would be granted on a case-by-case basis and not requested on USFS surface estate. Where seasonal wildlife stipulations are required, and exceptions are not available, drilling and completion of wells would be scheduled outside of the stipulation windows. This would result in an on-and-off cycle scheduled around variable timing stipulations designed to protect sensitive wildlife resources including greater sage-grouse leks, seasonal wildlife habitats, mountain plover nests, swift fox dens, and occupied raptor nests. Granting exceptions to timing limit stipulations could adversely impact sensitive wildlife species by causing nest abandonment for raptors or sensitive bird species, sage-grouse nest abandonment or reduced reproductive success, reductions in lek attendance, and displacements from other sensitive seasonal ranges.

A wildlife review of federal APDs for 2012-2017 conducted by the BLM determined that approximately ***50*** percent of federal APDs were subject to given timing limitation stipulations. Applying that ***50*** percent coverage to the approximately 64 percent of the CCPA under federal mineral ownership would yield an estimated ***one-third*** of the CCPA that ***c***ould be subject to timing limitation stipulations. Additionally, not all raptor nests and greater sage-grouse leks are ***occupied*** every year. Several raptor species utilize alternate nests that are not used annually, further reducing the timing limitation area. For more detail regarding timing limit stipulations under Alternative B, see Section 2.5.2.

Federally Listed Species

Preble's Meadow Jumping Mouse (Federally Threatened)

Under Alternative B, the types of impacts to Preble's meadow jumping mouse would be the same as described under Alternative A but would be greater in magnitude relative to the overall increase in the number of well pads and other Project disturbance. Alternative B would result in surface disturbance of an estimated 158 acres, which would be approximately 3.5 percent of the 4,519 acres of modelled Preble's meadow jumping mouse habitat within the CCPA and approximately 1.9 percent of the 8,403 acres of habitat within the analysis area. As with Alternative A, compliance with management direction from the BLM Casper RMP as well as the Biological Opinion for the Casper RMP would minimize surface disturbance to riparian habitats on BLM surface estate.

Under Alternative B, habitat fragmentation would increase from 1.90 miles/square mile of existing linear Project components (roads, pipelines, overhead powerlines) to 3.72 miles/square mile in the CCPA (**Table 4.18-2**). This increase in habitat fragmentation would reduce the quality of habitat for Preble's meadow jumping mouse.

Compliance with the required measures and the already low potential for Preble's meadow jumping mouse to occur in the CCPA, Alternative B ***has potential for minimal adverse impacts for*** Preble's meadow jumping mouse populations in the CCPA.

Black-footed Ferret (Non-essential Experimental Population)

The types of impacts to black-footed ferrets under Alternative B would be the same as Alternative A. Alternative B would result in surface disturbance to an estimated 55*4* acres, or 3.5 percent of the prairie dog colonies within the CCPA (15,825 acres) and 1.14 percent of the existing 48,672 acres of existing prairie dog colonies within the entire analysis area.

Prairie dog colonies in Management Areas within the TBNG are required to be managed as if they were occupied by black-footed ferret. Therefore, all USFS Standards and Guidelines related to black-footed ferret (USFS 2001) would be applied in this area to protect and minimize impacts to suitable black-footed ferret habitat.

Based on the above information indicating there are no black-footed ferrets present in the vicinity of the CCPA combined with the application of USFS Standards protecting suitable habitats in prairie dog colonies within the TBNG, impacts to black-footed ferret would be expected to be minor based on the potential to impact prairie dog colonies located on private surface and mineral estate.

Platte River Species (Federally Listed; Interior Least Tern, Piping Plover, Whooping Crane)

Under Alternative B, well drilling and completion and dust control would require up to 8,050 acre-feet of additional source water per year. Water would be withdrawn from up to 50 new groundwater wells drilled into the Wasatch/Fort Union Aquifer and, to a lesser extent, the Fox Hills/Lance Aquifer System. However, specific well locations and sources have not been identified at this time. Any new depletions in the North Platte subbasin in Wyoming would contribute to flow reductions in the Platte River in Nebraska and would result in adverse effects on federally listed species including the interior least tern, piping plover, and whooping crane.

The Platte River Recovery Implementation Program was established in 2006 to assist in the conservation and recovery of specific target species and their associated habitats along the central and lower Platte River in Nebraska. This Platte River Recovery Implementation Program called for a basin-wide cooperative approach agreed to by the states of Wyoming, Nebraska, and Colorado and the USDOI to address adverse impacts of existing and certain new water related activities on the Platte River target species and associated habitats. The Platte River Recovery Implementation Program also provides Section 7 compliance for effects to the target species and whooping crane critical habitat from such activities including avoidance of any prohibited take of such species. The State of Wyoming is in compliance with their obligations under the Platte River Recovery Implementation Program.

If the proposed water-related activity would deplete more than 0.1 acre-feet in the Platte River system and would rely on surface water or hydrologically connected groundwater, an evaluation would be required by the WSEO. If the WSEO were to determine that the activity would be considered an existing water-related activity, further action could be required to maintain compliance with the Platte River Recovery Implementation Program. In this case, a Wyoming Platte River Recovery Agreement would be executed between the water user and the Wyoming State Engineer.

BLM and USFS Sensitive Species

Greater Sage-grouse

The types of impacts to greater sage-grouse under Alternative B would be similar to those described under Alternative A; however, impacts would be greater in magnitude relative to the overall increase in the number of well pads and other Project disturbance. In addition, 1,500 miles of electrical distribution lines would be constructed under Alternative B, which would increase habitat fragmentation and predator perching opportunities.

Impacts to Greater Sage-grouse PHMAs

Impacts to PHMAs under Alternative B were assessed based on BLM and USFS PHMA and the WGFD Core Area Version 3 Map as directed by the Approved Resource Management Plan Amendment for the Wyoming Sage-grouse Sub-region (Attachment 4 to BLM 2015b). Any new surface disturbance in PHMAs and Core Areas within the CCPA would be subject to current BLM, USFS, and WGFD management regulations that would restrict surface disturbance and disruption in important sage-grouse habitats, including restrictions on surface disturbance exceeding the 5 percent disturbance threshold and 1 well pad and associated infrastructure per 640 acres, on average (WY EO ***2019-3***, Attachment 4 to BLM 2015b, Attachment B to USFS 2015b).

Table 4.18-26 provides a summary of the analysis of existing and new surface disturbance within the DDCT assessment areas (**Figure 4.18-1**). As shown, existing disturbance within the DDCT assessment areas already exceeds the five percent disturbance cap for four of the five assessment areas as stipulated in WY EO ***2019-3***, the Approved Resource Management Plan Amendment for the Wyoming Greater Sage-grouse Sub-region (Attachment 4 to BLM 2015b), and the Land Management Plan Amendment for TBNG (Attachment B to USFS 2015b). Under Alternative B, an estimated 11,177 acres (3.5 percent) of PHMA within the DDCT assessment area would be subject to surface disturbance.

Table 4.18-26 Existing and New Surface Disturbance in Greater Sage-grouse PHMA under Alternative B

PHMA[1]	Size of DDCT Assessment Area (acres)	Surface Disturbance in the DDCT Assessment Area					
		Existing		New		Total	
		Acres	Percent	Acres	Percent	Acres	Percent
Bill	4,054	67	1.7	142	3.5	209	5.1
Douglas	88,195	23,328	26.5	3,092	3.5	26,420	30.0
M Creek	26,445	239	0.9	927	3.5	1,166	4.4
North Glenrock	118,201	12,129	10.3	4,144	3.5	16,273	13.8
Thunder Basin	81,953	7,967	9.7	2,873	3.5	10,840	13.2

[1] Based on BLM/USFS PHMA and Core Area Version 3 Maps.

The programmatic nature of this document details that the current 5 percent disturbance cap is exceeded in four of the PHMA (Bill, Douglas, North Glenrock, and Thunder Basin). However, under Alternative B, development could be approved on a site-specific basis consistent with the ***Wyoming EO 2019-3 and the*** DDCT process if found to be under the 5 percent cap.

Impacts to Greater Sage-grouse Leks and Breeding Habitats

Similar to Alternative A, assuming an even distribution of 1,955 total new well pads (i.e., including oil and gas, production, water source, and disposal well pads; see **Table 2.4-1**) spread throughout the CCPA under Alternative B, an estimated average of 10 of these pads could be placed within 2 miles of each of the occupied leks. **Table 4.18-27** presents the existing number of well pads within 2 miles of each lek as well as the estimated average number of well pads that would be developed under Alternative B that would be within 2 miles of each lek, assuming an evenly spread well pad development scenario.

Based on analysis of well pads within 2 miles of each lek, an estimated ***20*** leks would be subject to a low level of impact, and ***26*** would be subject to a moderate level of impact under Alternative B. No leks would be subject to a high level of impact under Alternative B. According to Wyoming EO ***2019-3***, any lek with greater than 11 well pads within a 2-mile radius would be in exceedance of the disturbance cap, which restricts more than 1 well pad and associated infrastructure per 640 acres, on average. Assuming an even distribution of well pads, development under Alternative B would exceed this level of development for 38 of the 46 ***occupied or undetermined*** sage-grouse leks within 2 miles of the CCPA. In areas were the 1 well pad and associated infrastructure per 640 acres potentially would be exceeded, site specific coordination between WGFD, the land management agency, and the operator would be required to avoid and minimize impacts to sage-grouse in PHMA.

As discussed under Alternative A and shown on **Table 4.18-27**, the 54 leks within the CCPA and the 2-mile buffer around the CCPA have experienced a reduction in peak male attendance of 83.9 percent between 2006 and 2016.

Table 4.18-27 Estimated Impacts from Alternative B to Occupied Leks with Well Pads within a 2-mile Radius

Lek ID	WGFD Status	Well Pads within CCPA and 2-mile Buffer			Degree of Impact[1]
		Existing	Estimated New	Estimated Total	
55 Ranch 1	Occupied	9	9.9	18.9	Moderate
55 Ranch 3	Occupied	6	9.9	15.9	Moderate
55 Ranch 4	Occupied	4	9.9	13.9	Moderate
55 Ranch 5	Undetermined	9	9.9	18.9	Moderate
55 Ranch 8	Occupied	9	9.9	18.9	Moderate
Bill Hall	Occupied	10	9.9	19.9	Moderate
Bill Hall South	Occupied	16	9.9	25.9	Moderate
Blue Hill 1	Occupied	3	9.9	12.9	Moderate
Blue Hill 2	Occupied	9	9.9	18.9	Moderate
Blue Hill 3	Occupied	5	9.9	14.9	Moderate
Blue Hill 4	Occupied	24	9.9	33.9	Moderate
Cheyenne Divide 1	Occupied	2	9.9	11.9	Low
Cheyenne Divide 2	Occupied	3	9.9	12.9	Moderate
Clausen Ranch	Occupied	8	9.9	17.9	Moderate
Clausen Ranch 2	Occupied	6	9.9	15.9	Moderate
Cole Creek	Occupied	0	9.9	9.9	Low
Cow Creek Road	Occupied	25	9.9	34.9	Moderate

Table 4.18-27 Estimated Impacts from Alternative B to Occupied Leks with Well Pads within a 2-mile Radius

Lek ID	WGFD Status	Well Pads within CCPA and 2-mile Buffer			Degree of Impact[1]
		Existing	Estimated New	Estimated Total	
Downs	***Occupied***	-	9.9	9.9	Low
Dull Center	Occupied	16	9.9	25.9	Moderate
East Antelope #1	Occupied	2	9.9	11.9	Low
East Steckley Road[2]	Occupied	-	9.9	9.9	Low
Flat-Top	Occupied	11	9.9	20.9	Moderate
Highland	Occupied	2	9.9	11.9	Low
Iberlin	Occupied	-	9.9	9.9	Low
Lone Tree Gulch 1	***Occupied***	1	9.9	10.9	Low
Lone Tree Gulch 2	Occupied	2	9.9	11.9	Low
Mai Tai	Occupied	3	9.9	12.9	Moderate
North 95	Occupied	-	9.9	9.9	Low
North 95 East	Occupied	-	9.9	9.9	Low
North Bobcat Road[2]	Occupied	13	9.9	22.9	Moderate
North Owens	Occupied	15	9.9	24.9	Moderate
North Shawnee	Occupied	6	9.9	15.9	Moderate
Ormsby Draw	Occupied	0	9.9	9.9	Low
Red Hills[2]	***Undetermined***	-	9.9	9.9	Low
Rocky Top	Occupied	14	9.9	23.9	Moderate
Sand Creek 1	Undetermined	-	9.9	9.9	Low
Sand Creek 2	Occupied	2	9.9	11.9	Low
South Jenny Trail	Undetermined	1	9.9	10.9	Low
South Poison Draw	Undetermined	1	9.9	10.9	Low
Steckley Road[2]	Occupied	-	9.9	9.9	Low
Suicide Hill	Occupied	5	9.9	14.9	Moderate
Tillards 1	Occupied	6	9.9	15.9	Moderate
Tillards 2	Occupied	2	9.9	11.9	Low
Turner Divide	Undetermined	9	9.9	18.9	Moderate
Upper Lake Creek[2]	Occupied	11	9.9	20.9	Moderate
West Harney Creek	Occupied	2	9.9	11.9	Low

[1] Degree of impact based on the following from Doherty et al. 2010:
Low: 1-12 well pads within 2 miles of lek.
Moderate: 12- 39 well pads within 2 miles of lek.
High: >39 well pads within 2 miles of lek.

[2] Lek are outside of CCPA but within 2 miles.

As discussed under Alternative A, there would be potential for mortalities of nesting sage-grouse resulting from the destruction of active nests due to the amount of habitat impacted. This potential typically would be limited by seasonal timing restrictions of oil and gas operations activities. However, under Alternative B, operators would request exceptions to timing stipulations for sage-grouse outside of PHMA. As described previously under Alternative A (Section 4.18.3.1), sage-grouse display one of the lowest nest success rates of all upland game birds, hens have been observed abandoning active nests due to human disturbance and ground disturbing activities within a certain proximity (Schroeder 1997), and habitat selection by sage-grouse is very specific. The potential for exceptions to timing stipulations would increase impacts to sage-grouse and associated habitat. Despite NSO stipulations around lek sites, by granting exceptions to timing limitations for sage-grouse ***leks in GHMA*** development activity could disrupt activity during sensitive time periods, lead to lek and nest abandonment, and prohibit use of associated habitats or relocation to less desirable habitat. As a result, there would be a reduction in the use of nesting habitat, lower reproductive ***nest*** success including lower brood survival, and a loss of foraging habitat.

Table 4.18-28 presents the total acres within the CCPA that would be impacted under Alternative B within sage-grouse lek buffers and timing restriction areas. Surface occupancy would be prohibited within 0.25 mile of active sage-grouse leks outside of PHMA and within 0.6 mile of active leks inside PHMA.

Table 4.18-28 Estimated Surface Disturbance to Greater Sage-grouse Leks and Habitat under Alternative B

Lek Buffer/Habitat Type	Acres of Total Habitat within the CCPA	Estimated Acres of Surface Disturbance[1]
0.25-Mile Lek Buffer (NSO outside of PHMA)[2]	2,665	0
0.6-Mile Lek Buffer (NSO inside PHMA)[2]	13,751	0
2.0-Mile Lek Buffer (March 15 to July 14 Timing Restriction) outside of PHMA in CCPA[3]	118,619	4,15*2*

[1] Due to the programmatic nature of this EIS, actual disturbance values were not available; therefore, a quantitative estimate was calculated as a percentage (3.5) of the new surface disturbance for Alternative B (52,667 acres) multiplied by each lek buffer/habitat within the CCPA.

[2] No surface disturbance is allowed within NSO buffers.

[3] Planned development under Alternative B would be subject to the no surface disturbance restriction within PHMA. However, exceptions to the timing restriction between March 15 to July 14 within 2 miles of occupied leks outside of PHMAs may be requested.

Impacts to Greater Sage-grouse Habitat

Alternative B would result in surface disturbance to approximately 11,584 acres (3.5 percent) of the available 330,463 acres of sagebrush shrubland habitat within the CCPA. Based on the possibility of exceptions to timing stipulations under Alternative B, approximately 4,15***2*** acres (3.5 percent) of the 118,619 acres included in 2-mile buffers around lek sites within the CCPA (**Table 4.18-28**) could be impacted. Impacts to the sage-grouse under Alternative B could lead to a decline of the population as a result of further habitat disturbance and fragmentation in the CCPA. Habitat fragmentation would increase from 1.90 miles per square mile of existing linear Project components (roads, pipelines, and overhead powerlines) to 3.72 miles per square mile in the CCPA under Alternative B (**Table 4.18-5**). In total, 4,400 miles of new linear Project components would be constructed, which would reduce the quality of sage-grouse habitat in the CCPA.

Summary of Effects to Greater Sage-grouse

Under Alternative B, habitat fragmentation would increase from 1.90 miles of existing linear Project components per square mile to 3.72 miles per square mile in the CCPA (**Table 4.18-5**). In addition, well pad density would increase from 0.61 well pads per square miles to 1.45 well pads per square miles due to the addition of 1,955 new well pads.

The estimated acreage of surface disturbance within 2 miles of occupied leks in GHMA would increase to 4,15***2*** acres, and additional impacts to breeding sage-grouse would occur in areas where exceptions to seasonal timing limitations were granted. In addition, the average number of new well pads installed within 2 miles of a lek could be increased by 10; approximately 8 more than under Alternative A.

Considering the slight downward trend in male attendance at leks in the CCPA along with the level of existing disturbance, Alternative B would result in a substantial increase in risk to sage-grouse. The direct loss of birds, loss and alteration of habitat, habitat fragmentation, and indirect impacts related to increased predation and the spread of noxious weeds and invasive plant species would all lead to the continued decline of sage-grouse numbers in the CCPA. In addition, surface use within 2 miles of sage-grouse leks would be allowed under Alternative B during the breeding season within timing stipulation areas in GHMA, resulting in surface disturbance to approximately 4,15***2*** acres (3.5 percent) of the 118,619 acres included in 2-mile buffers around lek sites within the CCPA (**Table 4.18-27**). Disturbance and noise within this buffer would result in adverse impacts to breeding sage-grouse that could lead to reductions in the number of sage-grouse in the CCPA as discussed in detail under Alternative A.

Bats (Fringed Myotis, Long-eared Myotis, Townsend's Big-eared Bat, and Hoary Bat)

Under Alternative B, impacts to fringed myotis (BLM and USFS sensitive), long-eared myotis (BLM sensitive), Townsend's big-eared bat (BLM and USFS sensitive), and hoary bat (USFS sensitive) would be similar in nature to impacts described under Alternative A; however, the magnitude of these impacts would be greater. The BLM and USFS require protection of riparian habitats, so impacts to these habitats would be reduced on BLM- and USFS-administered lands within the CCPA. However, vehicle traffic at stream crossings and new stream crossings still would result in impacts to foraging habitat for these species on non-BLM land. In addition, surface disturbance impacts to riparian habitat on non-federal lands still would occur. In total, Alternative B would result in surface disturbance to approximately 383 acres (1.8 percent) of the available 21,593 acres of suitable riparian and wetland foraging habitat within the analysis area and 4.2 percent of the available 9,108 acres of habitat within the CCPA. As discussed under Alternative A, impacts to bat day roost areas and wintering sites on the TBNG would be minimized through adherence to USFS Guidelines.

Special Status Small Mammals (Black-tailed Prairie Dog, Northern River Otter, and Swift Fox)

Under Alternative B, impacts to black-tailed prairie dog (BLM and USFS sensitive, MIS), northern river otter (USFS sensitive), and swift fox (BLM and USFS sensitive) would be similar in nature to impacts described under Alternative A.

As under Alternative A, BLM and USFS management guidelines would minimize impacts to prairie dog colonies on BLM- and USFS-administered lands by requiring avoidance of prairie dog colonies and the establishment of new prairie dog colonies when applicable. However, additional impacts to the species still would occur, especially on non-federal lands. The types of impacts to prairie dogs under Alternative B would be the same as described under Alternative A, but would be greater in magnitude relative to the higher degree of oil field development. Impacts to black-tailed prairie dog would include surface disturbance to approximately 55***4*** acres, or 3.5 percent of the prairie dog colonies within the CCPA (15,825 acres) and 1.14 percent of the existing 48,672 acres of known prairie dog colonies in the analysis area.

Impacts to northern river otter would be the same as described under Alternative A, but any potential effects to the species or habitat would be greater in magnitude relative to the higher degree of oil field development.

Under Alternative B, the types of impacts to swift fox would be the same as described under Alternative A but would be greater in magnitude. Impacts would include surface disturbance to approximately 34,905 acres, 3.51 percent of the available 995,706 acres of grassland habitat in the CCPA and 2.55 percent of the available 1,370,493 acres of the entire wildlife analysis area. Impacts to breeding swift foxes on the TBNG would be minimized with adherence to USFS Standards and Guidelines that prohibit construction within 0.25 mile of den sites March 1 to August 31.

Special Status Migratory Avian Species

The types of impacts to special status migratory avian species under Alternative B would be the same as described under Alternative A but would occur at a greater magnitude relative to the increase in oil field development. **Table 4.18-29** presents estimated disturbance impacts to special status migratory avian species habitat in the CCPA from Alternative B.

Table 4.18-29 Disturbance to BLM and USFS Sensitive Migratory Bird Species Habitats from Alternative B

Species Common Name	Potential Habitat in CCPA (acres)[1]	Estimated Impacts to Potential Habitat in CCPA[2] (acres)
American three-toed woodpecker	11,239	394
American bittern	9,108	***319***
Baird's sparrow	995,706	34,***850***
Bald eagle	9,108	3***19***
Black tern	9,108	3***19***
Brewer's sparrow	330,463	11,5***67***
Burrowing owl	1,469,876	51,***446***
Chestnut-collared longspur	995,706	34,***850***
Ferruginous hawk	1,469,876	51,***446***
Flammulated owl	11,239	394
Grasshopper sparrow	330,463	11,5***67***
Lewis's woodpecker	11,239	394
Long-billed curlew	1,015,088	35,***529***
Loggerhead shrike	11,239	394
McCown's longspur	995,706	34,***850***
Mountain plover	1,121,722	39,***261***
Northern goshawk	11,239	394
Northern harrier	19,382	***679***
Olive-sided flycatcher	11,239	394
Peregrine falcon	1,478,984	51,***765***
Sagebrush sparrow	330,463	11,5***67***
Sage thrasher	337,880	11,8***26***
Short-eared owl	1,015,088	35,***529***
Trumpeter swan	9,108	3***19***
White-faced ibis	9,108	3***19***

1 Potential habitat is described in **Appendix F** for each species.

2 Estimated values calculated as approximately 3.5 percent of potential habitat present in CCPA.

Terrestrial Invertebrates (Ottoe Skipper, Regal Fritillary, Monarch Butterfly, and Western Bumble Bee)

The types of impacts to terrestrial invertebrates would be the same under Alternative B as described under Alternative A but would be greater in magnitude relative to the increase in oil field development. Under Alternative B, impacts to Ottoe skipper would include surface disturbance to approximately 34,***850*** of the available 995,706 acres (3.5 percent) of grassland habitat in the CCPA. This would be approximately 2.55 percent of the available 1,370,493 acres of grassland habitat within the wildlife analysis area. Impacts to regal fritillary would include surface disturbance to approximately 35,***169*** of the 1,004,814 acres (3.5 percent) of grassland and wetland/riparian habitats in the CCPA, which would be approximately 2.53 percent of the 1,392,086 acres of available suitable habitat in the analysis area. Impacts to monarch butterfly and western bumble bee would include surface disturbance to approximately 52,***584*** acres (3.5 percent) of the available 1,502,381 acres of suitable habitat within the CCPA and approximately 2.4 percent of the 2,206,155 acres of suitable habitat in the analysis area.

Wyoming Species of Greatest Conservation Need

In general, impacts to SGCN mammals under Alternative B would be the same as those identified under Alternative A but would occur at a greater magnitude relative to the increase in oil field development. **Table 4.18-30** presents impacts to associated habitat for each of the SGCN mammals with the potential to occur within the CCPA. SGCN avian species are analyzed in Section 4.18.2 and SGCN aquatic species are analyzed in Section 4.18.5.

Table 4.18-30 Disturbance to SGCN Mammal Species Habitats from Alternative *B*

Species	Potential Habitat in CCPA[1] (acres)	Estimated Impacts to Potential Habitat in CCPA[2] (acres)
Dwarf shrew	137,255	4,8***04***
Eastern red bat	10,946	3***84***
Eastern spotted skunk	7,417	2***60***
Hayden's shrew	1,004,814	35,***169***
Little brown myotis	20,347	7***13***
Long-legged myotis	20,347	7***13***
Olive-backed pocket mouse	1,139,413	39,***880***
Pallid bat	1,470,841	51,***480***
Plains harvest mouse	1,326,169	46,***416***
Sagebrush vole	330,463	11,5***67***
Sand Hills pocket gopher	995,706	34,***850***
Silky pocket mouse	1,121,722	39,***261***
Spotted ground squirrel	1,013,397	35,***469***
Western small-footed myotis	1,149,486	40,***233***

1 Based on associated habitat descriptions found in **Table 3.18-5** and **Appendix F.**

2 Estimated values calculated as approximately 3.5 percent of potential habitat present in the CCPA.

Summary of Impacts to Special Status Species under Alternative B

Table 4.18-31 provides a summary of Impacts to special status terrestrial species under Alternative B.

Table 4.18-31 Summary of Impacts to Special Status Terrestrial Species under Alternative B

Species	Available Habitat in the Analysis Area	Acres of Surface Disturbance	Primary Effects
Preble's meadow jumping mouse	8,403	158	• Vehicle crushing • Loss and alteration of habitat • Habitat fragmentation
Black-footed ferret	48,672 (prairie dog colonies)	579 (prairie dog colonies)	• Loss of suitable prairie dog colonies
Greater sage-grouse	483,630 (sagebrush) 284,375 (PHMA) 118,619 (2-mile lek buffer GHMA)	11,584 (sagebrush) 1,126 (M Creek PHMA only) 4,15***2*** (2-mile lek buffer GHMA)	• Surface use in proximity to leks • Loss and alteration of habitat • Noise impacts • Increased predation • Reduced breeding success due to disturbance near leks/ breeding areas
Bats	21,593	383	• Loss and alteration of foraging habitat • Herbicide effects on individual fitness
Black-tailed prairie dog	48,672 (colonies)	55***4***	• Habitat loss and alteration • Crushing of burrows or vehicle strikes • Increased predation
Northern river otter	2,970 (open water)	0	• Habitat/water quality degradation
Swift fox	1,370,493	34,905	• Loss and alteration of grassland habitat • Increased competition with and predation from coyote • Vehicle strikes
Migratory avian species	2,206,155	52,667	• Loss and alteration of habitat • Noise impacts • Collision/electrocution with power lines • Reduced breeding success due to disturbance near nests • Crushing of nests or vehicle strikes
Ottoe skipper	1,370,493	34,905	• Grassland conversion • Invasive plants • Herbicide effects
Regal fritillary	1,392,086	35,225	• Grassland conversion • Invasive plants • Herbicide effects

Table 4.18-31 Summary of Impacts to Special Status Terrestrial Species under Alternative B

Species	Available Habitat in the Analysis Area	Acres of Surface Disturbance	Primary Effects
Monarch butterfly and western bumble bee	2,206,155	52,667	• Habitat loss • Invasive plants • Herbicide effects
SGCN Mammals	2,206,155	52,667	• Loss and alteration of habitat • Crushing of burrows or vehicle strikes • Herbicide effects on individual fitness

4.18.3.3 Mitigation and Mitigation Effectiveness – Alternative B

Mitigation measures WLF-1 through WLF-8 (Section 4.18.1.2) and MIG-1 and MIG-2 (Section 4.18.2.2) recommended to minimize Project-related impacts to terrestrial wildlife species, including migratory birds, also would be applicable to further protect special status terrestrial species. Additionally, the following mitigation measures specific to special status wildlife species and their habitats would be applied to further minimize impacts related to development under Alternative B:

SSWS-1: A vehicle speed limit of ***25*** mph will be implemented on roads without posted speed limits in areas of occupied sage-grouse habitat.

SSWS-2: A Raven Management Plan will be developed that outlines active adaptive management strategies for controlling raven predation and nesting within the CCPA, including the post-construction monitoring for ravens and removal of raven nests.

SSWS-3: Bird diverters/markers will be installed on ***all*** fencing in PHMA ***to the extent set forth in applicable fencing agreements with private surface owners within the CCPA***.

SSWS-***4***: A 0.25-mile no surface use buffer will be maintained in any areas identified as occupied special status bat roosts. ***As described in Section 3.18.3.5, suitable roosting habitat found within the CCPA includes rock crevices, buildings, bridges, trees, and mines. Bat surveys will be required on any bridges that are modified.***

SSWS-***5***: Any areas where herbicides would be used for vegetation treatment will be searched for bat roosts prior to spraying, and a 0.5-mile no-spray buffer will be established around roost sites.

SSWS-***6***: Surveys will be conducted for Preble's meadow jumping mouse prior to surface disturbance based on the ***USFWS*** protocol ***(2004c)***. Surveys will take place in suitable habitats in areas where surface disturbance is to occur. If the species is located, additional coordination with the BLM, USFS, and USFWS will be required prior to surface disturbing activities.

Mitigation measures SSWS-1 through SSWS-3 would minimize impacts to sage-grouse and their habitat: SSWS-1 would limit potential for adverse impacts resulting from contact with construction equipment, vehicles, and personnel; SSWS-2 would limit corvid predation on sage grouse; and SSWS-3 would prevent sage-grouse collisions or entanglement with fencing. Mitigation measure SSWS-***4*** would reduce potential for noise-related impacts to roosting special status bats and possible roost-abandonment resulting from human activity and noise in the vicinity. Mitigation measure SSWS-***5*** would minimize direct impacts to special status bats by reducing the potential for herbicide exposure to bats and bat roosts. Mitigation measure SSWS-***6*** would minimize impacts to Preble's meadow jumping mouse and reduce potential for adverse effects from direct disturbance.

4.18.3.4 Residual Impacts – Alternative B

Residual impacts are defined as unavoidable adverse impacts to a resource that remain after implementation of proposed mitigation. Implementation of agency mitigation measures would reduce impacts to special status wildlife species and habitats on BLM and USFS surface and mineral estate, which comprise approximately 64 percent of the CCPA. Approximately 36 percent of the CCPA is state or private surface and mineral estate. These lands would not be subject to agency wildlife protection measures, as required on BLM and USFS surface and mineral estate. However, ESA protections for federally threatened, endangered, and proposed species ***and regulations set forth under Wyoming EO 2019-3 for sage-grouse*** are required regardless of land ownership. Additionally, approximately 7 percent of the CCPA is Wyoming state land, and state mitigation measures would be applied to reduce impacts in those areas.

Under Alternative B, agency reclamation standards would be implemented to BLM and USFS surface estate only, which comprise approximately 10 percent of the CCPA. Within the CCPA, 83 percent is private surface estate on which reclamation standards would be specified in private landowner agreements. Therefore, an increased potential exists for residual impacts to special status wildlife species and habitat on private surface estate.

Depending on land ownership, the types of residual impacts to special status wildlife species and their habitats that could remain after the implementation of additional mitigation measures include:

- Habitat loss, alteration, or fragmentation due to surface disturbance and associated aboveground structures.
- Increased number of vehicle/wildlife collisions due to the increased number and density of roads.
- Decrease in carrying capacity, fitness, and population numbers for sage-grouse due to habitat fragmentation, surface disturbance, and human activity and noise.
- Increased predation pressure on sage-grouse due to increased perches for birds of prey.

Specific to sage-grouse, despite the implementation of the mitigation measures above, based on the recent downward trend in peak male attendance, all sage-grouse leks in the CCPA would be at risk of being abandoned as development would continue to increase in surrounding areas under Alternative B. As described above, habitat selection by sage-grouse is very specific. The potential for granting of exceptions to timing limit stipulations would increase impacts to sage-grouse and associated habitat as a result of disturbance by noise and human presence. Despite NSO stipulations around lek sites, by granting exceptions to timing limitations within sage-grouse habitat, development activity could disrupt activity during sensitive time periods and prohibit use of associated habitats or cause relocation to less desirable habitat. As a result, there would be a reduction in the use of nesting habitat, lower reproductive ***nest*** success including lower brood survival, and a loss of foraging habitat.

Similarly for the Preble's meadow jumping mouse, due to the apparent rarity this species in the analysis area and the decline in the extent and quality of its habitat throughout is geographic range (69 FR 29101), any impact from Project development to the species potentially would lead to extirpation from the CCPA.

Therefore, Alternative B would result in impacts to special status wildlife species associated with surface disturbance, habitat fragmentation, human disturbance, and the potential for granting of exceptions to timing limit stipulations.

Avoidance and minimization of residual impacts to the species and its habitat may be inadequate or impossible based on the amount of existing disturbance within PHMA. ***Therefore, to achieve standards***

consistent with the Approved Resource Management Plan Amendment for the Wyoming Greater Sage-grouse (Attachment 4 to BLM 2015b), the Land Resource Management Plan Amendment for TBNG (Attachment B to USFS 2015b), the State of Wyoming EO 2019-3 (Greater Sage grouse Core Area Protection), additional mitigation consistent with these guidance documents would need to be considered, including accounting for any uncertainty associated with the effectiveness of such mitigation.

Other special status species would be adequately protected under federal and state regulations, avoidance and minimization mitigation, OG-committed design features, and the additional mitigation measures (Section 4.18.3.3).

4.18.3.5 Impacts to Special Status Wildlife Species from Alternative C

The types of impacts to wildlife species and habitat under Alternative C would be the same as under Alternative A and Alternative B; however, surface disturbance and related impacts would be less than under Alternative B based on the assumption that a higher average number of wells would be drilled from each pad (WGFD 2010b). The same number of oil and gas wells (5,000) would be drilled under the same drilling rate (500 wells per year) as Alternative B but under Alternative C there would be only 938 oil and gas well pads (562 less than under Alternative B), which subsequently would reduce the number of production pads, access roads, pipelines, and overhead electrical distribution lines needed (**Table 2.5-1**). Alternative C would not include changes to any of the proposed construction/production facilities discussed under Alternative B. Surface disturbances for Alternative C would be 37,267 acres; 15,400 acres less than Alternative B. In addition, implementation of management direction or requirements from the BLM Casper RMP (BLM 2007b) and USFS TBNG LRMP (USFS 2001) would minimize impacts to all wildlife species. These measures would be the same as discussed under Alternative A. In addition, OG-committed design features (see Chapter 6.0, Mitigation) would further minimize impacts to all wildlife species under Alternative C.

For detail regarding other alternative-specific activities under Alternative C, see to Section 2.5.2. Other activities that would change the impacts to special status wildlife resulting from development under Alternative C include the following:

- A single water supply and disposal pipeline could be used for water supply and the pumping direction could be reversed after all wells were completed to pump water back to the facilities for disposal. This process would reduce the number of pipelines required for production.
- Upon completion of construction activities, all disturbed areas not necessary for production would undergo interim reclamation to minimize environmental impacts. On federally managed lands and private lands above federal minerals, interim reclamation would be required to meet the BLM or USFS approval for suitable wildlife habitat. This would equate to approximately 65 percent of the CCPA.
- Timing limit stipulations would continue to be required as outlined in the BLM Casper RMP and USFS TBNG LRMP (**Table 2.5-2**). This would mean that exceptions to timing limit stipulations would not be granted on approximately 15 to 20 percent of the CCPA, which would eliminate some of the adverse impacts described under Alternative B.

<u>Federally Listed Species</u>

Preble's Meadow Jumping Mouse (Federally Threatened)

Alternative C would result in surface disturbance to an estimated 112 acres, which is 2.5 percent of the 4,519 acres of modelled Preble's meadow jumping mouse habitat within the CCPA and approximately 1.3 percent of the 8,403 acres of modeled habitat within the analysis area. The types of impacts to the species would be the same as described under Alternative A, but impacts would be greater in magnitude (approximately 80 acres more surface disturbance) relative to the overall increase in proposed well pads and other Project disturbance. Additionally, impacts would be similar to Alternative B, but to a lesser degree (approximately 50 acres less surface disturbance). Similar to all alternatives, management direction from the BLM Casper RMP as well as the Biological Opinion for the Casper RMP would minimize surface disturbance to riparian habitats on BLM-administered lands.

Under Alternative C, habitat fragmentation would increase from 1.90 miles/square mile of existing linear Project components (roads, pipelines, overhead powerlines) to 2.97 miles/square mile in the CCPA, approximately 0.75 mile/square mile less than under Alternative B (**Table 4.18-2**). Similar to Alternative B, this increase in habitat fragmentation would reduce the quality of habitat for Preble's meadow jumping mouse.

Compliance with the required measures and the already low potential for Preble's meadow jumping mouse to occur in the CCPA, Alternative C ***has potential for minimal adverse*** impacts to Preble's meadow jumping mouse populations in the CCPA.

Black-footed Ferret (Non-essential Experimental Population)

Impacts to the black-footed ferret as a result of Alternative C would be similar to those described under Alternatives A and B. Alternative C would result in surface disturbance to an estimated 39***6*** acres (2.5 percent) of existing prairie dog colonies within the CCPA (15,825 acres) and 0.81 percent of the existing prairie dog colonies within the entire analysis area (48,672 acres), which would be approximately 160 acres (30 percent) less than Alternative B.

Platte River Species (Federally Listed; Interior Least Tern, Piping Plover, Whooping Crane)

Water supply and consumptive surface water use would be the same as Alternative B. Therefore, impacts to the interior least tern, piping plover, and whooping crane would be the same under Alternative C.

<u>BLM and USFS Sensitive Species</u>

Greater Sage-grouse

The types of impacts to greater sage-grouse under Alternative C would be similar to those described under Alternative B. Based on direction from the BLM, analysis of impacts under Alternative C was conducted using Core Area Version 4 Maps to represent PHMA on BLM lands as opposed to the current correspondence with Core Area Version 3 Maps, which was used in the Approved Resource Management Plan Amendment for Greater Sage-grouse and for analysis of impacts for Alternatives A and B. The types of impacts to the USFS Bill and M Creek PHMAs within the analysis area would be similar to Alternatives A and B.

<u>Impacts to Greater Sage-grouse PHMAs</u>

The DDCT assessment areas used for Alternative C (Core Area Version 4 Maps and USFS PHMA) are shown on **Figure 4.18-2**. A summary of the analysis of existing surface disturbance within the DDCT assessment areas for Alternative C is provided on **Table 4.18-32**. As shown, existing disturbance for three of the five DDCT assessment areas already exceeds the 5 percent disturbance cap stipulated in WY EO ***2019-3***, the Approved Resource Management Plan Amendment for the Wyoming Greater Sage-grouse Sub-region (Attachment 4 to BLM 2015b), and the Land Management Plan Amendment for TBNG (Attachment B to USFS 2015b). Under Alternative C, surface disturbance would be prohibited within PHMA.

Table 4.18-32 Existing and New Surface Disturbance in Greater Sage-grouse PHMA under Alternative C

PHMA[1]	Size of DDCT Assessment Area (acres)	Existing Surface Disturbance in the DDCT Assessment Area[2]	
		Acres	Percent
Bill	4,054	67	1.7
Douglas	66,841	15,713	23.5
M Creek	26,445	239	0.9
North Glenrock	114,202	11,741	10.3
Thunder Basin	81,916	7,940	9.7

[1] Based on BLM/USFS PHMA and Core Area Version 4 Maps.

[2] Under Alternative C, new surface disturbance would be prohibited under PHMA.

Impacts to Greater Sage-grouse Leks and Breeding Habitats

The number and status of leks within the analysis area would be the same as Alternatives A and B. **Table 4.18-33** presents the existing number of well pads within 2 miles of each lek as well as the estimated average number of well pads that would be developed under Alternative C within 2 miles of each lek.

Based on analysis of well pads within 2 miles of each lek, an estimated ***24*** leks would be subject to a low level of impact, and ***22*** would be subject to a moderate level of impact under Alternative C; lessening 4 leks to the status of low level impact compared to Alternative B. No leks would be subject to a high level of impact under Alternative C. According to Wyoming EO ***2019-3***, any occupied lek with greater than 11 well pads within a 2-mile radius would be in exceedance of the disturbance cap, which restricts more than 1 well pad and associated infrastructure per 640 acres within PHMA, on average. Assuming an even distribution of well pads, development under Alternative C would exceed this level of development for 26 of the 48 sage-grouse leks within 2 miles of the CCPA.

As discussed under Alternative A and shown on **Table 4.18-21**, the 54 leks within the CCPA and the 2-mile buffer around the CCPA have experienced reduction in peak male attendance and the average peak male attendance from 2006 to 2016. Similar to Alternatives A and B, based on the recent downward trend in peak male attendance, all sage-grouse leks in the CCPA would be at risk of being abandoned as development would continue to increase in surrounding areas under Alternative C.

Similar to Alternative B, there would be potential for mortalities of nesting sage-grouse resulting from the destruction of active nests due to the amount of habitat impacted. However, under Alternative C, the BLM would not grant exceptions to timing limit stipulations and operators would abide by the seasonal restrictions designed to protect sage-grouse leks and breeding habitats from oil and gas activities that could lead to nest abandonment and reduced reproductive success. As a result, the potential for impacts to sage-grouse would be further minimized under Alternative C. However, the application of seasonal timing stipulations ultimately would not prevent additional impacts associated with habitat loss and disturbance to breeding habitats.

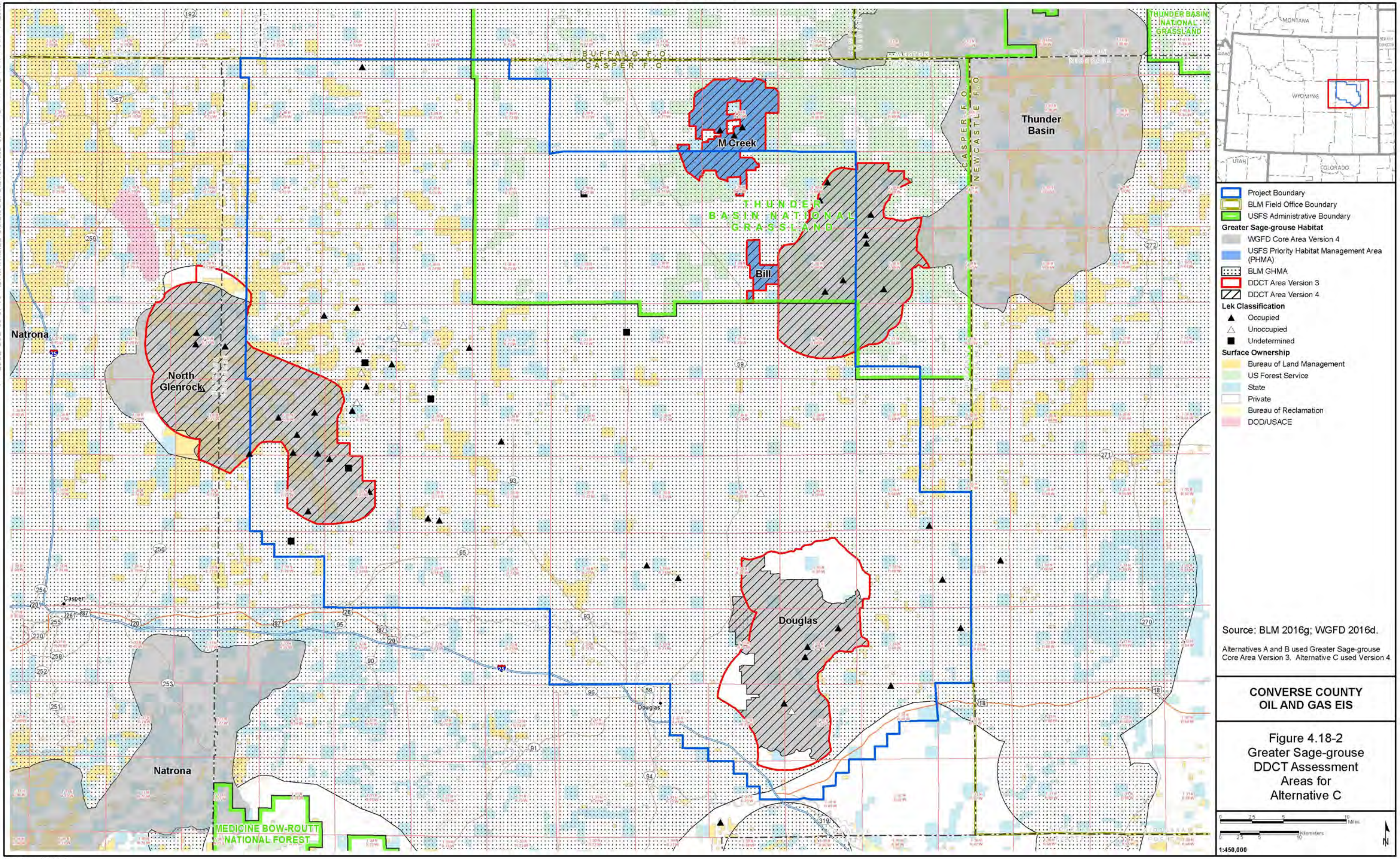

Figure 4.18-2
Greater Sage-grouse
DDCT Assessment
Areas for
Alternative C

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Table 4.18-33 Estimated Impacts from Alternative C to Occupied Leks with Well Pads within a 2-mile Radius

Lek ID	WGFD Status	Well Pads within 2-mile Buffer			Degree of Impact[1]
		Existing	Estimated New	Estimated Total	
55 Ranch 1	Occupied	9	6.4	15.4	Moderate
55 Ranch 3	Occupied	6	6.4	12.4	Moderate
55 Ranch 4	Occupied	4	6.4	10.4	Low
55 Ranch 5	Undetermined	9	6.4	15.4	Moderate
55 Ranch 8	Occupied	9	6.4	15.4	Moderate
Bill Hall	Occupied	10	6.4	16.4	Moderate
Bill Hall South	Occupied	16	6.4	22.4	Moderate
Blue Hill 1	Occupied	3	6.4	9.4	Low
Blue Hill 2	Occupied	9	6.4	15.4	Moderate
Blue Hill 3	Occupied	5	6.4	11.4	Low
Blue Hill 4	Occupied	24	6.4	30.4	Moderate
Cheyenne Divide 1	Occupied	2	6.4	8.4	Low
Cheyenne Divide 2	Occupied	3	6.4	9.4	Moderate
Clausen Ranch	Occupied	8	6.4	14.4	Moderate
Clausen Ranch 2	Occupied	6	6.4	12.4	Moderate
Cole Creek	Occupied	0	6.4	6.4	Low
Cow Creek Road	Occupied	25	6.4	31.4	Moderate
Downs	***Occupied***	-	6.4	6.4	Low
Dull Center	Occupied	16	6.4	22.4	Moderate
East Antelope #1	Occupied	2	6.4	8.4	Low
East Steckley Road[2]	Occupied	-	6.4	6.4	Low
Flat-Top	Occupied	11	6.4	17.4	Moderate
Highland	Occupied	2	6.4	8.4	Low
Iberlin	Occupied	-	6.4	6.4	Low
Lone Tree Gulch 1	***Occupied***	1	6.4	7.4	Low
Lone Tree Gulch 2	Occupied	2	6.4	8.4	Low
Mai Tai	Occupied	3	6.4	9.4	Moderate
North 95	Occupied	-	6.4	6.4	Low
North 95 East	Occupied	-	6.4	6.4	Low
North Bobcat Road[2]	Occupied	13	6.4	19.4	Moderate
North Owens	Occupied	15	6.4	21.4	Moderate
North Shawnee	Occupied	6	6.4	12.4	Moderate
Ormsby Draw	Occupied	0	6.4	6.4	Low
Red Hills[2]	***Undetermined***	-	6.4	6.4	Low
Rocky Top	Occupied	14	6.4	20.4	Moderate
Sand Creek 1	Undetermined	-	6.4	6.4	Low
Sand Creek 2	Occupied	2	6.4	8.4	Low

Table 4.18-33 Estimated Impacts from Alternative C to Occupied Leks with Well Pads within a 2-mile Radius

Lek ID	WGFD Status	Well Pads within 2-mile Buffer			Degree of Impact[1]
		Existing	Estimated New	Estimated Total	
South Jenny Trail	Undetermined	1	6.4	7.4	Low
South Poison Draw	Undetermined	1	6.4	7.4	Low
Steckley Road[2]	Occupied	-	6.4	6.4	Low
Suicide Hill	Occupied	5	6.4	11.4	Low
Tillards 1	Occupied	6	6.4	12.4	Moderate
Tillards 2	Occupied	2	6.4	8.4	Low
Turner Divide	Undetermined	9	6.4	15.4	Moderate
Upper Lake Creek[2]	Occupied	11	6.4	17.4	Moderate
West Harney Creek	Occupied	2	6.4	8.4	Low

[1] Degree of impact based on the following from Doherty et al. 2010:
Low: 1-12 well pads within 2 miles of lek.
Moderate: 12- 39 well pads within 2 miles of lek.
High: >39 well pads within 2 miles of lek.

[2] Lek are outside of CCPA but within 2 miles.

Table 4.18-34 presents the total acres within the CCPA that would be impacted under Alternative C within sage-grouse lek buffers and timing restriction areas. Surface occupancy would be prohibited within 0.25 mile of active sage-grouse leks outside of PHMA and within 0.6 mile of active leks inside PHMAs.

Table 4.18-34 Estimated Surface Disturbance to Greater Sage-grouse Leks and Habitat under Alternative C

Lek Buffer/Habitat type	Acres of Total Habitat within the CCPA	Estimated Acres of Surface Disturbance[1]
0.25-mile Lek Buffer (NSO outside of PHMA)[2]	2,665	0
0.6-mile Lek Buffer (NSO inside PHMA)[2]	13,751	0
2.0-mile Lek Buffer (March 15 to June 30 Timing Restriction) outside of PHMAs in CCPA	118,619	2,9***66***

[1] Due to the programmatic nature of this EIS, actual disturbance values were not available; therefore, a quantitative estimate was calculated as a percentage (2.5) of the new surface disturbance for Alternative C (37,267 acres) multiplied by each lek buffer/habitat within the CCPA.

[2] No surface disturbance is allowed within NSO buffers.

Impacts to Greater Sage-grouse Habitat

Alternative C would result in surface disturbance to approximately 8,197 acres (2.5 percent) of the available 330,463 acres of sagebrush shrubland habitat within the CCPA (**Table 4.18-34**). This would be approximately 3,000 acres (1.0 percent) less than Alternative B. Habitat fragmentation would increase from 1.90 miles per square mile of existing linear Project components (roads, pipelines, overhead powerlines) to 2.97 miles per square mile in the CCPA. In total, 2,943 miles (1,457 miles less than

Alternative B) of linear Project components would be constructed which would reduce the quality of sage-grouse habitat in the CCPA.

Summary of Effects to Greater Sage-grouse

Impacts to greater sage-grouse under Alternative C would be similar to those from Alternative B, but the magnitude generally would be less. Under Alternative C habitat fragmentation would increase from 1.90 miles of existing linear Project components per square mile to ***2.97*** miles per square mile in the CCPA (**Table 4.18-8**). In addition, well pad density would increase from 0.61 well pads per square mile to 1.15 well pads per square mile due to the addition of 1,254 new well pads (including oil and gas well pads, production pads, water source well pads, and disposal well pads; see **Table 2.5-1**).

Under Alternative C, no new surface disturbance would be considered within PHMA. The estimated acreage of surface disturbance within 2 miles of occupied leks in GHMA would increase to 4,407 acres. In addition, the average number of new well pads installed within 2 miles of a lek could be increased by 6.4; approximately 4.5 more than under Alternative A, but 3.5 fewer than under Alternative B.

Alternative C would not allow for surface use within 2 miles of sage-grouse leks during the breeding season within timing limit stipulation areas in GHMA, which would reduce impacts to breeding sage-grouse that could lead to reductions in the number of sage-grouse in the CCPA.

Bats (Fringed Myotis, Long-eared Myotis, Townsend's Big-eared Bat, and Hoary Bat)

Under Alternative C. impacts to fringed myotis (BLM and USFS sensitive), long-eared myotis (BLM sensitive), Townsend's big-eared bat (BLM and USFS sensitive), and hoary bat (USFS sensitive) would be similar in nature to impacts described under Alternative A and Alternative B; however, the magnitude of these impacts would be less than under Alternative B. In total, Alternative C would result in surface disturbance to approximately 272 acres (1.3 percent) of the available 21,593 acres of suitable riparian and wetland foraging habitat within the analysis area and 3.0 percent of the available 9,108 acres within the CCPA. As discussed under Alternative A, impacts to bat day roost areas on the TBNG would be minimized through adherence to USFS Guidelines.

Special Status Small Mammals (Black-tailed Prairie Dog, Northern River Otter, and Swift Fox)

Under Alternative C, impacts to black-tailed prairie dog (BLM and USFS sensitive, MIS), northern river otter (USFS sensitive), and swift fox (BLM and USFS sensitive) would be similar in nature to impacts described under Alternatives A and B.

The types of impacts to black-tailed prairie dogs under Alternative C would be the same as described under Alternative B, but to a lesser degree in magnitude. Impacts to black-tailed prairie dog would include surface disturbance to approximately 39***6*** acres (2.5 percent) of existing prairie dog colonies within the CCPA (15,825 acres) and 0.81 percent of the existing prairie dog colonies within the entire analysis area (48,672 acres), which would be approximately 160 acres (30 percent) less than Alternative B.

Impacts to northern river otter would be the same as described under Alternatives A and B, but any potential effects to the species or habitat would be of lesser magnitude than under Alternative B.

Under Alternative C, the types of impacts to swift fox would be the same as described under Alternatives A and B, but would be of lesser magnitude compared to Alternative B. Impacts would include surface disturbance to approximately 24,698 acres (2.48 percent) of the available 995,706 acres of grassland habitat in the CCPA. This would be 10,207 acres (1.0 percent) less than Alternative B and 1.80 percent of the available 1,370,493 acres of habitat in the entire wildlife analysis area (approximately 0.75 percent less than Alternative B). Impacts to breeding swift foxes on the TBNG would be minimized with adherence to USFS Standards and Guidelines that prohibit construction within 0.25 mile of dens sites March 1 to August 31.

Special Status Migratory Avian Species

The types of impacts to special status migratory avian species under Alternative C would be the same as described under Alternatives A and B; however, the impacts would be lower in magnitude than Alternative B because a greater number of wells would be drilled from each pad, resulting in fewer pads. **Table 4.18-35** presents estimated disturbance impacts to special status migratory avian species habitat in the CCPA from Alternative C.

Table 4.18-35 Disturbance to BLM and USFS Sensitive Migratory Avian Species Habitats from Alternative C

Species Common Name	Potential Habitat in CCPA (acres)[1]	Estimated Impacts to Potential Habitat in CCPA[2] (acres)
American three-toed woodpecker	11,239	***281***
American bittern	9,108	***228***
Baird's sparrow	995,706	24,***893***
Bald eagle	9,108	2***28***
Black tern	9,108	2***28***
Brewer's sparrow	330,463	8,***262***
Burrowing owl	1,469,876	36,***747***
Chestnut-collared longspur	995,706	24,***893***
Ferruginous hawk	1,469,876	36,***747***
Flammulated owl	11,239	2***81***
Grasshopper sparrow	330,463	8,***262***
Lewis's woodpecker	11,239	2***81***
Long-billed curlew	1,015,088	25,***378***
Loggerhead shrike	11,239	2***81***
McCown's longspur	995,706	24,***893***
Mountain plover	1,121,722	2***8,044***
Northern goshawk	11,239	2***81***
Northern harrier	19,382	4***85***
Olive-sided flycatcher	11,239	2***81***
Peregrine falcon	1,478,984	36,***975***
Sagebrush sparrow	330,463	8,***262***
Sage thrasher	337,880	8,***447***
Short-eared owl	1,015,088	25,***378***
Trumpeter swan	9,108	2***28***
White-faced ibis	9,108	2***28***

[1] Potential habitat is described in **Appendix F** for each species.

[2] Estimated values calculated as approximately 2.5 percent of potential habitat present in CCPA.

Terrestrial Invertebrates (Ottoe Skipper, Regal Fritillary, Monarch Butterfly, and Western Bumble Bee)

The types of impacts to terrestrial invertebrates would be the same under Alternative C as described under Alternatives A and B, but would to a lesser degree in magnitude compared to Alternative B. Under Alternative C, impacts to Ottoe skipper would include surface disturbance to approximately 24,***893*** of the available 995,706 acres (2.5 percent) of grassland habitat in the CCPA. This would be approximately 1.8 percent of the available 1,370,493 acres of grassland habitat within the wildlife analysis area. Impacts to regal fritillary would include surface disturbance to approximately 2***5,121*** of the 1,004,814 acres (2.5 percent) of grassland and wetland/riparian habitats in the CCPA, which would be approximately 1.79 percent of the 1,392,086 acres of available suitable habitat in the analysis area. Impacts to monarch butterfly and western bumble bee would include surface disturbance to approximately 37,***560*** acres (2.5 percent) of the available 1,502,381 acres of suitable habitat within the CCPA and approximately 1.69 percent of the available 2,206,155 acres of suitable habitat in the analysis area.

Wyoming Species of Greatest Conservation Need

In general, impacts to SGCN mammals under Alternative C would be the same as those identified under Alternative B. Impacts would occur at a lesser magnitude than under Alternative B because there would be fewer pads and associated infrastructure, which would result in less surface disturbance. **Table 4.18-36** presents impacts to associated habitat for each of the SGCN mammals with the potential to occur within the CCPA. SGCN avian species are analyzed in Section 4.18.2 and SGCN aquatic species are analyzed in Section 4.18.5.

Table 4.18-36 Disturbance to SGCN Mammal Species Habitats from Alternative *C*

Species	Potential Habitat in CCPA[1] (acres)	Estimated Impacts to Potential Habitat in CCPA[2] (acres)
Dwarf shrew	137,255	***2***
Eastern red bat	10,946	274
Eastern spotted skunk	7,417	18***6***
Hayden's shrew	1,004,814	25,12***1***
Little brown myotis	20,347	509
Long-legged myotis	20,347	509
Olive-backed pocket mouse	1,139,413	28,48***6***
Pallid bat	1,470,841	36,77***2***
Plains harvest mouse	1,326,169	33,15***5***
Sagebrush vole	330,463	8,262
Sand Hills pocket gopher	995,706	24,893
Silky pocket mouse	1,121,722	28,04***4***
Spotted ground squirrel	1,013,397	25,335
Western small-footed myotis	1,149,486	28,73***8***

[1] Based on associated habitat descriptions found in **Table 3.18-5** and **Appendix F.**

[2] Estimated values calculated as approximately 2.5 percent of potential habitat present in the CCPA.

Summary of Impacts to Special Status Species under Alternative C

Table 4.18-37 provides a summary of Impacts to special status terrestrial species under Alternative C.

Table 4.18-37 Summary of Impacts to Special Status Terrestrial Species under Alternative C

Species	Available Habitat in the Analysis Area	Acres of Surface Disturbance	Primary Effects
Preble's meadow jumping mouse	8,403	112	• Vehicle crushing • Loss and alteration of habitat • Habitat fragmentation
Black-footed ferret	48,672 (prairie dog colonies)	39***6*** (prairie dog colonies)	• Loss of suitable prairie dog colonies
Greater sage-grouse	531,791 (sagebrush) 259,198 (PHMA) 118,619 (2-mile lek buffer GHMA)	8,197 (sagebrush) 644 (Bill and M Creek PHMA only) 2,942 (2-mile lek buffer GHMA)	• Surface use in proximity to leks • Loss and alteration of habitat • Noise impacts • Increased predation • Reduced breeding success due to disturbance near leks/ breeding areas
Bats	21,593	272	• Loss and alteration of foraging habitat • Herbicide effects on individual fitness
Black-tailed prairie dog	48,672 (colonies)	39***6***	• Habitat loss and alteration • Crushing of burrows or vehicle strikes • Increased predation
Northern river otter	2,970 (open water)	0	• Habitat/water quality degradation
Swift fox	1,370,493	24,698	• Loss and alteration of grassland habitat • Increased competition with and predation from coyote • Vehicle strikes
Migratory avian species	2,206,155	37,267	• Loss and alteration of habitat • Noise impacts • Collision/electrocution with power lines • Reduced breeding success due to disturbance near nests • Crushing of nests or vehicle strikes
Ottoe skipper	1,370,493	24,698	• Grassland conversion • Invasive plants • Herbicide effects
Regal fritillary	1,392,086	24,919	• Grassland conversion • Invasive plants • Herbicide effects

Table 4.18-37 Summary of Impacts to Special Status Terrestrial Species under Alternative C

Species	Available Habitat in the Analysis Area	Acres of Surface Disturbance	Primary Effects
Monarch butterfly and western bumble bee	2,206,155	37,267	• Habitat loss • Invasive plants • Herbicide effects
SGCN Mammals	2,206,155	37,267	• Loss and alteration of habitat • Crushing of burrows or vehicle strikes • Herbicide effects on individual fitness

4.18.3.6 Mitigation and Mitigation Effectiveness – Alternative C

Mitigation measures and mitigation effectiveness under Alternative C for special status wildlife species would be the same as for Alternative B.

4.18.3.7 Residual Impacts – Alternative C

Residual impacts are defined as unavoidable adverse impacts to a resource that remain assuming implementation of proposed mitigation. Residual impacts to special status wildlife species and their habitats would be similar to Alternative B but generally to a lesser degree of magnitude. Alternative C also would result in impacts to wildlife resources associated with surface disturbance, habitat fragmentation, and human presence. However, the fewer miles of roads, pipelines, and electrical distribution lines would incrementally reduce habitat fragmentation and fewer well pads would reduce impacts resulting from surface disturbance and human presence. In addition, there would be no exceptions to timing limitation stipulations, which would reduce impacts during sensitive seasons and in sensitive areas.

Under Alternative C, the BLM would require reclamation to suitable wildlife habitat for all federal surface and split estate with federal minerals, which would include approximately 64 percent of the CCPA (Section 2.5.2.9) compared to 10 percent of the CCPA under Alternative B. Under Alternative C, as much as 36 percent of the CCPA would have the potential to result in the residual impacts associated with wildlife habitat loss or alteration based on private land reclamation. This alternative would result in an increase of lands where BLM and USFS reclamation standards would be applied by approximately ***55*** percent, compared to Alternative B. The actual amount of habitat to be reclaimed on private mineral estate would be dependent on landowner agreements.

Similar to the sage-grouse, other special status species would be adequately protected under federal and state regulations, avoidance and minimization mitigation, OG-committed design features, and the additional mitigation measures (Section 4.18.3.6).

4.18.3.8 Relationship between Local Short-term Uses of the Human Environment and Maintenance and Enhancement of Long-term Productivity

The relationship between local short-term uses of the human environment and maintenance and enhancement of long-term productivity is the disclosure regarding whether the short-term use of a resources associated with a project affects the long-term sustainability of that resource. Project construction would impact approximately 0.7 percent of available habitats for special status wildlife species in the CCPA under Alternative A, 3.5 percent under Alternative B, and 2.5 percent under Alternative C. Special status wildlife habitat would be diminished due to local short-term and long-term uses until reclaimed areas return to pre-disturbed vegetation communities. As discussed above, these temporal losses can vary in the time required to return to pre-construction conditions. This range of temporal loss generally would be between 5 and 50 years, depending on the vegetation community.

This short-term use of habitat may affect long-term productivity of special status terrestrial species should there be alteration, loss, modification, or fragmentation of habitat; direct mortality of individuals; or increased disturbance from human activity. Special status wildlife habitat would be reduced due to local short-term uses until reclaimed areas return to mature vegetation communities that provide suitable habitat. The BLM could only recommend reclamation on most private surface under Alternative B, while under Alternative C, reclamation also would occur as recommended by the BLM and USFS on federal surface as well as private surface underlain by federal mineral estate. This would increase the likelihood of habitat reclamation, which also would increase the likelihood of long-term habitat restoration for terrestrial wildlife species. Oil and gas development activities would have localized impacts on wildlife populations during development, particularly during the construction drilling and completion phases.

4.18.3.9 Irreversible/Irretrievable Commitment of Resources

Irreversible/irretrievable impacts are subsets of unavoidable adverse/residual impacts. Irreversible impacts are those that cannot ever be restored; they would be lost forever. Irretrievable impacts are those for which the resource value would be irretrievably lost until restoration of that resource takes place. Construction and production under any of the Project alternatives would result in the irretrievable commitment of both wildlife and potential suitable habitats during the life of the Project. Interim reclamation under Alternative C would not reduce impacts to wildlife species because it would be minimal and in very close proximity to Project components. After the end of the life of the Project (i.e., following decommissioning), a portion of habitat disturbed during construction and production would be reclaimed on state and federal lands, as required by applicable regulations. Under Alternative B, the actual amount of area to be reclaimed on private land (approximately 83 percent of the CCPA) would be dependent on landowner agreements; however, under Alternative C, reclamation would occur as recommended by the BLM and USFS on federal surface as well as on private surface underlain by federal mineral estate (i.e., approximately 65 percent of the CCPA).

Depending on the selection of alternatives, the amount of special status wildlife habitat irretrievably committed would range from 10,253 acres under Alternative A to 52,667 acres under Alternative B. Some vegetation communities would be expected to return to a native state within in a relatively short period of time (i.e., 5 years). Other more sensitive habitats, such as sagebrush shrublands, may require up to 50 years or longer to return to pre-construction conditions. Regardless of timeframes, special status wildlife habitat impacted during construction could return to pre-disturbance conditions, which would avoid any irreversible commitments of wildlife habitat.

4.18.4 Impacts to Aquatic Biological Resources

The CCPA overlaps with approximately 126 miles of perennial streams. Named perennial streams are shown in **Figure 3.18-15**. Streams with the largest linear length within the CCPA include Antelope Creek (25 miles), Sand Creek (24 miles), North Platte River (22 miles), Wind Creek (10 miles), and La Prele Creek (10 miles). There would be a potential higher risk of effects on aquatic habitat and species for the streams with the larger linear distances within the CCPA.

Current management actions to protect aquatic habitat and fisheries are provided by the Casper RMP and the TBNG LRMP. The Casper RMP requires no direct disturbance to aquatic habitat by restricting surface disturbance within 500 feet of Class 1 and 2 waterbodies. Similarly, the TBNG LRMP requires that stream health be maintained or improved in relation to stream geometry, pattern, and habitat. Numerous other management actions from both plans are specified to minimize effects to aquatic habitat from sediment, potential spills, or flow alterations. The Casper RMP requires coordination with the BLM and WGFD in regard to use of water sources.

4.18.4.1 Impacts to Aquatic Biological Resources from Alternative A – No Action

Under Alternative A, new development would continue within the CCPA over a 15-year period as disclosed under NEPA (Section 2.3.2). Approximately 10,253 acres of new disturbance would occur from construction of 386 new well pads (including other service well pads), 386 miles of new roads, 362 miles of gas-gathering pipelines (181 miles co-located with roads), 362 miles of electrical distribution lines (181 miles co-located with roads), and gas production facilities (**Table 2.3-3**).

Potential impacts to aquatic biological resources would include habitat alteration, erosion, and sedimentation from surface disturbance; risk of potential leaks or spills of contaminants from facilities or activities within or near perennial waterbodies; potential loss of aquatic species from spread of invasive species; and water depletions in streams and rivers where water use for well development or dust control would result in flow reductions. Well drilling and development on BLM- or USFS-administered lands would implement protection measures as part of the APD process for resources including fisheries and water resources.

Direct Disturbance to Habitat and Species

Under Alternative A, there would be no direct loss or alteration of aquatic habitat in streams or rivers on BLM-administered lands that contain fish-bearing perennial waterbodies as a result of well pad siting due to Casper RMP restrictions regarding surface disturbance within 500 feet of Class 1 and 2 waterbodies. The TBNG LRMP (USFS 2001) also list standards for protecting streams and wetlands. These include 1) actions next to perennial and intermittent streams would be allowed only if the long-term health and riparian ecosystem condition are maintained; and 2) activities would be located away from the water's edge or outside riparian areas unless alternatives have been assessed and determined to be more environmentally damaging. Aquatic habitat could be disturbed where new roads or gas-gathering pipelines cross streams. If roads or gas-gathering pipelines are to cross perennial streams, construction would result in temporary disturbance to aquatic habitat by altering bottom substrates and possibly removing riparian vegetation. Vegetative cover along streambanks provides cover for fish, shading, bank stability, and increased food and nutrient supply as a result of deposition of insect and vegetative matter into the watercourse. Disturbance to streambank areas at stream crossings would represent a relatively small portion of the overall vegetative cover along the stream. Bottom disturbance would result in mortalities to macroinvertebrates and possibly early life stages of fish. Macroinvertebrate communities likely would recover within several months after disturbance from road, pipeline, or flowline construction at stream crossings (Waters 1995).

New road crossings may require a culvert to be placed in streams, which would result in a permanent loss of stream bottom. The area of habitat loss would be relatively small in relation to the overall habitat area in the stream. Compliance with necessary permits also would be required. For streams that contain fish, culverts would be designed to maintain or improve passage for fish species. Juvenile and adult fish likely would move from the disturbed areas.

Traffic within surface disturbance areas and on access roads could result in amphibian mortalities during spring and summer breeding migrations to and from flooded areas, wetlands, streams, ponds, or lakes. Vehicle crossings of streams could cause frog mortalities because they use these habitats throughout the year. Vehicle traffic also could result in toad mortalities in upland terrestrial habitat. The mortality risk would depend on the timing of amphibian movements, amphibian abundance, and traffic density. Based on previous studies of toad mortalities from vehicles, the probability that a road crossing event would result in death ranged from 0.3 to 0.6 at volumes of approximately 3,200 vehicles per day (Jochimsen et al. 2004). Project traffic volumes would be 10 times less than those in the toad studies; therefore, the probability of mortalities would be much lower than 0.3. Vehicle activity also could cause increased sediment on a temporary basis in stream disturbance areas.

BLM and USFS stipulations provide protection to aquatic habitat and buffer distances around perennial streams and wetlands through requirements for waterbody crossings that minimize impacts to wetlands, riparian vegetation, and aquatic habitat. Similarly, the TBNG LRMP requires that the stream pattern, geometry, and habitats be maintained. Waterbody crossings by vehicles and equipment also pose a risk of transferring invasive aquatic species between drainages.

Water Quality Effects on Habitat and Species

Aquatic habitat for game fish species could be adversely affected by water quality effects from surface disturbance activities and potential fuel spill risks. New disturbance under Alternative A would comprise 0.7 percent of the CCPA. When combined with existing development, total disturbance under Alternative A would be 1.6 percent of the CCPA. Perennial streams with game fish species are present in portions of the following basins that overlap with the CCPA:

- Cheyenne River Basin – Lightning and Antelope creeks;
- North Platte River Basin – North Platte River, La Prele Creek, Antelope Creek;
- Powder River Basin – Salt Creek.

Erosion and surface disturbance may impact aquatic habitats by increasing sediment input to waterbodies. Changes in water quality from surface disturbance within or near waterbodies would include increases in suspended sediment concentrations and turbidity. Sediment that is suspended from direct disturbance or enters the waterbody from adjacent areas would be re-deposited in downstream areas. The extent of the sedimentation effect would depend on the flow conditions, substrate composition, stream configuration, and types of aquatic communities located within the affected areas. Fish species that could be affected by sedimentation include game fish that occur in most of the perennial streams within the analysis area (**Tables 3.18-12** and **3.18-13**).

The effect of sedimentation on aquatic species would range from adverse effects on species behavior and physiological functions or important activities such as spawning (Waters 1995). Sediment deposition in fish spawning areas could adversely affect reproduction. The duration of sediment effects could range from short-term to long-term depending on the duration of the surface disturbance activities. Sediment input to streams would be minimized on federally administered lands through adherence to management actions contained in the Casper RMP and TBNG LRMP that require disturbance activities to minimize sediment effects on streams. In general, many of the warmwater fish species would be more tolerant than coldwater species to suspended sediment concentrations. Coldwater trout species are present in only two streams (North Platte River and La Prele Creek), which are located in the North Platte River Basin.

Fuel or lubricant spills from vehicles and equipment used within or near waterbodies as well as the use of reserve pits and storage of hazardous materials would pose a risk to aquatic habitat and species. If fuel reached a waterbody, aquatic species could be exposed to toxic conditions. Spills also could result in chemical residues within or on substrates in waterbodies. Impacts could include direct mortalities or reduced health of aquatic species. The magnitude of impacts would depend on the volume of spilled fuel, flow conditions, channel configuration, and species present in the affected area. Contaminant input to streams would be minimized on federally administered lands through adherence to management direction in the Casper RMP and TBNG LRMP that require measures to reduce spill risks to waterbodies. As part of the APD conditions, applicant-committed protection measures contained within a SPCC Plan would be implemented to reduce the potential occurrence of spills. If a spill did occur, the SPCC would implement spill cleanup actions.

Introduction or Spread of Aquatic Invasive Species

Various life stages of aquatic invasive species could attach to vehicles or equipment and be introduced to a waterbody from activities that occur in multiple watersheds. Existing aquatic invasive diseases and species populations in the North Platte River Basin include rusty crayfish, Asian clam, brook stickleback, aquatic plants, and whirling disease. Under Alternative A, new oil and gas development would involve construction and maintenance activities in drainages if waterbody crossings are required where no bridges are present. Existing Wyoming regulations described by the Wyoming Game and Fish Commission and management by the WGFD require vehicles, boats, and equipment to be inspected for invasive species on all waters of the state. However, inspection activities by WGFD under this regulation focus on use of these waterbodies by watercraft.

Water Quantity Changes and Effects on Habitat and Species

Under Alternative A, fresh water required for well drilling and completion purposes would continue to be obtained from existing groundwater supply wells and existing permitted surface water sources. It is assumed that withdrawals would be made from suppliers that hold existing withdrawal permits for groundwater or surface water through the WSEO. Under Alternative A, approximately 1,500 acre-feet per year of fresh water withdrawal would be needed for well drilling and completion as well as dust abatement. When considering the 15-year time frame of well drilling and completion, a total of approximately 22,500 acre-feet would be used for these activities. No new water sources would be used for Alternative A, and it is likely that there would be no new water depletions because the water sources to be used are already permitted. Any potential water use with connections to surface flow has been accounted for within the Wyoming State Engineer process. Conditions related to water use would be applied at the APD stage.

4.18.4.2 Impacts to Aquatic Biological Resources from Alternative B – Proposed Action

Under Alternative B, approximately 5,000 new oil and gas wells would be drilled on 1,500 multi-well pads over a period of 10 years (500 new wells per year) with the ability to request exceptions to timing limitation stipulations (Section 2.4). Construction would include 455 other service well pads, approximately 1,970 miles of new roads, 4,400 miles of other linear facilities (i.e., gas-gathering pipelines, water pipelines, and overhead electrical distribution lines), and other construction and production facilities (**Table 2.4-1**). The types of impacts to aquatic biological resources and habitat under Alternative B would be the same as discussed for Alternative A but would be to a greater extent. Perennial streams with game fish species that would be affected under Alternative B would be the same as those listed under Alternative A.

Direct Disturbance to Habitat and Species

Development under Alternative B would not cause direct loss or alteration of aquatic habitat in streams or rivers on BLM-administered land that contain fish species, during well pad construction and development due to Casper RMP restrictions to surface disturbance within 500 feet of Class 1 and 2 waterbodies. There are no similar restrictions for surface disturbance near waterbodies on USFS, state, or private land, but the facilities would not be located in perennial stream channels.

Disturbance to aquatic habitat could occur from construction of new roads or gas-gathering pipelines, water pipelines, or overhead electrical distribution lines across streams. The quantity of habitat disturbed would be based on the area of the instream width of construction. Assuming that the disturbance area is reclaimed within several months after the completion of construction, habitat effects would be short-term. The risk of impacts to aquatic species under Alternative B would be higher in perennial streams bordered by private lands (approximately 70 percent of the total perennial stream length within the CCPA) because reclamation would be conducted per individual landowner agreements, so the degree to which the land would be reclaimed to pre-disturbed conditions would be uncertain (i.e., lost riparian vegetation potentially would not be restored on some private lands). However, any disturbance to the stream channel would be restored regardless of land ownership in compliance with the USACE 404 permitting process. Long-term loss of habitat would occur if culverts or other permanent structures were installed, but this loss would be less than 1 percent of the overall stream area at a particular crossing.

Similar to Alternative A, traffic within surface disturbance areas and on access roads under Alternative B could result in amphibian mortalities during spring and summer breeding migrations to and from flooded areas, wetlands, streams, ponds, or lakes. Vehicle crossings of streams could cause frog mortalities, since they use these habitats throughout the year. Vehicle traffic also could result in toad mortalities in upland terrestrial habitat.

Water Quality Effects on Habitat and Species

Surface disturbance activities under Alternative B would contribute to impacts on water quality in the subwatersheds that would overlap with surface-disturbing activities. Similar to Alternative A, disturbance within perennial stream drainages that contain game, native, and non-native fish species would contribute sediment and pose risks of spills; however, compliance with the Casper RMP and TBNG LRMP management actions that require disturbance activities and measures to reduce the risk of spills to waterbodies would minimize impacts to streams on federally administered lands. As part of the APD conditions, applicant-committed protection measures such as the SPCC Plan would be implemented to avoid or contain spills. The risk of sediment input to perennial streams located on private lands under Alternative B would be higher because reclamation would be conducted per individual landowner agreements (e.g., reclamation in an area used for agriculture may focus on crop species rather than vegetation preferred for prevention of erosion). However, a SWPPP would be required on public and private land, which would control sediment input from runoff on disturbed areas.

The discharge of hydrostatic test water to streams could adversely affect water quality and flow characteristics in receiving streams. However, hydrostatic test water would be disposed of as approved by the BLM, USFS, and the State, as applicable. The WDEQ requires a General Permit for Temporary Discharge involving Construction Activities, which includes hydrostatic testing of pipes. The permit requires that discharge waters would not cause erosion, damage to channel characteristics, or degradation of habitat for aquatic life.

Introduction or Spread of Aquatic Invasive Species

If construction and maintenance activities or waterbody crossings occur under Alternative B involving multiple watersheds, there would be a potential for transfer and spread of aquatic invasive species and diseases. ***In addition, water movement between 4th level HUC-8 watersheds could spread aquatic invasive species.*** In total, approximately 1,970 miles of new roads would be constructed under Alternative B, which could cross waterbodies in multiple watersheds. No BMPs or design features have been defined to require equipment or vehicle washings prior to crossing waterbodies. Existing Wyoming regulations described by the Wyoming Game and Fish Commission identify actions to prevent and control aquatic invasive species and diseases in all Wyoming waters; however, inspection activities by WGFD under this regulation focus on the use of these waterbodies by watercraft. Instream disturbance from oil and gas development is not included in the WGFD inspection program; therefore, there would be a risk of introducing or spreading invasive species and diseases from instream disturbance in multiple HUC-8 watersheds.

Water Quantity Changes and Effects on Habitat and Species

Under Alternative B, water primarily would be obtained from existing and proposed groundwater supply wells, with the remainder drawn from existing permitted surface water sources. The total water usage for well development and dust control would range from 32,500 to 80,000 acre-feet of water, which would represent an average of approximately 3,250 to 8,000 acre-feet per year over the 10-year period. The peak water use for Alternative B would be approximately 7,000 acre-feet and likely would occur in year 10. There potentially is approximately 13,100 acre-feet per year of water available from existing groundwater and surface water sources; however, to cover the annual anticipated needs for Alternative B, up to 50 new groundwater wells could be drilled that would provide as much as 8,050 acre-feet per year of additional source water, as necessary.

Based on map information available on the WSEO website (WSEO 2014, areas were mapped within the North Platte River drainage with potential connections between groundwater and surface water (**Figure 3.16-6**). A portion of the CCPA overlaps with an area of hydrological connectivity on both sides of the North Platte River. New groundwater withdrawals in this area could result in flow reductions in the North Platte River and some of its tributaries, which could reduce the amount of available habitat for aquatic species. If the magnitude of the flow change was to alter a substantial portion of habitat needed for the various life stages of development, negative effects on fish species could occur. Flow reductions could result in shifts in habitat use due to reduced depths; reductions in the quantity and types of cover for fish; and restrictions in fish movement or migrations from decreased depths (Poff and Zimmerman 2010). Depending on the volume and timing of potential flow reductions, there also could be temperature increases, which would affect habitat quality (Dewson et al. 2007). Under the Platte River Recovery Implementation Program, all new water sources are subject to limitations, and mitigation could be required to offset new depletions that would benefit fish and other aquatic species.

Withdrawal of water from the permitted streams could result in the entrainment and impingement of early life stages of fish. The extent of the potential impact would depend on the timing and location of water withdrawals in the streams. Entrainment of young fish could occur in portions of the stream used as nursery areas, which typically occur in shallow areas along the margin of streams, side channels, or backwater areas.

<u>Additional Fishing Pressure on Game Fish Streams/Fish Regulations</u>

Although public lands make up a relatively small portion of the CCPA (approximately 10 percent), fishing pressure on streams with game fish species incrementally could increase from construction crews and due to public use of new access roads. The increased fishing pressure could result in higher numbers of fish harvested in some of the streams near the CCPA. However, the anticipated impact level would be considered low because of the small percentage of public lands.

4.18.4.3 Mitigation and Mitigation Effectiveness – Alternative B

The following mitigation measures would be applied to further minimize impacts to aquatic biological resources related to Alternative B.

ABR-1: When avoidance of perennial streams with game and special status fish populations will not be feasible and a culvert will be required during construction, flow will be maintained in a portion of the stream to allow unrestricted fish passage. Any plan for dewatering the stream at the culvert site must be approved by the appropriate federal and state agencies. Culvert size and type will be selected to facilitate the continued and long-term connectivity and movement of target aquatic species. If the culvert is to be in place during Project construction and operation, approval must be obtained from the federal or state agency management authority. An alternative crossing method may be required.

ABR-2: If spawning areas for game and special status fish species are known to occur at streams proposed for vehicle crossing or culvert construction, instream disturbance will be scheduled to avoid the spawning period. The exact dates for avoidance will be determined through discussions with WGFD and the appropriate federal land management agency (i.e., BLM, or USFS). All disturbed areas will be restored to pre-construction conditions prior to the next spawning season.

ABR-3: Pipeline crossings of blue ribbon (North Platte River) and red ribbon (LaPrele Creek) streams, if required, will be accomplished by boring underneath the stream. Pipeline crossings for other perennial streams proposed for trenching will be considered on a case-by-case basis through discussions with WGFD. If trenching is approved, WGFD will determine if a construction avoidance period will be required for fish spawning. All disturbed areas will be restored to pre-construction conditions.

ABR-***4***: ***To prevent the spread of aquatic invasive species, surface water will not be moved between 4th level HUC-8 watersheds.*** If vehicles and equipment are moved between multiple HUC8 watersheds, all equipment will be decontaminated, which would occur before arrival at a Project site. Decontamination will consist of either of these actions: 1) Drain all water from equipment and compartments; clean equipment of all mud, plants, debris, and aquatic organisms; and dry equipment for specified time by season (5 days in June through August, 18 days in March through May, and 3 days in December through February when temperatures are at or below freezing). A field monitor will be present to ensure that the cleaning was completed prior to vehicle and equipment moving to other streams and drainages.

The proposed mitigation measures would be effective in avoiding effects to aquatic species and their habitat. Mitigation measures ABR-1, ABR-2, and ABR-3 would avoid construction effects on fish passage and spawning periods for game and special status fish species. It is assumed that any waterbody could contain aquatic invasive species or diseases; therefore, mitigation measure ABR-***4*** would avoid the transfer and spread of aquatic invasive species and diseases from a previous work site or near waterbody as a result of decontamination and cleaning procedures being applied during construction. Recommendations for Development of Oil and Gas Resources within Important Wildlife Habitats (WGFD 2010b) were used as a source for mitigation measure ABR-3.

4.18.4.4 Residual Impacts – Alternative B

Residual impacts are defined as unavoidable adverse impacts to a resource that remain assuming implementation of proposed mitigation. Implementation of agency stipulations would reduce impacts to aquatic biological resources and habitats on BLM- and USFS-administered lands, which comprise approximately 10 percent of the CCPA. In relative terms, the magnitude of residual effects likely would be higher on private and state surface. Residual impacts that would remain after the implementation of additional mitigation measures would include:

- Potential loss or alteration of aquatic habitat in smaller streams that require culverts or vehicle crossings.
- Potential loss or disturbance to riparian vegetation along streams where the ROW would be parallel and adjacent to streams.
- Potential loss of aquatic habitat and effects on habitat quality and associated aquatic species if water withdrawals occur in perennial streams.
- Potential entrainment and impingement of early life stages of fish if water withdrawals and intakes are required in perennial streams.
- Potential amphibian mortalities from vehicle traffic during amphibian movements to and from waterbodies located within the pipeline ROWs.

Residual impacts identified under Alternative B would be minimized through the application of avoidance and minimization mitigation, and the additional mitigation measures (Section 4.18.4.3).

4.18.4.5 Impacts on Aquatic Biological Resources from Alternative C

The types of impacts to aquatic biological species and habitat under Alternative C would be the same as those discussed under Alternative B but at a lower magnitude. Under Alternative C, the same number of new oil and gas wells (5,000) would be drilled under the same drilling rate (500 wells per year) as Alternative B; however, there would be only 938 well pads under Alternative C (562 fewer than under Alternative B), which subsequently would reduce the number of production pads, miles of new roads, gas-gathering pipelines, water pipelines, and overhead electrical distribution lines (**Table 2.5-1**). The notable difference in impacts to aquatic biological resources under Alternative C compared to Alternative B would be less surface disturbance for linear facilities. In addition, Alternative C would involve reclamation to BLM or USFS standards for suitable wildlife habitat on private lands overlain by federal minerals, which could assist in reducing the sediment input into perennial streams. Perennial streams with game fish species that would be affected under Alternative C would be the same as listed for Alternatives A and B.

Direct Disturbance to Habitat and Species

As under Alternative B, Alternative C would not cause direct loss or alteration of aquatic habitat in streams or rivers on BLM land that contain fish species during well pad construction and development because of the Casper RMP surface disturbance restriction within 500 feet of Class 1 and 2 waterbodies. The TBNG LRMP (USFS 2001) also has standards that would restrict development near streams and riparian areas, as described for Alternative B.

Disturbance to aquatic habitat could occur from construction of new roads or gas-gathering pipelines, water pipelines, or overhead electrical distribution lines across streams. Under Alternative C, the length of linear facilities would be 33 percent less than under Alternative B; therefore, there would be a lower occurrence of effects to aquatic habitat and species in perennial streams. Implementation of reclamation on private land overlying federal minerals would assist in restoring riparian vegetation along a portion of the 88 miles of perennial streams within the CCPA that are bordered by private lands. Private lands overlain by federal minerals would be reclaimed to BLM suitable habitat standards, which could result in a higher level of riparian vegetation development and benefit habitat for aquatic species in terms of overhanging cover and stream channel stability. As with Alternative B, long-term loss of habitat would occur if culverts or other permanent structures would be installed, but this loss would be less than 1 percent of the overall stream area at a particular crossing.

Similar to Alternatives A and B, traffic within surface disturbance areas and on access roads under Alternative C could result in amphibian mortalities during spring and summer breeding migrations to and from flooded areas, wetlands, streams, ponds, or lakes. However, with 33 percent less linear facilities than Alternative B, there would be a relatively lower risk to amphibians from construction traffic-related mortalities under Alternative C.

Water Quality Effects on Habitat and Species

Surface disturbance activities under Alternative C would contribute to impacts on water quality in the subwatersheds similar to those discussed under Alternative B. Disturbance within or adjacent to perennial stream drainages that contain game, native, and non-native fish species would contribute sediment and pose risks of spills. Implementation of reclamation on private lands overlying federal minerals would assist in applying standard methods to minimize erosion and sediment input to perennial streams. Adherence to Casper RMP and TBNG LRMP management actions that require disturbance activities to minimize sediment and contaminant spill effects on streams would reduce water quality effects to surface water and aquatic species under Alternative C. As part of the APD conditions, applicant-committed protection measures such as the SPCC Plan would be implemented to avoid or contain spills.

Introduction or Spread of Aquatic Invasive Species

If instream disturbance occurred in multiple ***4th level*** HUC-8 watersheds using the same vehicles and equipment, ***or surface water is moved between HUC-8 watersheds,*** there would be a risk of introducing or spreading aquatic invasive species or diseases under Alternative C. However, the risk would be lower than under Alternative B because there would be less surface disturbance associated with a 33 percent reduction in linear facilities.

Water Quantity Changes and Effects on Habitat and Species

The effects of water use on aquatic biological resources under Alternative C would be similar to those under Alternative B because the water use for well development and completion would be the same.

Additional Fishing Pressure on Game Fish Streams/Fish Regulations

As under Alternative B, the effect of fishing pressure on streams with game fish species could increase from construction crews and due to public use of new access roads. The impact level would be low because work crews would have limited time off.

4.18.4.6 Mitigation and Mitigation Effectiveness – Alternative C

Mitigation measures ABR-1 through ABR-5 also would apply to Alternative C for the purpose of maintaining flow for fish passage; avoiding disturbance to spawning habitat for game fish species; avoiding the effects of hydrostatic water discharge on aquatic species and habitat; and preventing the spread of invasive aquatic species and diseases. The effectiveness of these measures would be the same as discussed for Alternative B.

4.18.4.7 Residual Impacts – Alternative C

Residual impacts are defined as unavoidable adverse impacts to a resource that remain assuming implementation of proposed mitigation. Residual impacts to aquatic biological resources would be the same as discussed for Alternative B but with the following differences:

- Potential disturbance to streams from linear facilities would be approximately 33 percent less than under Alternative B based on the length of linear facilities.
- Potential risk of mortalities to amphibians from construction traffic of linear facilities would be approximately 33 percent less than under Alternative B.

Impacts identified under Alternative C would be minimized through the application of avoidance and minimization mitigation, and the additional mitigation measures (Section 4.18.4.6).

4.18.4.8 Relationship between Local Short-term Uses of the Human Environment and Maintenance and Enhancement of Long-term Productivity

The relationship between local short-term uses of the human environment and maintenance and enhancement of long-term productivity is the disclosure regarding whether the short-term use of a resources associated with a project affects the long-term sustainability of that resource. Surface disturbance to perennial streams would result in short-term effects to aquatic habitat and species, but these impacts would not affect the long-term productivity of their populations. Similarly, one-time water withdrawals could affect aquatic habitat and species on a short-term basis, but these impacts would not affect the long-term productivity of aquatic populations because natural water flow conditions would resume.

4.18.4.9 Irreversible/Irretrievable Commitment of Resources

Irreversible/irretrievable impacts are subsets of unavoidable adverse/residual impacts. Irreversible impacts are those that cannot ever be restored; they would be lost forever. Irretrievable impacts are those for which the resource value would be irretrievably lost until restoration of that resource takes place. The potential loss of aquatic habitat in streams that would require culverts for vehicle crossings would be irretrievable; however, the habitat loss would be reversible if the culvert was removed at a later time. The potential amphibian mortalities from vehicle traffic would be an irretrievable and irreversible loss of a portion of amphibian populations.

4.18.5 Special Status Aquatic Species

The full list of special status species initially considered for analysis is contained in **Appendix F**. Four special status aquatic species potentially could be impacted by the Project, including one federally listed endangered species (pallid sturgeon) and three USFS sensitive species (plains topminnow, flathead chub, and northern leopard frog). There are no BLM sensitive aquatic species that potentially would be impacted within the analysis area. In addition, there are seven native fish species of conservation need (WGFD 2016, 2010) within the analysis area (bigmouth shiner, brassy minnow, central stoneroller, common shiner, Iowa darter, plains killifish, and plains topminnow).

4.18.5.1 Impacts on Special Status Aquatic Species from Alternative A – No Action

Under Alternative A, new development would continue within the CCPA as disclosed under previous NEPA documents (Section 2.3.2). Approximately 10,253 acres of new disturbance would occur over a 15-year period from construction of 386 new well pads (including other service well pads), 386 miles of roads, 362 miles of gas-gathering pipelines (181 miles co-located with roads), 362 miles of electrical distribution lines (181 miles co-located with roads), and ancillary facilities (**Table 2.3-3**).

It is assumed that water use under Alternative A has been evaluated in previous NEPA analyses and Section 7 consultations have been completed. Any new water sources under Alternative A have been reviewed by the Wyoming State Engineer to confirm that there were no new depletions; therefore, there would be no adverse effect on the federally listed species (pallid sturgeon) in the Platte River.

Continuation of oil and gas well development under Alternative A would result in habitat alteration, erosion and sedimentation from existing surface disturbance, risk of potential leaks or spills of contaminants from facilities or activities within or near perennial waterbodies, and water depletions in streams and rivers where water use for well development or dust control would result in flow reductions. Surface disturbance-related activities potentially could affect the three USFS Sensitive species. Sensitive species and their habitat could be adversely affected if surface disturbance were to occur within drainages that support them. This would include Antelope Creek in the Cheyenne River Basin for plains topminnow and northern leopard frog and Lightning Creek for flathead chub. Potential habitat for these aquatic species expressed as linear stream miles within the TBNG administrative boundary includes 3.9 miles in Antelope Creek and less than 1 mile in Lightning Creek. In addition, Alternative A could disturb approximately 11 acres of wetland habitat within the TBNG administrative boundary. Alternative A may impact plains topminnow, flathead chub, and northern leopard frog individuals, but likely would not result in a loss of viability in the CCPA. Current BMPs and existing management actions in the TBNG LRMP provide protection to habitat for these species; therefore, no substantial change in overall population numbers would be expected.

There would be no effect on the plains minnow in the Salt Creek drainage or the flathead chub in the North Platte River or Salt Creek drainages because the streams containing potential habitat for these species are located outside of the TBNG.

Disturbance within or near perennial streams throughout the CCPA also could affect native fish species of conservation need.

4.18.5.2 Impacts on Special Status Aquatic Species from Alternative B – Proposed Action

Under Alternative B, approximately 5,000 new oil and gas wells would be drilled on 1,500 multi-well pads over a period of 10 years (500 new wells per year) with the ability to request exceptions to timing limitation stipulations. Additional surface disturbance would occur from the construction of other service well pads, access roads, pipelines, electrical distribution lines, and ancillary facilities (**Table 2.4-1**). The types of impacts to special status aquatic species and habitat under Alternative B would be the same as under Alternative A but would be to a greater extent.

<u>Federally Listed Species</u>

The total water usage for well development and dust control under Alternative B would range from 32,500 to 80,000 acre-feet, which would represent an average of 3,250 to 8,000 acre-feet per year over a 10-year period. The peak water use of approximately 7,000 acre-feet per year likely would occur in year 10. Approximately 13,100 acre-feet per year of water potentially would be available from existing groundwater and surface water sources. Water would be withdrawn from up to 50 new groundwater wells drilled into the Wasatch/Fort Union Aquifer and, to a lesser extent, the Fox Hills/Lance Aquifer System; however, specific well locations and sources have not been identified at this time. As discussed for general aquatic biological resources (Section 4.18.4), a portion of the CCPA overlaps with an area of hydrological connectivity between groundwater and surface water on both sides of the North Platte River (**Figure 3.16-3**). New groundwater withdrawals in this area could result in flow reductions in the North Platte River and some its tributaries. Any new depletions in the North Platte subbasin in Wyoming would contribute to flow reductions in the Platte River in Nebraska, and result in adverse effects on federally listed species including one fish species, pallid sturgeon.

The Platte River Recovery Implementation Program was established in 2006 to assist in the conservation and recovery of target species and their associated habitats along the central and lower Platte River in Nebraska through a basin-wide cooperative approach agreed to by the States of Wyoming, Nebraska, and Colorado and the USDOI. The Platte River Recovery Implementation Program addresses the adverse impacts of existing and certain new water-related activities on the Platte River target species and associated habitats and provides Section 7 compliance for effects to critical habitat from such activities. The state of Wyoming is in compliance with their obligations under the Platte River Recovery Implementation Program. All new water sources are subject to limitations and could require mitigation to offset new depletions to the Platte River System.

If the proposed water-related activity would deplete more than 0.1 acre-feet in the Platte River system and rely on surface water or hydrologically connected groundwater, an evaluation by the Wyoming State Engineer would be required to determine whether the water use is a new or existing activity. If the activity is considered an existing water-related activity, further action could be required to be covered by the Platte River Recovery Implementation Program. If further actions would be required, a Wyoming Platte River Recovery Agreement would be executed between the water user and the Wyoming State Engineer.

USFS Sensitive Species

New disturbance under Alternative B could occur within or near perennial streams that contain special status fish species, which potentially could affect USFS Sensitive species as discussed for Alternative A. Potential impacts to special status aquatic species would include habitat alteration, erosion and sedimentation from existing surface disturbance, risk of potential leaks or spills of contaminants from facilities or activities within or near perennial waterbodies, and water depletions in streams and rivers where water use for well development or dust control would result in flow reductions. Construction and production activities also could affect habitat for northern leopard frog and cause direct mortalities to frogs if traffic routes were to overlap with migration areas to breeding habitats (i.e., flooded areas, wetlands, streams, ponds, or lakes). As discussed under Alternative A, the risk of northern leopard frog mortalities would be considered low when assessing Project traffic levels. Construction disturbance near perennial streams that contain known or potential habitat for Forest Sensitive fish species (i.e., plains topminnow in Antelope Creek and flathead chub in Lightning Creek) could contribute sediment and pose risks of spills. Potential habitat for these aquatic species expressed as linear stream miles within the TBNG administrative boundary includes 3.9 miles in Antelope Creek and less than 1 mile in Lightning Creek. Disturbance in Antelope Creek also could affect potential habitat for northern leopard frog within or adjacent to 3.9 stream miles. In addition, Alternative B could disturb approximately 55 acres of wetland habitat within the TBNG administrative boundary. Alternative B may impact plains topminnow, flathead chub, and northern leopard frog individuals but likely would not result in a loss of viability in the CCPA. The current BMPs and existing management actions in the TBNG LRMP provide protection to habitat for these species; therefore, no substantial change in overall population numbers would be expected.

Well drilling and development on BLM- or USFS-administered lands be conducted under protection measures for aquatic resources and special status aquatic species. The Casper RMP requires waterbody crossing techniques that would minimize impacts to wetlands, riparian vegetation, and aquatic habitat in perennial streams. Similarly, the TBNG LRMP requires that the stream pattern, geometry, and habitats would be maintained.

Native Species of Conservation Need

Similar to Alternative A, disturbance within or near perennial streams throughout the CCPA could affect native fish species of conservation need.

4.18.5.3 Mitigation and Mitigation Effectiveness – Alternative B

Mitigation measures ABR-1 through ABR-5 (Section 4.18.4.2.1) would be implemented to reduce potential impacts to special status aquatic species by avoiding impacts on special status fish spawning habitat; maintaining fish movement in streams; avoiding the effects of hydrostatic test water discharge on species and habitat; and avoiding the spread of invasive aquatic species and diseases. The following additional measures specific to special status aquatic species and their habitats would be applied to further minimize impacts related to development under Alternative B.

SSAS-1: Where habitat for special status aquatic species cannot be avoided as a surface water source for well development activities, approval will be required from the federal agency responsible for managing the lands and WGFD responsible for managing special status species in Wyoming. Agency approval will ensure that water withdrawal methods will avoid or minimize entrainment or impingement effects to early life stages of special status fish species.

Mitigation measure SSAS-1 would be effective in reducing potential impacts to special status aquatic species by requiring approval of withdrawal methods.

4.18.5.4 Residual Impacts – Alternative B

Residual impacts are defined as unavoidable adverse impacts to a resource that remain assuming implementation of proposed mitigation. Implementation of agency stipulations would reduce impacts to aquatic biological resources and habitats on BLM- and USFS-administered lands. Residual impacts that would remain after the implementation of additional mitigation measures would include:

- Potential loss or alteration of special status aquatic species habitat in smaller streams that require culverts or vehicle crossings.
- Potential loss or disturbance to riparian vegetation along streams containing special status aquatic species where the ROW would be parallel and adjacent to streams.
- Potential northern leopard frog mortalities from vehicle traffic during movements to and from waterbodies located within the pipeline ROWs.

Impacts identified under Alternative B would be minimized through the application of avoidance and minimization mitigation, and the additional mitigation measures (Section 4.18.5.3).

4.18.5.5 Impacts on Special Status Aquatic Species from Alternative C

Under Alternative C, the same number of new oil and gas wells (5,000) would be drilled under the same drilling rate (500 wells per year) as Alternative B; however, there would be only 938 oil and gas well pads under Alternative C (562 fewer than under Alternative B), which subsequently would reduce the number of production pads, miles of new roads, pipelines, and overhead electrical distribution lines (**Table 2.5-1**). Potential disturbance related to the linear facilities would be approximately 33 percent less than Alternative B.

Federally Listed Species

Water usage for well development and dust control under Alternative C would be the same as under Alternative B; therefore, potential impacts to pallid sturgeon and other Platte River species would be the same as discussed under Alternative B.

USFS Sensitive Species

Surface disturbance-related activities for Alternative C potentially could affect the same USFS Sensitive species as discussed for Alternative B. Potential impacts to special status aquatic species would include the same types of impacts identified for Alternative B (i.e., habitat alteration, erosion and sedimentation from existing surface disturbance, risk of potential leaks or spills of contaminants from facilities or activities within or near perennial waterbodies, and water depletions in streams and rivers where water use for well development or dust control results in flow reductions); however, the risk of impacts related to disturbance from construction of linear facilities (roads, pipelines, and electrical distribution lines) would be an estimated 33 percent less compared to Alternative B. As under Alternative B, construction and production activities also could affect habitat for northern leopard frog and cause direct mortalities to frogs if traffic routes were to overlap with migration areas to breeding habitats (flooded areas, wetlands, streams, ponds, or lakes). As discussed under Alternative A, the risk of northern leopard frog mortalities would be considered low when assessing Project traffic levels. Construction disturbance near perennial streams that contain known or potential habitat for Forest Sensitive fish species (i.e., plains topminnow in Antelope Creek and flathead chub in Lightning Creek) could contribute sediment and pose risks of spills. Potential habitat for these aquatic species expressed as linear stream miles within the TBNG administrative boundary includes 3.9 miles in Antelope Creek and less than 1 mile in Lightning Creek. Disturbance in Antelope Creek also could affect potential habitat for northern leopard frog within or adjacent to 3.9 stream miles. In addition, Alternative C could disturb approximately 39 acres of wetland habitat within the TBNG administrative boundary. Alternative C may impact plains topminnow, flathead chub, and northern leopard frog individuals but would not be likely to result in a loss of viability in the CCPA. The current BMPs and existing management actions in the TBNG LRMP provide protection to habitat for these species; therefore, no substantial change in overall population numbers would be expected.

Native Species of Conservation Need

Similar to Alternatives A and B, disturbance within or near perennial streams throughout the CCPA could affect native fish species of conservation need.

4.18.5.6 Mitigation and Mitigation Effectiveness – Alternative C

Mitigation measures ABR-1 through ABR-5 and SSAS-1 also would apply under Alternative C for the purpose of reducing impacts to special status aquatic species by maintaining flow for fish passage; avoiding disturbance to spawning habitat; avoiding the effects of hydrostatic test water discharge; avoiding the spread of invasive aquatic species and diseases; and avoiding water withdrawal effects on special status aquatic species. The effectiveness of these measures would be the same as discussed for Alternative B.

4.18.5.7 Residual Impacts – Alternative C

Residual impacts are defined as unavoidable adverse impacts to a resource that remain assuming implementation of proposed mitigation. Residual impacts to special status aquatic species would be the same as discussed for Alternative B but with the following differences:

- Potential disturbance to streams from linear facilities would be approximately 33 percent less than under Alternative B based on the length of linear facilities.

- Potential risk of mortalities to northern leopard frog from linear facility construction traffic of linear facilities would be approximately 33 percent less than under Alternative B.

Impacts identified under Alternative C would be minimized through the application of avoidance and minimization mitigation, and the additional mitigation measures (Section 4.18.5.6).

4.18.5.8 Relationship between Local Short-term Uses of the Human Environment and Maintenance and Enhancement of Long-term Productivity

The relationship between local short-term uses of the human environment and maintenance and enhancement of long-term productivity is the disclosure regarding whether the short-term use of a resources associated with a project affects the long-term sustainability of that resource. The Project would result in short-term disturbance to special status fish and northern leopard frog habitat, but these impacts would not affect the long-term productivity of their populations.

4.18.5.9 Irreversible/Irretrievable Commitment of Resources

Irreversible/irretrievable impacts are subsets of unavoidable adverse/residual impacts. Irreversible impacts are those that cannot ever be restored; they would be lost forever. Irretrievable impacts are those for which the resource value would be irretrievably lost until restoration of that resource takes place. The potential loss of habitat for special status aquatic species in streams that require culverts for vehicle crossings would be irretrievable; however, the habitat loss would be reversible if the culvert was removed at a later time. The potential risk of mortalities to special status fish and northern leopard frog from linear facility construction traffic would be an irretrievable and irreversible loss of a portion of the populations. The potential loss of special status fish and northern leopard frog habitat in streams that require culverts for vehicle crossings would be irretrievable; however, the habitat loss would be reversible if the culvert was removed at a later time.

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5.0 Cumulative Impacts

Analysis of past, present, and reasonably foreseeable future actions is required by NEPA. Reasonably foreseeable actions are determined according to the potential impacts that would result both in a spatial and temporal scope relative to the project. The BLM NEPA Handbook (BLM 2008e) and Forest Service Handbook 1909.15 (USFS 2012) also provide guidance for assessing cumulative impacts. According to the BLM NEPA Handbook (BLM 2008e), “The purpose of cumulative effects analysis is to ensure that federal decision-makers consider the full range of consequences of actions (the proposed action and alternatives, including the No Action alternative).” Speculative projects are not analyzed under the NEPA process. Projects that are not considered to be speculative include those for which the NEPA process has already been initiated, permit applications have been submitted, or resources or funding have been committed.

The analysis of both potential negative and positive impacts assumes successful implementation of all mitigation measures, adherence with all BMPs and OG-committed design features, and compliance with all federal, state, and local regulations and requirements.

5.1 Temporal and Spatial Boundaries

The temporal scope for analyzing cumulative impacts is 55 to 60 years after construction activities are initiated. This timeframe includes 10 years of ongoing construction and drilling (see Section 2.4.1), approximately 30 years of operational activities (see Section 2.2.2), and 15 to 20 years for successful reclamation of the primary (grassland) vegetation type within the CCPA.

CISAs have been identified for each resource where effects (direct and indirect) may be caused by the proposed Project. Some resources share common CISAs, and others have unique CISA boundaries designed to include all elements of the resource. Resource-specific CISAs and their rationale are defined in **Table 5.1-1**.

Table 5.1-1 Resource Specific CISAs and Rationale

Resource	Cumulative Impact Study Area	Rationale
Air Quality	The 4-km modeling domain.	The 4-kilometer modeling domain was adopted by the USEPA as part of the CAMx model.
Cultural Resources	<u>Cultural resources</u>: The CCPA boundary.	For spatially bounded sites, cumulative impacts are restricted to within the specific site area ***and their settings as appropriate***.
	<u>Linear sites</u>: The length of the entire resource north to south within Wyoming and east and west within the BLM High Plains District boundary.	The degree of cumulative impacts to a linear resource depends on the size of a specific project’s impacts relative to the entire length of the resource. Therefore, a portion of the linear site should be examined to determine the degree of cumulative effects.
	<u>Native American ***interests***</u>: The entire Pine Ridge area plus any property of traditional religious and cultural importance, sacred site, or other resource identified by ***a*** tribe as sensitive.	These resources are often affected by visual, auditory, and atmospheric changes, and impacts to setting or viewshed may go beyond the physical extent of the site. Therefore, their entire extents should be considered. Tribes and the BLM have already identified Pine Ridge as a sensitive area.

Table 5.1-1 Resource Specific CISAs and Rationale

Resource	Cumulative Impact Study Area	Rationale
Geology and Mineral Resources	The CCPA boundary with a 2-mile buffer.	Given the programmatic nature of the analysis, the exact locations of oil and gas-related activities cannot be predicted with certainty within the CCPA. A 2-mile buffer around the CCPA is recommended to account for effects that may extend beyond the CCPA boundary, but also consider developments in the cumulative analysis that may occur in close proximity and possibly interact with the proposed project, but are outside of the CCPA boundary.
Hazardous Materials	The CCPA boundary with a 2-mile buffer.	Given the programmatic nature of the analysis, the exact locations of oil and gas-related activities cannot be predicted with certainty within the CCPA. A 2-mile buffer around the CCPA is recommended to account for effects that may extend beyond the CCPA boundary, but also consider developments in the cumulative analysis that may occur in close proximity and possibly interact with the proposed project, but are outside of the CCPA boundary.
Land Use	The CCPA boundary.	Land uses within the CCPA are not expected to be affected by cumulative projects outside of the CCPA boundary.
Lands and Realty	The CCPA boundary.	Realty authorizations within the CCPA are not expected to be affected by cumulative projects outside of the CCPA boundary.
Noise	The CCPA boundary with a 1-mile buffer.	Noise effects are not typically observed beyond 1 mile.
Paleontology	The CCPA boundary.	Direct and indirect effects to the resource due to the proposed project are not likely to occur beyond the project boundary.
Range Resources	All BLM- or USFS-permitted allotments in their entirety that overlapped by the CCPA.	Impacts that occur outside of the CCPA but within an allotment impacted by the proposed project would affect the allotments overall ability to produce AUMs and potentially decrease the carrying capacity or permitted use. Such impacts also could affect livestock health and operations management.
Recreation	The CCPA boundary plus a 2-mile buffer.	Activity associated with the proposed project and cumulative projects may affect the recreational setting within and beyond the immediate CCPA boundary.

Table 5.1-1 Resource Specific CISAs and Rationale

Resource	Cumulative Impact Study Area	Rationale
Socioeconomics and Environmental Justice	Converse, Natrona, and Campbell counties.	These three counties encompass the geographic region in which the vast majority of project-related direct, indirect, and induced effects would occur with sufficient intensity, magnitude, and duration to raise the potential for measurable cumulative effects when considered in combination with the effects of other actions that have occurred or may occur in the area in the future.
Soils	The CCPA boundary.	Impacts to soil resources generally are site-specific and localized in nature. The CCPA boundary is fairly substantial in size and should adequately capture cumulative disturbances to soil resources.
Transportation	The CCPA, City of Douglas, and the federal/state highways, and Converse County and BLM roads providing access to the site within a 10-mile buffer.	The proposed project and cumulative projects potentially would affect transportation resources within the CCPA boundary but also could affect nearby transportation corridors that service the CCPA. The 10-mile buffer is the area within which the potential changes and impacts to the transportation network would be noticed. This area also would capture potential impacts along I-25 near the southern border of the CCPA.
Vegetation	The CCPA boundary.	Impacts to vegetation generally are site-specific and localized in nature. The CCPA boundary is fairly substantial in size and should adequately capture cumulative disturbances to vegetation.
Visual	The CCPA boundary plus a 15-mile buffer	A 15-mile background distance zone is specified for analysis in the BLM Visual Resource Management System.
Water	Surface Water: The HUC-12 drainages within or intersected by the CCPA.	Any cumulative impacts to surface waters would occur within the boundary of HUC-12 subwatersheds.
	Groundwater: Northern boundary - Townships 41 and 42 to the north; the outcrop of the Fox Hills/Lance Creek aquifer to the east and west; and the structural limit of the Powder River Basin to the south.	The west, east, and south boundaries are based on geology, and the aquifers of interest do not extend beyond the described limits. The northern boundary coincides with the groundwater model northern boundary (**Appendix D**), which provides an adequate area outside of the CCPA in which to determine if there would be effects and possible interactions with developments to the north of the CCPA.
Wetlands / Riparian	HUC-12 drainages intersected by the CCPA boundary.	Vegetation composition and density effects can result in hydrologic changes on a watershed scale as well as associated influence on fish habitat, wetlands, and water quality.

Table 5.1-1 Resource Specific CISAs and Rationale

Resource	Cumulative Impact Study Area	Rationale
Wildlife	HUC-12 hydrological units intersected by the CCPA for small game species and nongame species, including special status species, raptors and other migratory birds, and aquatic biological resources.	This analysis area provides a clear bio-geographical delineation of vegetation communities and wildlife habitats for these species. For aquatic biological resources, subwatershed boundaries were used to account for any potential downstream effects of cumulative actions both within and outside of the CCPA boundary.
	Big Game: The WGFD Game Management Units within the CCPA in their entirety for big game.	Pronghorn are the most abundant ungulate in the region with many more individuals than deer or elk. The herd units tend to be slightly smaller than mule deer, making for a more reasonable CISA. Using the pronghorn herd units would allow for a CISA that extends well beyond the CCPA boundary to allow for assessing impacts to mobile, wide-ranging wildlife species such as pronghorn.
	Greater Sage-grouse: An 11-mile radius from the CCPA for greater sage-grouse.	While not considered a migratory bird under the MBTA, sage-grouse are nonetheless local migrants and are known to move up to 40 miles between seasonal ranges. According to Connelly et al. 2000, an 11-mile radius from the project boundary in the context of "large" projects may be appropriate to consider all seasonal habitats that may be affected for birds that use the habitats associated with the project during some portion of the life-cycle of seasonally migratory sage-grouse. In addition, WY-2012-019 states that "effects analysis may extend out to 11 miles or more from the project boundary for large-scale projects."

5.2 Past, Present, and Reasonably Foreseeable Future Projects

Historical disturbance within the southern Powder River Basin (**Figure 3.3-1**) primarily has been due to oil and gas, coal, and uranium extraction. Past, present, and reasonably foreseeable future projects included in the general cumulative effects area include those for oil and gas development, mining operations, wind power facilities, and other projects (e.g., power plants, electrical distribution lines, pipelines, and railroads). Additional detailed information can be found in Section 3.3, Geology and Minerals and Section 3.4, Land Use.

The first step in identifying the list of cumulative projects to include in the analysis regardless of resource was to use the general CISA boundary (i.e., the greatest boundary extent of all CISAs not including air quality, cultural resources [specifically historic trails], groundwater, environmental justice, and socioeconomics). Projects considered for the cumulative effects analysis include non-federal undertakings as well as other federal undertakings. Once this list was obtained, the resource-specific CISA GIS layers were used to determine which projects (or what portions of these projects) were to be included in the analysis for each respective resource.

Many of the projects listed for cumulative effects analysis overlap in space and time with each other as well as with the proposed Project. Disturbance impacts for each project were assessed based on the disturbance only, not based on the entire project area; therefore, impact calculations did not double-count disturbance in areas of overlap. This is particularly important when considering projects for which the disturbance is only a portion of the project area (i.e., oil and gas exploration and production, uranium mining, and wind power).

5.2.1 Oil and Gas Exploration and Production

Oil and gas development in the southern Powder River Basin began in the late 1800s based on surface seeps. Drilling activity began in the early 1900s in shallow targets. It wasn't until the 1960s and 1970s that drilling targets were located in deeper strata. Oil and gas projects that currently exist within the general CISA boundary include exploratory and development oil and gas projects, gas plants, and coalbed natural gas projects.

As presented in Chapter 2.0 (Section 2.3.1), 1,449 well pads and 32 associated facilities currently exist within the CCPA. Under Alternative A, an additional 386 well pads and 26 associated facilities remain to be developed within the CCPA as disclosed in existing NEPA decision documents (Section 2.3.2). **Table 5.2-1** provides a list of these and other past, present, and reasonably foreseeable oil and gas activity in the larger general CISA for the proposed Project. The projects listed as reasonably foreseeable include those for which NEPA decision documents are anticipated or in process but have not yet been completed, excluding the proposed Project. These projects also are displayed on **Figure 5.2-1**.

Table 5.2-1 also provides information on the five gas plants within the CCPA associated with existing oil and gas production as of December 31, 2015. Four additional gas plants occur outside the CCPA but within the general CISA.

In addition, as of December 31, 2015, there were approximately 100 to 115 smaller active oil and gas projects within the general CISA (primarily to the north in Campbell County) totaling 2,333 to 2,458 wells (BLM 2016a). It is assumed that the portion of the projects listed in **Table 5.2-1** that are within the CCPA are accounted for as part of the existing and approved activities disclosed in **Tables 2.3-1** and **2.3-3**. Therefore, additional cumulative disturbance (i.e., that outside of the CCPA) is calculated in **Table 5.2-1**.

5.2.2 Mining Projects

The CCPA is located in the southern Powder River Basin, an area with a history of oil and gas, uranium, and coal production. Coal mining in the general area dates back to the late 1800s and early 1900s. Small uranium mines initially were worked in the 1950s, and more recently, wind farms have been constructed in the southwestern portion of the CCPA. Mining projects that currently exist within the CCPA and associated CISAs include uranium, coal, leonardite, and mineral material mines. All reasonably foreseeable future mining activities would be for uranium extraction (i.e., there are no reasonable foreseeable future coal mines). It is possible that the existing coal mines, leonardite mine, and the quarries could apply for permit boundary expansion; however, it was not anticipated as of December 31, 2015.

Table 5.2-1 All Other Cumulative Oil and Gas Projects

Project Name	Total per Project			Outside the CCPA			
	Wells (number)	Well Pads (number)	Disturbance (acres)	Fraction (percent)	Wells (number)	Pads (number)	Disturbance (acres)
Cole Creek Exploratory Drilling	11	11	58	100	11	11	58
East Converse Exploratory Oil and Gas Development	21	18	243	41	9	7	100
Highland Loop Road Exploratory Oil and Gas Development	40	37	941	2	1	1	22
Hornbuckle Field Development	192	48	821	0	0	0	0
Marys Draw Oil and Gas Exploration and Development	55	19	170	100	55	19	170
Mohawk Oil and Gas Exploration and Development	32	6	226	0	0	0	0
PRCC Oil and Gas Development[1]	32	15	231	82	26	123	189
Salt Creek Fieldwide Expansion	415	Unknown	2,606	100	415	Unknown	2,606
Scott Field Development	150	40	686	0	0	0	0
Spearhead Ranch Exploratory Oil and Gas Development	79	56	935	0	0	0	0
Wold East Plan of Development	9	6	113	0	0	0	0
BLM Buffalo Field Office Active Coalbed Natural Gas Projects[2]	2,410	Unknown	11,086	100	2,410	Unknown	11,086
Buck Draw North Gas Plant	NA	NA	40	100	NA	NA	40
Bucking Horse Gas Plant[3]	NA	NA	100	100	NA	NA	100
Buckshot Treating Facility	NA	NA	40	100	NA	NA	40
Douglas Gas Plant	NA	NA	40	0	NA	NA	0
Fort Union Treating Facility	NA	NA	40	100	NA	NA	40
Morton Gas Plant	NA	NA	40	0	NA	NA	0
NorthCut Refinery	NA	NA	40	0	NA	NA	0
Sage Creek Gas Plant	NA	NA	40	0	NA	NA	0
Sand Dunes Gas Plant	NA	NA	40	0	NA	NA	0
Additional No Action Existing Disturbance[4]	Unknown	1,449	13,619	0	NA	0	0

Table 5.2-1 All Other Cumulative Oil and Gas Projects

Project Name	Total per Project Wells (number)	Total per Project Well Pads (number)	Total per Project Disturbance (acres)	Outside the CCPA Fraction (percent)	Outside the CCPA Wells (number)	Outside the CCPA Pads (number)	Outside the CCPA Disturbance (acres)
Additional No Action New Disturbance[4]	Unknown	156	6,367	0	NA	0	0
Greater CrossBow Exploratory Oil and Gas Development Project	1,500	100	6,131	97	1,458	97	5,959

[1] Value for total well pads for the project includes 9 well pads and 6 production pads.

[2] As of December 31, 2015, the Buffalo Field Office NEPA register had approximately 110 active oil and gas projects listed (since 2003) that were within the general CISA but outside of the CCPA. These projects have been approved but not necessarily all have been fully developed. Disturbance was calculated assuming 4.6 acres per well based on disturbance values obtained for a subset of approximately 27 percent of these projects.

[3] Construction on the Bucking Horse Gas Plant was completed in February 2015; therefore, it was assumed that reclamation had not yet occurred, and the disturbance estimate used was the same as that used for construction disturbance in **Table 2.3-3**.

[4] Includes acreage from all No Action existing disturbance (**Table 2.3-1**) not yet accounted for (i.e., 13,819 acres less 200 acres for 5 existing gas plants) and all No Action new disturbance (**Table 2.3-3**) not yet accounted for (i.e., 10,253 acres less 3,886 acres for 230 new well pads); No Action data collected from WOGCC and WPA.

Source: BLM 2016a,b, 2014a,b, 2013a,b, 2012a,b,c,d,f,g; EOG 2015; WPA 2015b.

Uranium was discovered in the southern Powder River Basin in the early 1950s. There are several areas where uranium occurs in the Powder River Basin; however, many have been mined out or the uranium is not economically viable. Today, uranium mining occurs in the Southern Powder River Uranium District through the in situ leach method. However, due to the continued depressed uranium market, a number of planned NRC licensing actions have been modified or delayed indefinitely (Uranium One Americas 2013). Past, present, and reasonably foreseeable future uranium mining projects as of December 31, 2015, are listed in **Table 5.2-2** and displayed on **Figure 5.2-2**.

Table 5.2-2 Cumulative Uranium Mining Projects

Project Name	Total Project Area (acres)	Inside or Outside the CCPA	Project Disturbance[1] (acres)	Disturbance Outside the CCPA (acres)
Past and Present Projects				
Highland Ranch Uranium Mine	16,754	Inside	1,257	0
Highland/Morton Ranch Uranium Mine	1,131	Inside	85	0
Moore Ranch Uranium Mine	7,110	Outside	533	533
Nichols Ranch Hank Unit Uranium Mine	2,292	Outside	172	172
Nichols Ranch Uranium Mine	1,174	Outside	88	88
Reynolds Ranch Uranium Mine	8,609	Inside	646	0
Smith Ranch Uranium Mine	14,876	Inside	1,116	0
Reasonably Foreseeable Future Projects				
Collins Draw Uranium Mine	1,201	Outside	180	180
Ludeman Uranium Mine	19,863	98 percent Inside	2,979	57
Nichols Ranch Jane Dough Unit	3,813	Outside	572	572
Reno Creek Uranium Mine	6,057	Outside	909	909

[1] The Generic EIS estimated that the construction disturbance for previously permitted projects averaged 15 percent (NRC and WDEQ 2009). Assuming approximately 50 percent of that would be reclaimed; the operational disturbance would be 7.5 percent of the total project area. Therefore, past and present projects were calculated assuming 7.5 percent disturbance and future projects were calculated assuming 15 percent disturbance.

[2] Sources: NRC and WDEQ 2009; World Information Service on Energy 2016.

Major booms in coal mining occurred in the 1970s and early 1980s. The coal mines located within the general CISA include a portion of the southern group of coal mines near Wright, Wyoming. These include the Antelope, Black Thunder, Jacobs Ranch, North Antelope Rochelle, and School Creek mines, all of which are located in Campbell County. Portions of the Antelope and North Antelope Rochelle Mines also are located in Converse County (**Figure 5.2-2** and **Table 5.2-3**). None of these coal mines are located within the CCPA and future coal development or further expansion is not anticipated at this time (BLM 2004g). However, to account for possible future growth within the lease area, it was assumed that the entire coal lease area would be mined-out and additional disturbance beyond the coal lease boundary was assumed to be approximately 20 percent of the lease area. Therefore, project disturbance for each coal mine was conservatively calculated to include the entire lease area plus this additional off-lease disturbance.

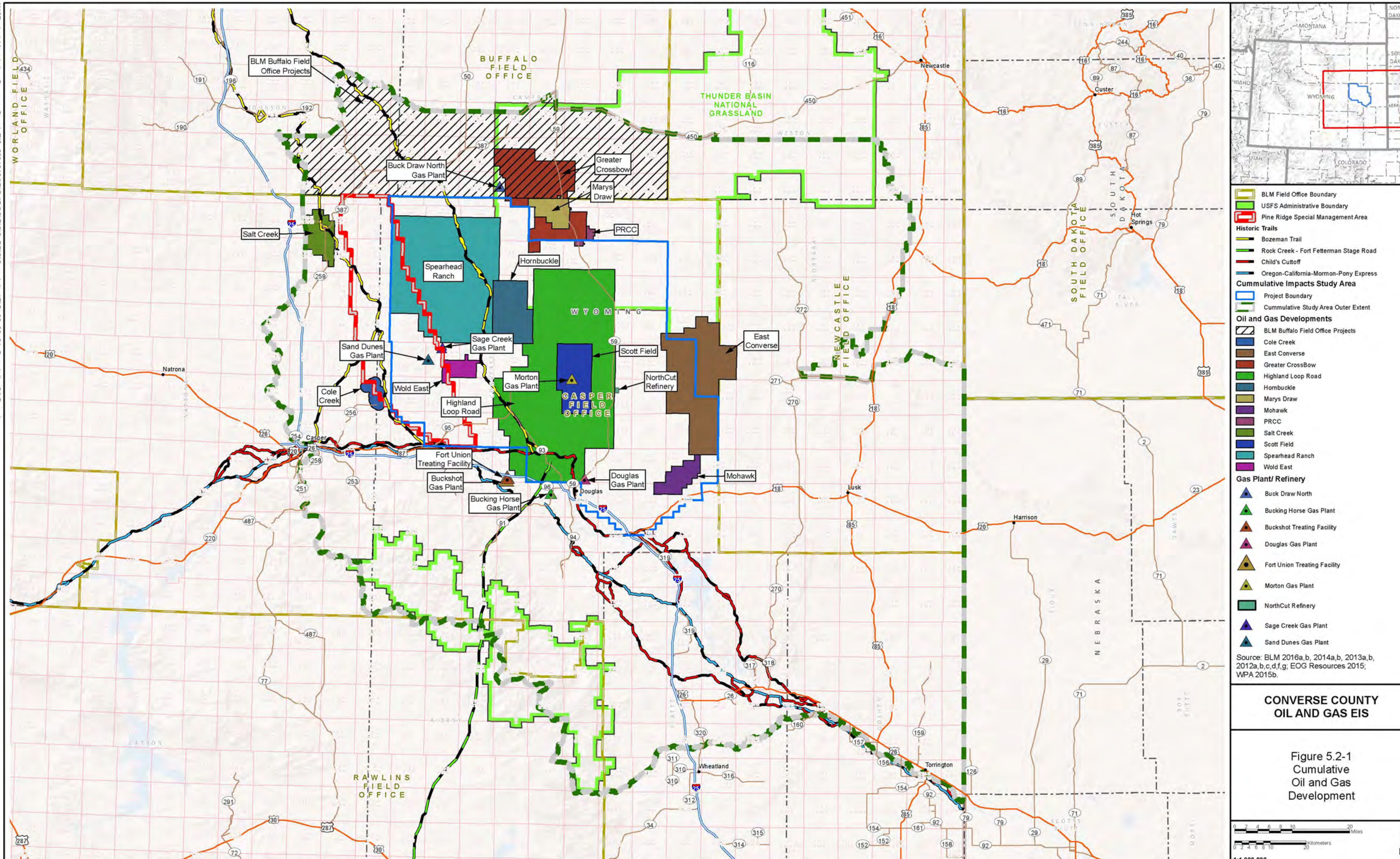

Figure 5.2-1 Cumulative Oil and Gas Development

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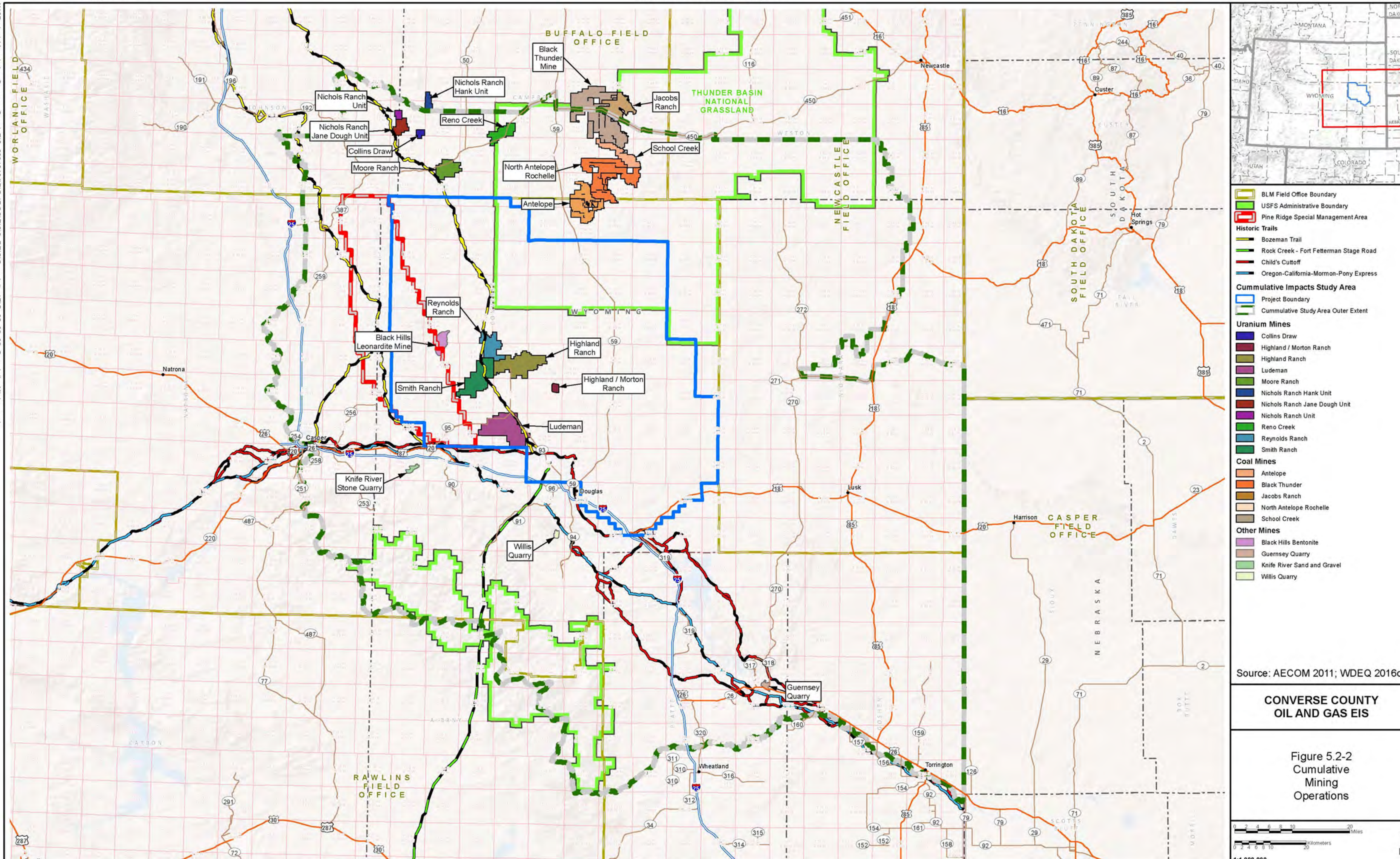

Figure 5.2-2 Cumulative Mining Operations

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Table 5.2-3 Past and Present Coal and Other Mining Projects

Project Name	Total Project Area[1] (acres)	Inside or Outside the CCPA	Project Disturbance[2] (acres)	Disturbance Outside the CCPA (acres)
Coal Mines[3]				
Antelope Coal Mine	16,129	Outside	19,355	19,355
Black Thunder Coal Mine	42,648	Outside	51,178	51,178
Jacobs Ranch Coal Mine[4]	10,412	Outside	12,494	12,494
North Antelope Rochelle Coal Mine	26,431	Outside	31,717	31,717
School Creek Mine	7,408	Outside	8,890	8,890
Other Mines				
Black Hills Leonardite Mine	4,379	Inside	4,379	0
Guernsey Quarry	939	Outside	939	939
Knife River Stone Quarry	1,029	Outside	1,029	1,029
Willis Sand and Gravel Pit	690	Outside	690	690

[1] Total project area is the lease area.

[2] As a conservative estimate, additional disturbance beyond the coal lease boundary was assumed to be approximately 20 percent of the lease area. Assuming the entire coal lease area will be mined-out; project disturbance for coal mines was calculated to include the entire lease area plus this additional off-lease disturbance. For other mines, the total project area (i.e., lease area) is assumed to be equal to the disturbance acreage (i.e., no additional off-lease disturbance).

[3] Further detail regarding anticipated activity for the coal mines can be found in the Task 2 Report for the Powder River Basin Coal Review (AECOM 2011).

Sources: AECOM 2011; WDEQ 2016c.

Within the CCPA, the former Dave Johnston coal mine has been reclaimed and is now the site of three wind farms. These wind farms are discussed further in Section 5.2.3.

Other mining operations in the general CISA include the Black Hills Leonardite Mine, the Willis Sand and Gravel Pit, Guernsey Quarry, Knife River Stone Quarry, and multiple, smaller gravel pits (**Figure 5.2-2** and **Table 5.2-3**). Leonardite is a low ranking coal that contains a high content of humic acid. It is used as a thinner in drilling mud and as a fertilizer. The Black Hills Leonardite Mine is located approximately 1 mile to the north of the reclaimed Dave Johnston coal mine. The Willis Sand and Gravel Pit is located southwest of the town of Douglas and the Knife River Stone Quarry is south of Glenrock. Both of these are just outside of the CCPA. The Guernsey Quarry is farther to the southeast of the CCPA in Platt County. Most of the remaining smaller gravel pits are located outside of the CCPAs southwestern boundary; those that are within the CCPA are in the southern portion.

5.2.3 Wind Power Projects

Wyoming is among one of the top states for wind energy potential and Converse County has the ability to support commercial-scale wind energy projects (**Figure 5.2-3** and **Table 5.2-4**). The Glenrock Wind Energy Project was the first to be built within the CCPA in 2008. It was followed by the Campbell Hill, Glenrock III, and Rolling Hills wind energy projects in 2009 and the Top of the World wind energy project in 2010. The Glenrock III wind project is the smallest of the wind farms and shares the 14,000-acre reclaimed former Dave Johnston coal mine project site with the Glenrock and Rolling Hills wind projects. The Reno Junction Wind Energy Project and the Pioneer Wind Park are both just outside the CCPA, to the north and south, respectively. As of December 31, 2015, there were no reasonably foreseeable future wind power projects.

Table 5.2-4 Past and Present Wind Energy Projects

Project Name	Total Project Area (acres)	Inside or Outside the CCPA	Size		Project Disturbance[1] (acres)	Disturbance Outside CCPA (acres)
			Number of Turbines	Power (MW)		
Campbell Hill Windpower	13,425	73 percent Inside	66	99	135	36
Glenrock Wind Energy	14,470	Inside	66	99	135	0
Glenrock III Wind Energy			26	39	53	
Rolling Hills Wind Energy			66	99	135	
Pioneer Wind Park I and II	23,795	Outside	62	99	172	172
Reno Junction Wind Energy	14,175	Outside	100	150	205	205
Top of the World Windpower	18,088	Inside	110	200	226	0

[1] Project disturbance calculations assumed: one 3-acre substation per 100-megawatt (MW) phase or project; 0.25 mile of roads per tower with a 50-foot-wide ROW (i.e., 1.5 acres/tower); and 0.5 acres per tower for tower foundation.

Sources: Duke Energy 2009a,b; PacifiCorp 2007; Third Planet Windpower 2010; Wasatch Wind 2011.

5.2.4 Other Development

Other energy-related development has occurred in northeast Wyoming to process and transport the energy and energy-related products resulting from the oil and gas, mining, and wind power development as noted in the subsections above. These other existing or proposed cumulative projects within the CCPA and associated CISAs include the power plant, pipeline, rail lines, and electric distribution lines as detailed in **Table 5.2-5** and shown on **Figure 5.2-3**.

Other development that currently exists within the CCPA and associated CISAs includes the Dave Johnston Power Plant and associated transmission lines, the Greencore CO_2 pipeline, and a network of BNSF and UP railroads (**Table 5.2-5** and **Figure 5.2-3**).

- Dave Johnston Power Plant and approximately 780 miles of associated transmission lines: The Power plant is located along the Platte River approximately six miles east of Glenrock and was commissioned in 1958. The plant and transmission lines generate and distribute 817 MW of electricity. Disturbance includes:
  - Approximately 200 acres for the Dave Johnston Power Plant site.
  - It was assumed that approximately 98 percent of disturbance associated with the transmission lines was reclaimed within the year of construction; therefore, minimal surface disturbance remains associated with previously existing transmission and was not accounted for in this analysis.

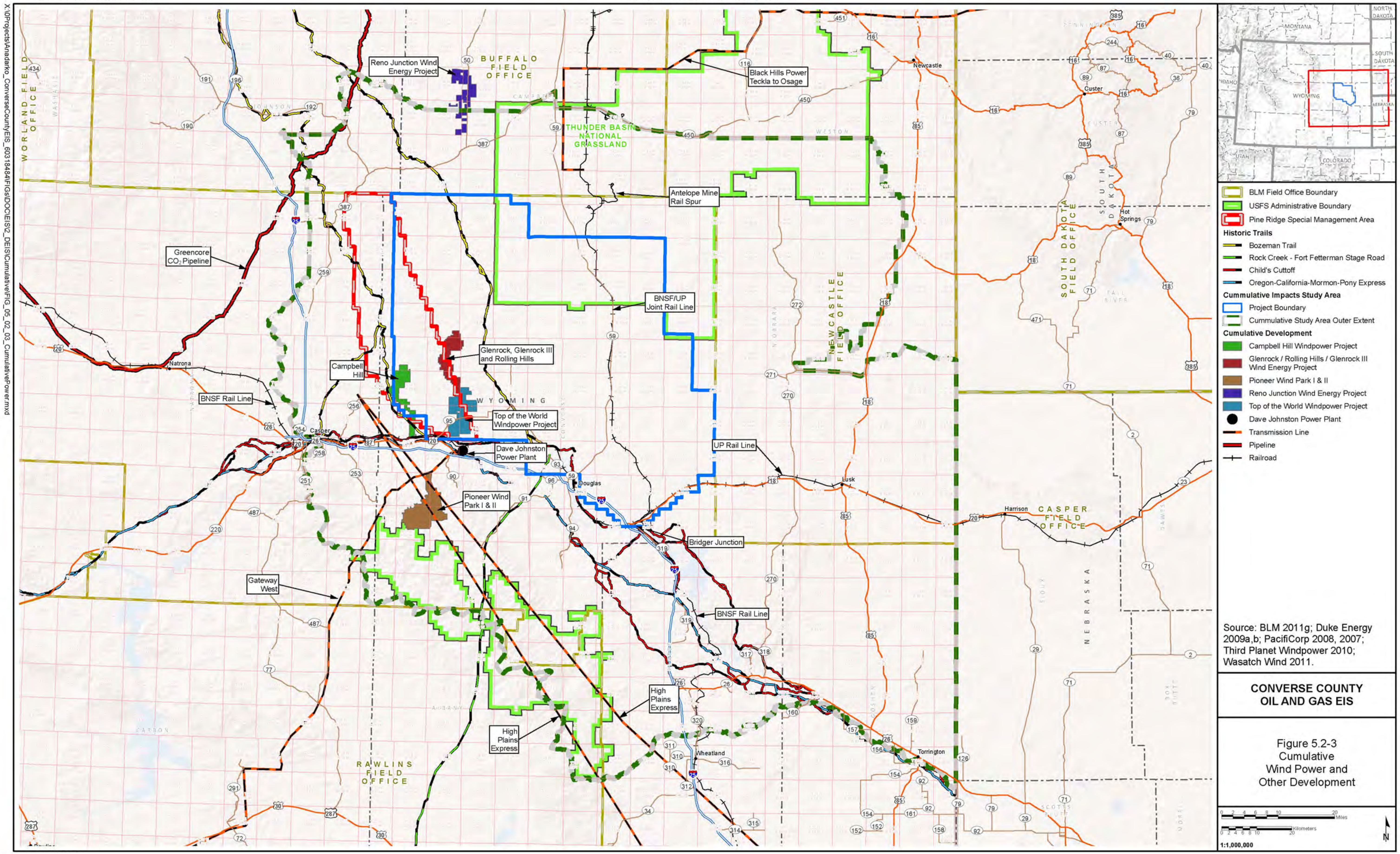

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Table 5.2-5 Cumulative Power Plants and Linear Projects

Project Name	ROW Width (feet)	Length within CCPA (miles)	Project Area within CCPA (acres)	Length Outside CCPA but within Associated CISAs (miles)	Project Area Outside CCPA but within Associated CISAs (acres)
Past and Present Projects					
Dave Johnston Power Plant[1]	0	NA	0	NA	200
Greencore Pipeline[2]	0	0	0	21	0
BNSF/UP Joint Rail Line	150	54	982	27	491
BNSF Rail Line – south and west from Bridger Junction	150	18	327	100	1,818
UP Rail Line – east from Bridger Junction	150	13	236	48	873
Reasonably Foreseeable Future Projects[3]					
Teckla to Osage Transmission Line	125	0	0	15	80
Gateway West Transmission Line	250	0	0	28	297
High Plains Express Transmission Line	250	0	0	158	1,676

1 Disturbance provided includes the power plant only. It is assumed that approximately 98 percent of the associated transmission line disturbance has been reclaimed; therefore, minimal surface disturbance would be associated with the existing transmission lines and is not accounted for in this analysis.

2 Construction of the pipeline was completed in 2012; therefore, it is assumed that the ROW has been reclaimed (BLM 2011g). There is minimal surface disturbance associated with pipeyards, pump stations, and other facilities; therefore, disturbance is not accounted for in this analysis.

3 It is assumed that constructed electric transmission lines (i.e., reasonably foreseeable future projects) would have a temporary surface disturbance of approximately 35 percent of the total permitted ROW acreage (AECOM 2011).

Sources: Black Hills Energy 2016; BLM 2011g; High Plains Express 2016; PacifiCorp 2008; Rocky Mountain Power and Idaho Power 2016.

- Greencore Pipeline: A 21-mile portion of this 232-mile CO_2 pipeline runs through Natrona and Johnson counties just west of the CCPA and runs through the northwest portion of the general CISA. Construction of the pipeline was completed in 2012; therefore, it is assumed that the ROW has been reclaimed (BLM 2011g). Disturbance includes:
  - Minimal surface disturbance associated with pipeyards, pump stations, and other facilities; therefore, it is not accounted for in this analysis.
- The UP/BNSF Joint Rail Line: Approximately 81 miles of this north-south line passes through the CCPA and associated CISAs to Bridger Junction (southeast of Douglas, Wyoming). It provides service for the South Gillette and Wright coal mines. Disturbance includes:
  - Assumed 150-foot-wide existing disturbance ROW (AECOM 2011).
- Other UP and BNSF Rail Lines: These rail lines include those that continue to run south from Bridger Junction, southeast of Douglas, Wyoming (BNSF) and the east-west lines from Nebraska through Bridger Junction (UP) and continuing on from Bridger Junction through Casper, Wyoming and westward (BNSF). A total of approximately 179 miles of these rail lines

pass through the southern portion of the CCPA and associated CISAs. As with the joint rail line, these lines provide service for the Powder River Basin coal mines. Disturbance includes:

- Assumed 150-foot wide existing disturbance ROW (AECOM 2011).

As of December 31, 2015, there were no reasonably foreseeable future plans for new major pipelines or rail line expansions in the area. All future linear projects are for electric transmission line development (**Table 5.2-5** and **Figure 5.2-3**). It was assumed that newly constructed electric transmission lines would have a temporary surface disturbance of approximately 35 percent of the total permitted ROW acreage (AECOM 2011). The reasonably foreseeable transmission line projects include the following:

- Teckla to Osage (proposed by Black Hills Power): A 144-mile, 230-kV line that begins approximately 30 miles south of Wright, Wyoming, and ends in Rapid City, South Dakota. Approximately 15 miles occurs within the associated CISAs for this Project. Construction disturbance includes:
  - 35 percent of the approximate 125-foot ROW width.
- Gateway West (proposed by PacifiCorp and Idaho Power): An 1,000-mile, 230-kV/500-kV line from the Dave Johnston Power Plant, passing southwest through Converse and Natrona counties, and eventually terminating in southern Oregon. The western 850 miles would be a 500-kV line and the remaining 150-mile eastern portion (i.e., the portion running through the CCPA) would be a 230-kV line. Approximately 28 miles of the 230-kV eastern portion would occur within the associated CISAs for this Project. Construction disturbance for the eastern portion would include:
  - 35 percent of the approximate 250-foot ROW width.
- High Plains Express (proposed by Tri-State Generation and Transmission Association, Inc.): A 1,300-mile, 500-kV line that would originate at the Windstar substation near Casper and travel southeast through Converse County, eventually terminating in southern Arizona. Approximately 158 miles would occur within the associated CISAs for this Project. Construction disturbance would include:
  - 35 percent of the assumed 250-foot ROW width.

5.3 Cumulative Impacts by Resource

5.3.1 Air Quality

The cumulative air quality impacts were assessed using two different models: a near-field dispersion model and a far-field regional photochemical model. The near-field modeling results were used to assess criteria and HAP impacts within and near the CCPA. The regional modeling was used to assess the cumulative impacts of criteria pollutants, ozone, visibility and deposition. Details of the modeling are discussed in Section 4.1 and the Air Quality Technical Support Document (**Appendix A**).

5.3.1.1 Cumulative Air Emissions

<u>Cumulative Criteria Emissions</u>

For the near-field modeling analysis, cumulative emissions were not modeled explicitly, which is consistent with the approach agreed to by the reviewing agencies. To estimate cumulative air quality impacts, background ambient air quality concentrations were added to the modeled Project impacts.

For the photochemical modeling analysis, the complete cumulative emissions inventory included point sources, area sources, non-road and on-road mobile sources, as well as ammonia emissions, windblown dust, biogenic emissions, and fire emissions. The annual total emissions for all source sectors for the maximum project year are provided in **Table 5.3-1**. Alternative B was modeled in combination with all other cumulative emissions to estimate the total cumulative 2028 impacts. Alternative C was not modeled; however, cumulative impacts would be similar or less than those for Alternative B.

Table 5.3-1 Cumulative Annual Emissions Inventory

Emission Sector	NO_X (tpy)	TOG[1] (tpy)	CO (tpy)	SO_2 (tpy)	PM_{10} (tpy)	$PM_{2.5}$ (tpy)	NH_3 (tpy)
Oil and Gas	106,625	1,078,570	84,008	10,694	17,350	7,737	141
Livestock	0	0	0	0	0	0	79,448
Fertilizer	0	0	0	0	0	0	37,946
Residential Wood Combustion	547	3,940	549	252	1,831	1,648	226
Fugitive Dust	0	0	0	0	491,941	61,202	0
Non-Point	5,660	136,432	19,478	1,439	3,915	3,440	957
On-road Mobile	26,701	16,131	243,388	309	2,086	1,390	840
Airplane, Locomotive, and Marine	55,418	1,863	13,850	33	1,678	1,561	36
Non-Road	14,810	24,587	149,747	36	2,042	1,963	36
Biogenic	22,525	483,501	55,920	0	0	0	0
Windblown Dust	0	0	0	0	609,451	60,945	0
Point	174,662	42,991	64,764	67,574	57,186	33,325	1,301
Lightning	59,687	0	0	0	0	0	0
Fires	13,103	15,094	500,786	1,851	50,587	46,089	0
Total for All Other Cumulative Sources	**479,738**	**1,803,109**	**1,132,490**	**82,188**	**1,238,067**	**219,300**	**120,931**
Alternative B	10,696	21,444	9,539	30	16,902	2,281	0
Total Cumulative with Alternative B	**490,434**	**1,824,553**	**1,142,029**	**82,218**	**1,254,969**	**221,581**	**120,931**
Percent Alternative B Contributing to Total	**2.2**	**1.2**	**0.8**	**0.04**	**1.4**	**1.0**	**0.0**

[1] TOG includes VOC and methane.

The emission totals for the oil and gas emission sector shown in **Table 5.3-1** include existing and new oil and gas sources. For new oil and gas sources within eastern and southern Wyoming that are near CCPA, emissions are comprised of reasonably foreseeable development and reasonably foreseeable future actions. Unless otherwise noted in **Appendix A**, the data were provided by the BLM and were used without modification. **Table 5.3-2** provides the reasonably foreseeable development and reasonably foreseeable future projects explicitly included in the emissions inventory.

Table 5.3-2 2028 Oil and Gas Emissions for Reasonably Foreseeable Development

Project Name or Field Office	NO_X (tpy)	VOC (tpy)	CO (tpy)	SO_2 (tpy)	PM_{10} (tpy)	$PM_{2.5}$ (tpy)
Bird Canyon	658	641	481	5	250	64
Buffalo Field Office	5,675	1,433	7,779	372	348	348
CFO[1]	1,397	2,108	1,038	4	4,311	499
Continental Divide-Creston	4,742	14,716	8,588	2	2,235	455
Greater Crossbow	4,701	7,844	4,438	19	2,039	486
Hiawatha	1,861	1,556	919	1	318	100
Jonah Infill	1,099	2,705	686	62	28	28
Monell Arch	253	276	220	8	33	17
Moneta Divide	5,547	5,405	7,267	173	2,724	598
Moxa Arch	3,987	23,056	4,858	1	1,427	334
Normally Pressured Lance Natural Gas Development	472	310	623	10	968	145
Pinedale Anticline	1,381	2,286	1,250	53	79	79
Rock Springs Field Office	998	3,318	2,369	1	516	93
Cumulative Emissions from Other Sources	**32,771**	**65,654**	**40,516**	**711**	**15,276**	**3,246**
Alternative B	10,696	15,506	9,539	30	16,902	2,281
Total Cumulative Oil and Gas Emissions	**43,467**	**81,160**	**50,055**	**741**	**32,178**	**5,527**
Percent Alternative B Contributing to Total	**24.6**	**19.1**	**19.1**	**4.1**	**52.5**	**41.3**

[1] The method to estimate reasonably foreseeable development emissions for the CFO are described in **Appendix A**. Modeled emissions for the CFO are notably less than the emissions estimated for Alternative A (shown in **Table 4.1-1**). This is due to two factors: 1) a different method was used to estimate the number of wells to be developed in the CFO when the modeling analysis was conducted. As a result the modeled emissions were based on development of 1,336 wells rather than 1,663 wells estimated under Alternative A; and 2) the modeled CFO emissions do not include new ancillary facilities for processing or transporting produced oil and gas, while Alternative A does include these types of sources.

5.3.1.2 Cumulative Impacts to Criteria Pollutants

Near-field Impacts

Near-field modeling was used to assess the cumulative impacts within and nearby the CCPA resulting from Project-related development and production emissions. While near-field modeling analyses do not explicitly model other projects, the addition of existing background concentrations used to characterize total cumulative impacts would be representative of potential conditions within the CCPA. Maximum air quality impacts resulting from the Alternative B drilling and production activities within the CCPA were added to representative background concentrations. The resulting total cumulative concentrations were found to be below the levels of the NAAQS/WAAQS for all pollutant and averaging times, except for annual PM_{10} during periods of active construction. Construction activities frequently are predicted to exceed the NAAQS/WAAQS, but the sources are transient and temporary; therefore, impacts would be expected to be localized in the immediate vicinity of the construction activities. After construction activities stop, the impacts would end and concentrations would return to background levels.

Regional Impacts

The incremental impacts from Alternative B would not lead any area to exceed the AAQS in 2028 that would not already be exceeding the NAAQS/WAAQS for all other cumulative actions. **Tables 5.3-3** and **5.3-4** provide the highest Alternative B impacts for each criteria pollutant reported in the form of applicable NAAQS/WAAQS. The cumulative concentrations provided correspond to the same location and averaging period as the highest Alternative B impacts. Therefore, the cumulative concentrations in **Table 5.3-3** and **Table 5.3-4** do not represent the cumulative highest modeled concentrations, except when the impact from Alternative B was zero for all areas of a given type.

Table 5.3-3 2028 Cumulative Impacts Based on Absolute Model Results

Pollutant	Area	Alternative B	Other Cumulative Actions[1]	Total Cumulative[1]	NAAQS/ WAAQS	Location
Ozone	Class I	0 ppm	**0.077 ppm**	**0.077 ppm**	0.070 ppm	Rocky Mountain National Park and Fitzpatrick Wilderness Area
	Sensitive Class II	0.001 ppm	0.064 ppm	0.065 ppm		Fort Laramie National Historic Site
	4-km Domain Brute Force	0.002 ppm	0.063 ppm	0.065 ppm		Approximately 5.5 miles east of CCPA
	4-km domain Source Apportionment	0.003 ppm	0.061 ppm	0.064 ppm		***Approximately 15 miles north of CCPA***
NO_2 (1-hour)	Class I	0 ppb	9 ppb	9 ppb	100 ppb	North Absaroka Wilderness Area
	Sensitive Class II	0 ppb	17 ppb	17 ppb		Dinosaur National Monument
NO_2 (Annual)	Class I	0 ppb	1 ppb	1 ppb	53 ppb	North Absaroka Wilderness Area and Northern Cheyenne Indian Reservation
	Sensitive Class II	0 ppb	2 ppb	2 ppb		Fort Laramie National Historic Site
CO (1-hour)	Class I	0 ppm	**140 ppm**	**140 ppm**	9 ppm	North Absaroka Wilderness Area
	Sensitive Class II	0 ppm	**52 ppm**	**52 ppm**		Absaroka-Beartooth Wilderness
CO (8-hour)	Class I	0 ppm	**111 ppm**	**111 ppm**	35 ppm	North Absaroka Wilderness Area
	Sensitive Class II	0 ppm	**37 ppm**	**37 ppm**		Absaroka-Beartooth Wilderness
SO_2 (1-hour)	Class I	0 ppb	3 ppb	3 ppb	75 ppb	North Absaroka Wilderness Area
	Sensitive Class II	0 ppb	5 ppb	5 ppb		Devil's Tower National Monument

Table 5.3-3 2028 Cumulative Impacts Based on Absolute Model Results

Pollutant	Area	Alternative B	Other Cumulative Actions[1]	Total Cumulative[1]	NAAQS/ WAAQS	Location
SO_2 (3-hour)	Class I	0 ppm	0.1 ppm	0.1 ppm	0.5 ppm	North Absaroka Wilderness Area and Yellowstone National Park
	Sensitive Class II	0 ppm	0.1 ppm	0.1 ppm		Absaroka-Beartooth Wilderness
PM_{10} (24-hour)	Class I	10 µg/m^3	**4,120 µg/m^3**	**4,130 µg/m^3**	150 µg/m^3	North Absaroka Wilderness Area
	Sensitive Class II	0 µg/m^3	**1,620 µg/m^3**	**1,620 µg/m^3**		Absaroka-Beartooth Wilderness
PM_{10} (Annual)	Class I	0 µg/m^3	13.2 µg/m^3	13.2 µg/m^3	50 µg/m^3	Rocky Mountain National Park
	Sensitive Class II	0.2 µg/m^3	12.4 µg/m^3	12.6 µg/m^3		Fort Laramie National Historic Site
$PM_{2.5}$ (24-hour)	Class I	0.0 µg/m^3	20 µg/m^3	20 µg/m^3	35 µg/m^3	North Absaroka Wilderness Area
	Sensitive Class II	1 µg/m^3	10 µg/m^3	11 µg/m^3		Fort Laramie National Historic Site and Agate Fossil Beds National Monument
	4-km Domain	2.8 µg/m^3	9.2 µg/m^3	12.0 µg/m^3		Within CCPA
$PM_{2.5}$ (Annual)	Class I	0.0 µg/m^3	6.8 µg/m^3	6.8 µg/m^3	12 µg/m^3	North Absaroka Wilderness Area
	Sensitive Class II	0.1 µg/m^3	4.9 µg/m^3	5.0 µg/m^3		Fort Laramie National Historic Site
	4-km Domain	0.8 µg/m^3	4.1 µg/m^3	4.9 µg/m^3		Within CCPA

[1] Values in **bold** indicated exceedance of NAAQS/WAAQS.

Table 5.3-4 2028 Cumulative Impacts Based on Model-Adjusted Values

Pollutant	Area	Alternative B	Other Cumulative Actions[1]	Total Cumulative[1]	NAAQS/ WAAQS	Location
Ozone	Class I	0.001 ppm	0.061 ppm	0.062 ppm	0.070 ppm	Northern Cheyenne Indian Reservation
	Sensitive Class II	0 ppm	**0.075 ppm**	**0.075 ppm**		Wind River Roadless Area
	Monitoring Site	0 ppm	**0.076 ppm**	**0.076 ppm**		Boulder Site, Wyoming
$PM_{2.5}$ (24-hour)	Monitoring Site	0.4 µg/m^3	9.9 µg/m^3	10.3 µg/m^3	35 µg/m^3	Thunder Basin National Grassland Site, Wyoming

Table 5.3-4 2028 Cumulative Impacts Based on Model-Adjusted Values

Pollutant	Area	Alternative B	Other Cumulative Actions[1]	Total Cumulative[1]	NAAQS/ WAAQS	Location
$PM_{2.5}$ (Annual)	Class I	0.0 μg/m^3	**31.9 μg/m^3**	**31.9 μg/m^3**	12 μg/m^3	North Absaroka Wilderness Area
	Sensitive Class II	0 μg/m^3	**16.2 μg/m^3**	**16.2 μg/m^3**		Absaroka-Beartooth Wilderness
	Monitoring Site	0.2 μg/m^3	3.8 μg/m^3	4.0 μg/m^3		Thunder Basin National Grassland Site, Wyoming

[1] Values in **bold** indicated exceedance of NAAQS/WAAQS.

In general, areas with NAAQS/WAAQS exceedances were not near the CCPA, and development under Alternative B would not add to further exceedances. As discussed in **Appendix A**, the assessment areas with exceedances of other pollutants (e.g., CO, PM_{10}, and $PM_{2.5}$) would be attributed to wildfires near those areas.

Impacts from fires, biogenics, and windblown dust emissions influences are evident. Although not explicitly shown, the same assessment areas that had exceedances in the cumulative 2008 Base Year also show exceedances in the cumulative 2028 modeling scenarios. Furthermore, 37 of the 38 areas assessed have the same 24-hour PM_{10} concentrations in both the cumulative 2028 modeling scenarios and the Base Year modeling scenario. This similarity in the PM_{10} cumulative concentrations indicates the exceedances are due to emission sources that are held constant from the base and future year modeling scenarios such as fires, biogenics, and windblown dust emissions.

Other than these exceedances, impacts from Alternative B for other pollutants generally would be negligible or zero at all Class I and Sensitive Class II assessment areas as well as at monitoring locations.

5.3.1.3 Cumulative Impacts to HAPs

Cumulative impacts to HAPs were not explicitly assessed; however, impacts to HAPs from combinations of Project-related activities were assessed. Near-field HAP concentrations were all below the acute REL and non-carcinogenic HAP RfCs. Additionally, cancer risks were within acceptable limits for residents located more than 2 km from gas plants and compressor stations, even when well pads also were located in proximity to the facilities.

5.3.1.4 Cumulative Impacts to Visibility

Table 5.3-5 provides a summary of model-predicted and model-adjusted visibility impacts for the cumulative 2028 highest and lowest visibility ranges for the 20 percent best and worst visibility days. These tables also provide the locations of the impacts. Several of the highest and lowest visibility ranges for the cumulative modeling results were the same. This similarity indicates that Alternative B would not contribute to the visibility impact and the cumulative impact would be due to existing sources or a combination of existing sources and reasonably foreseeable activity. For the 20 percent best visibility days, the highest visibility range would be 361.1 km at the Mount Zirkel Wilderness Area and Rawah Wilderness Area. For the 20 percent worst days, the lowest visibility range would be 32.8 km at the North Absaroka Wilderness Area. As discussed in more detail in **Appendix A**, northwest Wyoming experienced several large fires resulting in low visibility. These areas were far from the CCPA and were not anticipated to contribute to additional impacts.

Table 5.3-5 2028 Cumulative Visibility Impacts

Visibility Metric	Method	Area	Highest Visibility Range: Other Cumulative Activity	Highest Visibility Range: Alternative B	Lowest Visibility Range: Other Cumulative Activity	Lowest Visibility Range: Alternative B
20 Percent Best Visibility	Model-predicted	Class I	339.2 km North Absaroka Wilderness Area	339.2 km North Absaroka Wilderness Area	230.0 km Badlands National Park	229.4 km Badlands National Park
		Sensitive Class II	344.7 km Absaroka-Beartooth Wilderness	344.7 km Absaroka-Beartooth Wilderness	211.7 km Fort Laramie National Historic Site	209.6 km Fort Laramie National Historic Site
	Model-adjusted	Class I	361.1 km Mount Zirkel Wilderness Area and Rawah Wilderness Area	361.1 km Mount Zirkel Wilderness Area and Rawah Wilderness Area	205.0 km Badlands National Park	205.0 km Badlands National Park
20 Percent Worst Visibility	Model-predicted	Class I	169.6 km Mount Zirkel Wilderness Area	169.6 km Mount Zirkel Wilderness Area	32. 8 km North Absaroka Wilderness Area	32. 8 km North Absaroka Wilderness Area
		Sensitive Class II	170.1 km Encampment River Wilderness Area	170.1 km Encampment River Wilderness Area	91.5 km Jewel Cave National Monument	91.4 km Jewel Cave National Monument
	Model-adjusted	Class I	157.9 km Mount Zirkel Wilderness Area and Rawah Wilderness Area	157.9 km Mount Zirkel Wilderness Area and Rawah Wilderness Area	83.3 km Badlands National Park	83.3 km Badlands National Park

5.3.1.5 Cumulative Impacts to Deposition

Cumulative deposition impacts were analyzed for several metrics, including nitrogen and sulfur deposition, total acidification, and ANC at sensitive lakes. As shown in **Appendix A**, the incremental impacts from Alternative B would not lead any areas to exceed nutrient nitrogen critical loads that are not already predicted to exceed the critical load for the other cumulative actions. Model-predicted cumulative total nitrogen deposition was compared to nutrient critical load thresholds of the most sensitive flora or fauna in a sensitive area or waterbody. **Table 5.3-6** provides a summary of Alternative B annual nitrogen and sulfur deposition fluxes, as well as total predicted acidification. Total acidification is provided for informational purposes, although no thresholds of concern have been established for this metric. Lakes in Mount Zirkel Wilderness Area would have the largest predicted cumulative nitrogen deposition, sulfur deposition, and total acidification. At these lakes, impacts from Alternative B would be negligible, as shown in **Table 5.3-6**. At other locations closer to the CCPA, Alternative B could contribute up to 0.055 kg nitrogen per hectar per year, but sulfur deposition would be zero at all analyzed locations. Nitrogen deposition in 2008 is already predicted to exceed the nitrogen critical load at 16 of the 20 sensitive lakes. By 2028, the number of sensitive lakes predicted to exceed the nitrogen critical load would decrease, and only 10 of these 16 lakes would continue to exceed the nitrogen critical load. The contribution Alternative B would make to lakes that exceed the nitrogen critical load would be negligible.

Analysis of the ANC change determined that Alternative B would not contribute to any lake exceeding the limit of acceptable change, so cumulative impacts were not further assessed.

Table 5.3-6 2028 Cumulative Deposition Impacts

Pollutant	Area	Alternative B	Other Cumulative Actions	Total Cumulative	Nitrogen Critical Load	Location
Nitrogen Deposition (kg N/ha/yr)	Class I	0.001	4.06	4.06	2.5	Mount Zirkel Wilderness Area
	Sensitive Class II	0.000	5.37	5.37	2.5	Mount Naomi Wilderness Area
	Lakes	0.001	5.22	5.22	3.0	Lake Elbert and Mount Zirkel Wilderness Areas
Sulfur Deposition (kg S/ha/yr)	Class I	0.000	1.61	1.61	N/A	Mount Zirkel Wilderness Area
	Sensitive Class II	0.000	1.55	1.55	N/A	Huston Park Wilderness Area
	Lakes	0.000	2.25	2.25	N/A	Lake Elbert and Mount Zirkel Wilderness Areas
Total Annual Acidification (N+S eq/ha/yr)	Class I	0	391	391	N/A	Mount Zirkel Wilderness Area
	Sensitive Class II	0	439	439	N/A	Mount Naomi Wilderness Area
	Lakes	0	514	514	N/A	Lake Elbert and Mount Zirkel Wilderness Areas

5.3.1.6 Climate Change Impacts

The GHG emissions from the Proposed Action and alternatives, outlined in Section 4.1.5, are a likely contributor to global climate change. A detailed discussion of global climate change and anticipated changes near the CCPA is presented in Section 3.1.5. The following subsection discusses the Project's GHG emissions as compared to local, state and national GHG emissions. Subsequent sections discuss cumulative mitigation considerations and social cost of carbon.

<u>GHG Emissions Comparisons</u>

As discussed in Section 4.1.5, the Proposed Action will result in direct GHG emissions associated with installing and producing new wells and indirect emissions associated with the potential downstream use of produced oil and gas. The direct and indirect GHG emissions for the maximum project year and life of project are presented in Table 5.3-7 for both Alternative A and Alternative B. As discussed in Section 4.1.4.1, it is anticipated that emissions for Alternative C would be marginally lower than Alternative B. Since it is expected that direct and indirect GHG emission totals for Alternative C would be slightly lower than Alternative B, the Alternative C GHG emissions are not discussed in this section. In this section, the cumulative direct and indirect emissions within the cumulative assessment area are put in context of local, statewide, and national emissions. Best available resources were utilized in these

assessments. Additional information regarding the local, state and national GHG emissions is outlined in Section 3.1.5.

Table 5.3-7 Alternative A and B GHG Emissions

Alternative	***Category***	***GHG Emissions (MMT CO_2e)***		
		Direct	***Indirect***	***Total***
Alternative A (No Action)	***Maximum Year (Year 15)***	***2.5***	***16.7***	***19.2***
	Life of Project	***67.2***	***325.7***	***392.8***
Alterative B (Proposed Action)	***Maximum Year (Year 10)***	***5.5***	***64.0***	***69.5***
	Life of Project	***152.2***	***981.5***	***1133.8***

Local

Direct GHG gas emissions were calculated for natural gas, CBNG, oil, horizontal natural gas, and horizontal oil wells for the majority of Wyoming BLM field offices as part of the Wyoming Greater Sage-Grouse RMP (BLM 2015, 2019). These emissions were calculated using USEPA approved emission factors and a reasonably foreseeable well development scenario with associated production estimates, prepared by the BLM's Reservoir Management Group. For Casper Field Office, where the CCPA is located, total direct and indirect CO_2e emissions for CFO were calculated to be 0.387 MMT CO_2e per year and 1.5 CO_2e per year, respectively, in 2020 (BLM 2015). The Alternative A and B direct GHG emissions from the maximum year are 641 percent and 1,423 percent, respectively, of the estimated CFO's direct GHG emissions. The difference between the Project's and CFO's indirect GHG emissions is even larger with the Alternative A and B direct GHG emissions from the maximum year being 1,124 percent and 4,310 percent, respectively, of the estimated CFO's indirect GHG emissions. The large differences between the CFO and Project GHG emissions are primary due to the number of wells, type of wells, and the total oil and gas production used in the calculations. CFO estimates up to 1,292 new wells will be developed over the life of the plan with the majority being CBNG and vertical oil wells, while Alternative B is for 5,000 oil wells with the majority of them being horizontally drilled. In addition to the well differences, both alternatives include the construction and operation of ancillary facilities on fee or state lands, which may not be full reflected in the CFO's estimate. It must be noted, as well, that a large number of the horizontal wells proposed within the CCPA will produce from multiple mineral estates. The production of state and private minerals and federal minerals that did not occur within the Sage-grouse habitat were not included in BLM's RFD production projections, or the resultant indirect GHG emissions prepared to support in the Greater Sage-grouse RMP (BLM 2015), however it was included in the CCPA projections.

In addition to the Greater Sage-grouse RMP, the direct and indirect GHG gas emissions were calculated for all active wells within the CFO using data from WOGCC for 2014. These emissions were calculated using USEPA approved emission factors, active wells from WOGCC, and associated production estimates. Using these data, total direct and indirect CO_2e emissions for CFO were calculated to be 3.03 MMT CO_2e per year and 37.6 CO_2e per year, respectively, in 2014. The Alternative A and B direct GHG emissions from the maximum year are 82 percent and 182 percent, respectively, of the estimated CFO's direct GHG emissions. Finally, the Alternative A and B indirect GHG emissions from the maximum year are 82 percent and 182 percent, respectively, of the estimated CFO's direct GHG emissions.

Statewide

As discussed in Section 3.1.5, there are many ways to calculate GHG emissions with each representing a different group of GHG emissions and in some cases being calculated using different assumptions and methodologies. The Project's direct and indirect GHG emissions for Alternative A and B are compared to the various Wyoming GHG emission totals to give a context of Project greenhouse gas emissions.

First, the USEPA GHG Reporting Program requires that certain industries report their emitted GHG emissions. In Wyoming for all reporting facilities, the total direct GHG emissions in 2017 was 60.4 MMT of CO_2e (USEPA 2019b), of which the Project's Alternative A and B are roughly 4.1 and 9.1 percent, respectively. Second, looking only at oil and gas related GHG emissions, the USGS SIR Report provided direct and indirect GHG emission for oil and gas systems on Federal lands for the year 2014. For Wyoming's Federal lands in 2014, 9.1 MMT of CO_2e for direct GHG emissions and 84.6 MMT of CO_2e for indirect GHG emissions was reported (USGS 2019). Alternative A and B are roughly 27 and 61 percent, respectively, of the Wyoming Federal land direct GHG emissions, while Alternative A and B are roughly 20 and 76 percent, respectively, of the Wyoming Federal land indirect GHG emissions. Finally, the total oil and gas production for all lands within Wyoming obtained from the Wyoming Oil and Gas Conservation Commission (WOGCC) can be converted to indirect GHG emissions assuming all product are combusted. Alternative A and B CO2e totals are roughly 12 and 47 percent, respectively, of the 135.3 MMT indirect CO_2e estimated in 2018 from Wyoming oil and gas production (WOGCC 2019).

National

Several different national GHG emission totals are compared to Alternative A and B to give a context to the Project's estimated greenhouse gas emissions. As discussed in Section 3.1.5, the gross total of direct GHG emission for the U.S. in 2017 was 6,456 MMT of CO_2e (USEPA 2019). Alternative A and B are roughly 0.04 and 0.09 percent, respectively, of this total. In 2017 the direct GHG emissions from the oil and gas system only was 252 MMT of CO_2e, while the indirect emissions from oil and gas was 3,679 MMT of CO_2e (USEPA 2019). Alternative A and B are roughly 1.0 and 2.2 percent, respectively, of the direct oil and gas emissions, while Alternative A and B are roughly 0.5 and 1.7 percent, respectively, of the indirect oil and gas emissions.

Uncertainty

GHG emission estimates involve significant uncertainty due to unknown factors including actual production, how produced substances are used, the form of regulation of GHG parameters by delegated agencies, and whether any Best Available Control Technologies are utilized at the upstream or downstream activity location. This variability is not captured well by generalized GHG emission factors used in calculations. The ultimate result in changing laws or policies also cannot be predicted with any accuracy; as a result, the input data (e.g. well count, production values, etc.) used in GHG emissions estimates may not be realized if these policies restricted future oil and gas development. Based on both historical and current information, the rate of production success for wells ranges from a low of 13% to nearly 90%, depending upon the well location, the geologic formations targeted, price indexes, and technological advances.

The rough estimates of indirect CO_2e emissions are also uncertain because both potential future production, and the end uses for the fuels extracted are difficult to predict with accuracy. Future production is uncertain regarding the actual levels of development over time, levels of development over the life of the well, new technology, geologic conditions, and the ultimate level of production from any given well (whether reservoir related, or for economic

reasons). After well extraction, end uses of oil and gas may include refining for fertilizer, transportation fuels, fuel oils for heating and electricity generation, or production of asphalt and road oil.

Climate Change Impacts Due to Project GHG emissions

The currently available information about GHGs and climate change does not permit an assessment of the relationship between specific project-scale GHG emissions and specific effects on climate change because climate change operates on a global scale. Assessing the impacts of GHG emissions on global climate requires modeling on a global scale, which would not be sensitive to the comparatively small contribution of emissions from the proposed action. The Project would contribute the equivalent of roughly 0.02% of the 2016 global GHG emissions from the energy sector (total of 32,310 MMT of CO_2e) (USEPA 2019). Potential effects on climate are influenced by GHG emission sources from around the globe, and current methodologies cannot distinguish global climate impacts associated with GHG emissions originating from a discrete, and relatively small, area such as the CCPA.

There are currently no established significance thresholds for GHG emissions that BLM can reference in NEPA analyses, but all GHGs contribute incrementally to the climate change phenomenon. When determining NEPA significance for an action, BLM is constrained to the extent that cumulative effects (such as climate change) are only considered in the determination of significance when such effects can be prevented or modified by decision-making. While GHG emissions resulting from individual decisions can certainly be modified or potentially prevented by analyzing and selecting reasonable alternatives that appropriately respond to the action's purpose and need, BLM has limited decision authority to meaningfully or measurably prevent the cumulative climate change impacts that could result from an increase in global emissions or concentrations of CO_2 in the atmosphere.

Mitigation Considerations

Due to the potential negative effects of climate change, strategies are being formulated to decrease GHG emissions to help decrease climate change impacts. These strategies are being addressed at both the federal, state, and local levels. For example, through federal mandates, fuel efficiency of cars is increasing and energy upgrades of millions of homes across the country have taken place. Wyoming is taking some measures to address potential climate change impacts associated with GHG emissions. Since 2008, renewable energy generation from wind, solar, and geothermal sources in Wyoming increased by almost a factor of five. In addition, the city of Gillette, Wyoming has committed to reducing energy consumption by 20 percent in city buildings (White House Fact Sheet 2014).

The BLM regulates portions of natural gas and petroleum systems identified in the EPA Inventory of U.S. Greenhouse Gas Emissions and Sinks report (USEPA 2019). In carrying out its responsibilities, BLM has developed Best Management Practices (BMPs) designed to reduce emissions from field production and operations. Analysis and approval of future development on the Federal Lands may include application of BMPs within BLM's authority, as Conditions of Approval (COAs), to reduce or mitigate GHG emissions. The mitigation measures for CCPA are outlined in Chapter 6. Additional mitigation measures for areas part of the cumulative impact analysis, including Casper Field Office, may include, but are not limited to:

- ***Flare hydrocarbon and gases at high temperatures in order to reduce emissions of incomplete combustion through the use of multi-chamber combustors;***
- ***Require that vapor recovery systems be maintained and functional in areas where petroleum liquids are stored;***

- ***Installation of liquids gathering facilities or central production facilities to reduce the total number of sources and minimize truck traffic and,***
- ***Use of natural gas fired or electric drill rig engines.***

Additionally, the BLM encourages oil and natural gas companies to adopt proven cost-effective technologies and practices that improve operation efficiency and reduce natural gas emissions, to reduce the ultimate impact from emissions.

At Federal level, the USEPA Natural Gas STAR Program is a framework in which Partner companies can learn about and commit to cost-effective methane emission reduction technologies, as well as document and share their voluntary emission reduction activities (USEPA 2019c). According to highlights provided by the USEPA Natural Gas Star program (USEPA 2019d): "During calendar year 2018, Partners submitted an annual report detailing their efforts in 2017 to reduce methane emissions from their operations. These voluntary activities consisted of 45 technologies and practices and resulted in emissions reductions of 96.8 Bcf for the year. These methane emissions reductions have cross-cutting benefits on domestic energy supply, industrial efficiency, revenue generation, improved air quality, and greenhouse gas emissions reductions. The emission reductions are equivalent to the additional revenue from approximately $291 million in natural gas sales (assumes an average natural gas price of $3.00 per thousand cubic feet)."

USEPA also reports that 89% of the methane reductions came from the oil and gas production sector, by utilizing a variety of technologies including: reducing blow down frequency, installing vapor recovery units, and converting gas-driven pumps to electric, mechanical, or solar driven pumps (USEPA 2019c). The BLM will continue to work with industry to promote the use of the relevant BMPs for operations proposed on Federal mineral leases where such mitigation is consistent with agency authorities and policies and is supported by BLM's NEPA analysis.

<u>Social Cost of Carbon</u>

Federal agencies are not required to conduct a cost-benefit analysis when preparing a NEPA document. Per 40 C.F.R. § 1502.23, "the weighing of the merits and drawbacks of the various alternatives need not be displayed in a monetary cost-benefit analysis and should not be when there are more important qualitative considerations". BLM has wide discretion in determining the methods and metrics most appropriate for impact assessment, and NEPA does not require BLM to use certain metrics or to monetize impacts. A recent Montana district court opinion (Western Organization of Resource Councils v. BLM 2018 WL 1475470 [D. Mont. March 26, 2018]) held that BLM was not required to prepare a social cost of carbon assessment even though the EIS at issue in that case reported monetized values for certain economic benefits, such as tax revenue and regional earnings and output.

For the social cost of carbon, there is no standard and recommended calculation methodology or thresholds used to give context to the results. Recognizing this issue, the Interagency Working Group was tasked with the development of a recommended social cost of carbon methodology. However, Executive Order 13783 issued on March 28, 2017 disbanded the Interagency Working Group and ordered that technical documents issued by the Interagency Working Group be withdrawn as no longer representing federal policy.

Although a quantitative social cost of carbon cost estimate is not included in this EIS, a thorough discussion of the climate and the impacts from climate change is found in Section 3.1.5.2, which can be used to assess the potential impacts of climate change to the environment in the future. Additionally, the direct and indirect GHG emissions from Alternative A and Alternative B are presented in Section 4.1.5.

5.3.2 Cultural Resources, Historic Trails, and Resources of Native American Concern

The CISAs for cultural resources, historic trails, and resources of Native American concern are as defined in **Table 5.1-1**. For most cultural resources, the CISA is the CCPA. Past, present, and reasonably foreseeable future actions that occur within the CISA are discussed in Section 5.2 and their locations are illustrated on **Figures 5.2-1** through **5.2-3**. The other cumulative projects that are located entirely or partially within the CISA are detailed in **Tables 5.2-1** through **5.2-5**. For linear resources, including historic trails, the CISA is the length of the entire resource or portion within Wyoming, whichever is smaller. The Pine Ridge Area and viewsheds of historic trails (**Figure 5.3-1**) intersect the following past, present, and reasonably foreseeable projects:

- Pine Ridge Area: Cole Creek Exploratory Drilling, Spearhead Ranch Oil and Gas, Wold East Oil and Gas, BLM Buffalo Field Office Active Coalbed Natural Gas Projects, Sand Dunes Gas Plant, Black Hills Leonardite, Campbell Hill Windpower, Glenrock / Rolling Hills Wind Energy, Top of the World Windpower, and BNSF Rail Line.
- Bozeman Trail: Cole Creek Exploratory Drilling, Highland Loop Road Oil and Gas, Hornbuckle Oil and Gas, Salt Creek Fieldwide Expansion, Spearhead Ranch Oil and Gas, Wold East Oil and Gas, BLM Buffalo Field Office Active Coalbed Natural Gas Projects, Highland Ranch Uranium, Moore Ranch Uranium, Nichols Ranch Uranium, Reynolds Ranch Uranium, Smith Ranch Uranium, Ludeman Uranium, Nichols Ranch Jane Dough Unit, Campbell Hill Windpower, Top of the World Windpower, Greencore Pipeline, and BNSF/UP Joint Rail Line.
- Child's Cutoff: Highland Loop Road Oil and Gas, Ludeman Uranium, Guernsey Quarry, Campbell Hill Windpower, Top of the World Windpower, and BNSF Rail Line.
- Oregon-California-Mormon-Pony Express: Guernsey Quarry, Knife River Stone Quarry, Willis Sand and Gravel, Campbell Hill Windpower, Top of the World Windpower, Gateway West Transmission Line, High Plains Express Transmission Line, and BNSF Rail Line.
- Rock Creek-Fort Fetterman: Highland Loop Road Oil and Gas and High Plains Express Transmission Line.

Cumulative impacts to cultural resources, historic trails, and resources of Native American concern occur as a result of both direct and indirect impacts. While ***many*** short-term indirect impacts can be reversed, all direct impacts and all long-term impacts of any kind could build upon one another to create cumulative impacts to cultural resources. Cumulative impacts could include the gradual reduction of the population of resources representing a particular type or time period. Even the incremental loss of such resources, if they are not thoroughly recorded or investigated, would diminish the archaeological understanding of the prehistoric and/or historic uses of a region. Cumulative impacts to cultural landscapes could include the diminishment of the setting and feeling of the landscape through the gradual introduction of modern visual, atmospheric, or audible elements such as roads, storage tanks, electrical distribution lines, and vehicular and mechanical noises. Other cumulative impacts to resources and landscapes could include increased looting and vandalism of resources facilitated by more human presence in the area from construction, maintenance, and recreational use of associated roads. Construction of infrastructure such as electrical distribution lines and roads could attract and facilitate future development, leading to an increase in the degree and extent of these same types of cumulative impacts.

5.3.2.1 Cultural Resources

Based on the estimated average cultural resource density used for direct and indirect impact analysis (Section 4.2) of one site per 107 acres or one component per 101 acres within the CCPA, approximately 836 sites or 886 components could be cumulatively impacted from Alternative B together with other past, present, and reasonably foreseeable projects. Alternative B would account for approximately 58.8 percent of this total cumulative impact within the CISA, which would result in a substantial adverse cumulative impacts to cultural resources associated with Alternative B. **Table 5.3-8** provides a breakdown of the estimated number of site types that could be affected. See **Table 4.2-7** for estimated incremental impacts due to Alternative B only.

Table 5.3-8 Estimated Cumulative Impacts to Cultural Resource Types with Alternative B

Component Type	Number Impacted by Other Cumulative Projects	Estimated Number Impacted with Alternative B			
		Total Components	Eligible	Not Eligible	Unevaluated
Prehistoric Components	255	620	70	331	219
Historic Components	110	266	19	159	88
Total Components	**365**	**886**	**89**	**490**	**307**

Prehistoric lithic scatters, open camps, and stone circles are expected to be the most abundant site types in the CCPA based on previous inventory; therefore, they would be the most likely affected types. Prehistoric lithic scatters and open camps generally would not be adversely impacted by indirect effects, and direct effects to them could be avoided, minimized, or mitigated. To resolve direct adverse effects, treatments to these types of sites could include excavation and data collection. Of the historic site types, homesteads/structures/foundations would be most likely to experience cumulative effects, followed by debris scatters/camps/dumps, and cairns/alignments. Cumulative effects to homesteads/structures/ foundations and possibly to cairns/alignments could manifest in a degradation of the historic setting and feeling of historic rural landscapes.

An estimated 693 sites or 734 components could be cumulatively impacted from Alternative C together with other past, present, and reasonably foreseeable projects. Alternative C would account for approximately 50.3 percent of this total cumulative impact within the CISA. **Table 5.3-9** provides a breakdown of the estimated number of site types that could be affected. See **Table 4.2-11** for estimated incremental impacts due to Alternative C only.

The same site types would be most likely to experience cumulative impacts under both Alternative B and Alternative C; however, Alternative B would contribute a greater incremental addition to total cumulative impacts because it would allow for a more intensive level of development.

Table 5.3-9 Estimated Cumulative Impacts to Cultural Resource Types with Alternative C

Site/Component Type	Number Impacted by Other Cumulative Projects	Estimated Number Impacted with Alternative C			
		Total Components	Eligible	Not Eligible	Unevaluated
Prehistoric Components	255	514	58	275	181
Historic Components	110	220	16	131	73
Total Components	**365**	**734**	**74**	**406**	**254**

5.3.2.2 Historic Trails

Cumulative impacts to historic trails, roads, and similar linear sites essentially would be the same as those cited for cultural resources. In addition, historic trails could experience cumulative impacts from projects located outside the CCPA because the trails extend across much of the state (**Figure 5.3-1**).

Widespread oil and gas development and several pipelines in Campbell and Johnson counties to the north potentially could contribute to degradation of the Bozeman Trail's historic setting and feeling, and could cross the trail itself. In addition, coal mine and railroad developments just north of Sheridan along the Wyoming/Montana state line could contribute cumulative effects to the Bozeman Trail. Similarly, uranium mining occurring near the center of Wyoming and heavy oil and gas development occurring south of Pinedale in southwestern Wyoming potentially could contribute to cumulative impacts to the joint Oregon-California-Mormon Pioneer-Pony Express NHT.

Alternative B would have a greater incremental contribution to total cumulative impacts to historic trails and other linear resources than Alternative C because Alternative B would have more extensive and intensive development. The same types of cumulative impacts could affect historic trails and other linear resources under Alternative C but they would be to a lesser extent than Alternative B. See Section 5.3.15, Visual Resources, for additional information regarding potential cumulative impacts to viewsheds of historic trails.

5.3.2.3 Resources of Native American Concern

Cumulative impacts to resources of Native American concern would be similar to those cited for cultural resources and historic trails. Additional cumulative impacts to resources of Native American concern could include a loss of culturally important natural habitat and changes in access to important areas due to development footprints and operations. However, ongoing tribal consultation between the BLM and tribes would help to avoid or minimize these potential cumulative impacts through gaining a better understanding of landscape-level effects and designing projects to avoid ***impacts to those types of resources***.

Tables 5.3-8 and **5.3-9** include the number of different types of cultural resources of Native American concern (especially prehistoric cairns/caches, alignments/hunting blinds, and stone circles, and historic cairns/alignments, trails/roads, and cemetery/graves) that could experience cumulative impacts. Alternative B would have the greater potential to cause incremental additional cumulative impacts to resources of Native American concern because it would allow for the greater level of development. Alternative C would have relatively less potential to cause additional incremental cumulative impacts; however cumulative impacts to setting under Alternative C would be further reduced by the requirement that interim reclamation meet BLM or USFS approval for suitable wildlife habitat on federally managed lands as well as lands above federal minerals (i.e., approximately 65 percent of the CCPA). See Section 5.3.15, Visual Resources, for additional information regarding potential cumulative impacts to viewsheds relevant to resources of Native American concern.

5.3.3 Geology and Minerals

The CISA for geology and mineral resources as defined in **Table 5.1-1** is the CCPA boundary plus a 2-mile buffer, for a total area of 1,797,822 acres. Past, present, and reasonably foreseeable future actions that occur within the CISA are discussed in Section 5.2 and their locations are illustrated on **Figures 5.2-1** through **5.2-3**. In addition to the projects that are located entirely or partially within the CCPA as detailed in **Tables 5.2-1** through **5.2-5**, the following projects also fall within the additional 2-mile buffer and are included in the cumulative analysis for geology and minerals:

- Oil and Gas: Cole Creek Exploratory Drilling, Marys Draw Exploration, BLM Buffalo Field Office Active Coalbed Natural Gas Projects, and Bucking Horse Gas Plant.
- Power Plants and Linear: Dave Johnston Power Plant.

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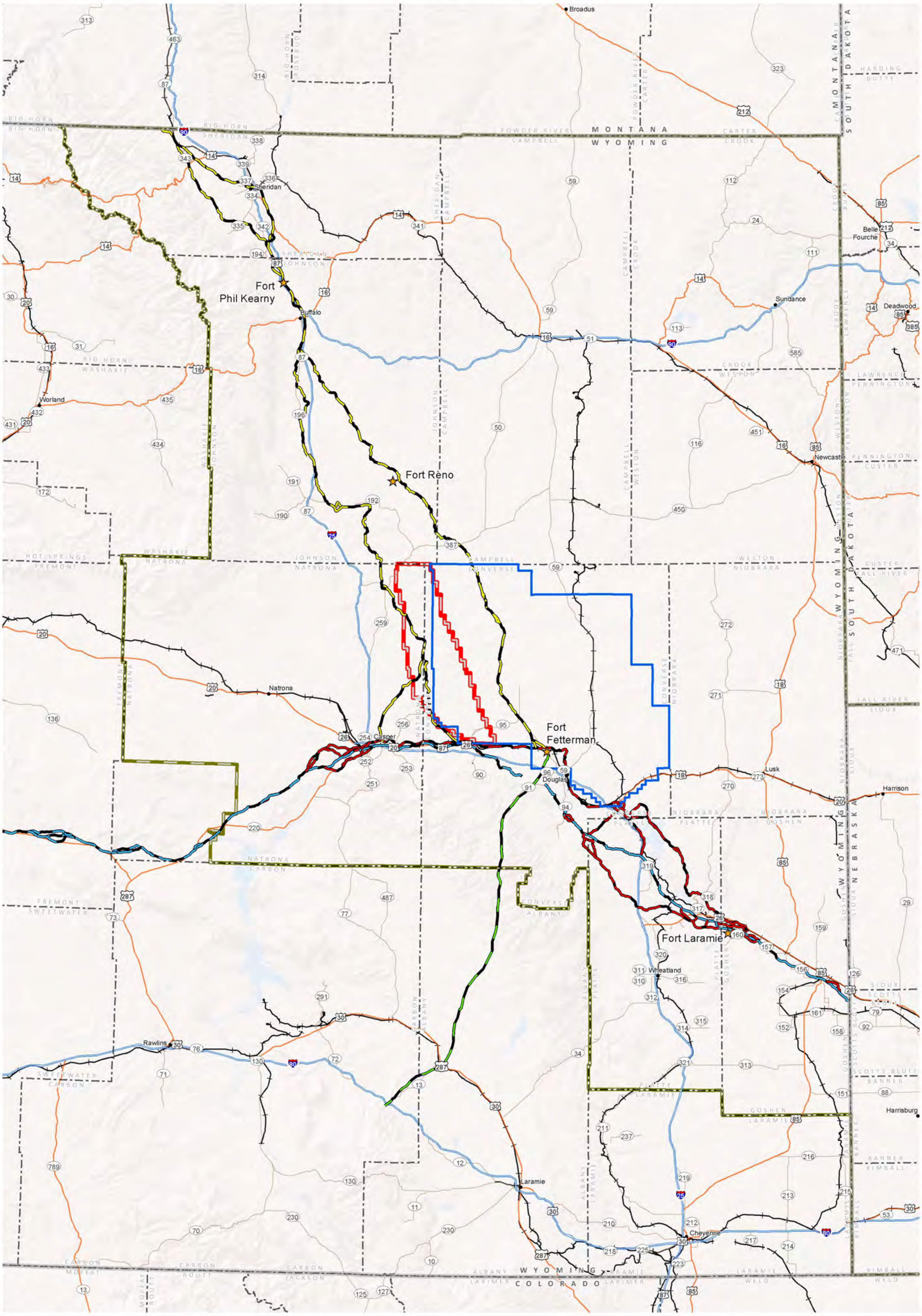

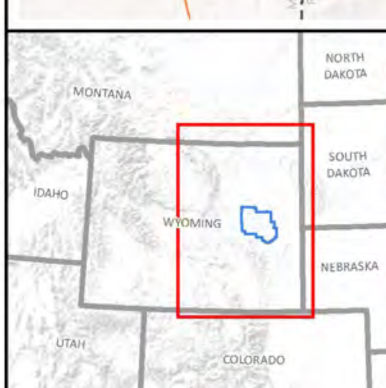

Project Boundary
BLM High Plains District Office Boundary
Pine Ridge Special Management Area
Historic Fort
Railroads
Interstate Highway
US/State Highway
Local Road/Highway

Historic Trails
Bozeman Trail
Rock Creek - Fort Fetterman Stage Road
Child's Cuttoff
Oregon-California-Mormon-Pony Express

Source: BLM 2007c, 2004h.

CONVERSE COUNTY OIL AND GAS EIS

Figure 5.3-1
Cultural Resources of Special Interest Cumulative

0 10 20 30 Miles
0 10 20 30 Kilometers
1:1,500,000
N

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5.3.3.1 Geology

There would be no impacts to unique geological resources from the proposed Project; therefore, there also would be no cumulative impacts. Additionally, natural geologic hazards would be expected to have minor to negligible impacts from the proposed Project; therefore, the proposed Project would contribute minor to negligible cumulative impacts due to those hazards.

Other than coal mining that occurs north of the CISA, the most likely mechanism for potentially causing felt or damaging induced seismicity in the CCPA would be through water injection disposal (Section 4.3.1.1); however, there have been no documented incidents of induced seismicity occurrences in the analysis area to date (Larsen and Wittke 2014). Also as discussed in Section 4.3.1.1, a large increase in injection disposal volume would have the potential to cause induced seismicity if injection were to reach a volumetric threshold that would affect the subsurface stress regime. Given that no felt or damaging induced seismic activity has yet been attributed to oil and gas activities, it is not possible to predict the potential severity and location of impacts of the cumulative increase in injection disposal due to the proposed Project and other reasonably foreseeable oil and gas projects. If induced seismicity were to result from oil and gas development, it would add to the periodic and ongoing induced seismicity from coal mine cast shots. Although coal mining would be most likely to be responsible for felt induced seismicity in the CCPA, it is not certain that the proposed Project or other reasonably foreseeable oil and gas projects would have a material contribution to cumulative impacts. No other reasonably foreseeable industrial projects would have the potential to generate seismic activity.

5.3.3.2 Mineral Resources

From 1978 through 2014, a cumulative 189 million barrels of oil, 809 billion cubic feet of natural gas, and 407 million barrels of produced water have been produced in Converse County. Under both Alternative B and Alternative C, 1.4 billion barrels of oil and 5.9 trillion cubic feet of gas would be produced (assuming a gas-oil ratio of 4,200 cubic feet of gas per barrel of oil based on historic cumulative production; **Table 3.3-2**). The existing wells would contribute another 83 million barrels of oil and 348 billion cubic feet of gas. The Crossbow project in the northern portion of the CISA could contribute over 400 million barrels of oil and 1.7 trillion cubic feet of gas. Oil and gas from other smaller reasonably foreseeable projects would account for an undetermined volume of production. The estimated production from the proposed Project would be several times the cumulative production from 1978 through 2014 and would result in a total cumulative production from 1978 to 2050 of 1.8 billion barrels of oil and 7.5 trillion cubic feet of gas.

As discussed in Section 3.3.3.1, the most recent USGS oil and gas resource assessment (Anna et al. 2010) estimated a mean undiscovered resource of 142 million barrels of oil and 2.123 trillion cubic feet of gas in the CISA. The disparity between the USGS estimate and the estimated production described in the previous paragraph likely is due to conservative assumptions used by the USGS and the fact that the assessment was conducted prior to the widespread use of large scale multi-stage hydraulic fracturing and horizontal drilling technology in the Powder River Basin.

Cumulative impacts of aggregate mining would be localized to the CISA because transportation expenses would limit the distance the material could be economically hauled; at some point it would become cost prohibitive. Cumulative production of aggregate in Converse County from 1990 to 2014 was approximately 15.7 million tons (Wyoming Department of Revenue 2017). During the 10-year period of active development of the proposed Project, development of infrastructure could require 16.0 million tons of aggregate (Section 4.3.1.2). The Crossbow Project could consume approximately 2 million tons of aggregate, but may access gravel resources far to the north of much of the Converse County development. Coal mines use a large volume of aggregate. If they were to expand it would put a large demand on this resource. The aggregate demand for other reasonably foreseeable projects would add another increment of production, but this is not easily estimated because of the diversity of the projects.

The programmatic nature of the proposed Project does not allow for a prediction of the sizes, locations, and numbers of new aggregate pits that would be required. The active aggregate mining pits in the CISA comprise a total of approximately 669 acres and average 42 acres in size (WDEQ, Land Quality Division 2016). Some large quarries are present south of and outside of the CISA including the Knife River Mine (approximately 1,029 acres) southwest of Glenrock and the Wills Sand and Gravel Pit (690 permitted acres) southwest of Douglas (**Table 5.2-3** and **Figure 5.2-3**). The number of pits likely would increase as a result of the proposed Project and ongoing maintenance and repair of the county and private roads in the CISA. The increase in demand has the potential to result in minor to negligible cumulative impacts depending on the availability of local aggregate resources to meet the demand.

Impacts due to mineral extraction conflicts would be expected to be negligible to none; therefore, cumulative impacts also would be expected to be negligible to none. Horizontal and extended reach drilling technologies have greatly lowered the potential for conflicts to arise with mineral resource extraction.

Although the magnitude of cumulative impacts due to increased aggregate extraction cannot be accurately quantified, a lesser amount of acreage used for pads, roads, and facilities would result in a commensurate reduction in impacts under Alternative C compared to Alternative B.

5.3.4 Hazardous Materials, Solid Waste, and Public Health and Safety

The CISA for hazardous materials, solid waste, and public health and safety as defined in **Table 5.1-1** is the CCPA boundary plus a 2-mile buffer with a total area of 1,797,822 acres. Past, present, and reasonably foreseeable future actions that occur within the CISA are discussed in Section 5.2 and their locations are illustrated on **Figures 5.2-1** through **5.2-3**. In addition to the projects that are located entirely or partially within the CCCPA as detailed in **Tables 5.2-1** through **5.2-5**, the following projects also fall within the additional 2-mile buffer and are included in the cumulative analysis for hazardous materials, solid waste, and public health and safety:

- Oil and Gas: Cole Creek Exploratory Drilling, Marys Draw Exploration, BLM Buffalo Field Office Active Coalbed Natural Gas Projects, and Bucking Horse Gas Plant.
- Power Plants and Linear: Dave Johnston Power Plant.

Oil and gas development under Alternatives B and C that would occur together with other reasonably foreseeable future actions would provide an additional risk of hazardous material and solid waste spills, contamination of soil and water, and safety concerns in the CCPA. However, operators would be required to comply with applicable rules and regulations, which would reduce the risk of spills and contamination. Total cumulative oil and gas development activities under Alternatives B or C would have a minor contribution to impacts due to hazardous material spills and mishandling of solid waste.

Reasonably foreseeable future oil and gas development also would provide an additional risk of accidents on roads with both public and industry-related motor vehicle traffic, as well as additional risk for health and safety effects to personnel from adverse winter weather conditions. Adherence to relevant safety regulations and enforcement by the respective agencies would reduce the probability of accidents. Activities such as flaring from the Project and other cumulative oil and gas projects also could pose a safety impact to personnel and sensitive receptors. All flaring would occur at a distance from the wellhead that would protect equipment, structures, personnel, and sensitive receptors. Additionally, pursuant to the new WOGCC Well Setback Rule (Wyoming Statutes Chapter 3, Section 46), a 500-foot setback is required as measured from the wellhead or nearest production facilities to the closest occupied structure. The potential for wildland fires also would be present as would firearms-related accidents, although the risk from firearms-related accidents would be minimal because the increased activity from other cumulative projects likely would discourage hunting in the immediate vicinity of energy development. Total cumulative oil and gas development activities under

Alternatives B or C would have a minor contribution to public health and safety impacts. The smaller footprint of Alternative C would result in slightly less impacts than under Alternative B when considered together with other cumulative actions.

5.3.5 Land Use

The CISA for land use as defined in **Table 5.1-1** is the CCPA boundary with a total area of 1,502,381 acres. Past, present, and reasonably foreseeable future actions that occur within the CCPA are discussed in Section 5.2 and their locations are illustrated on **Figures 5.2-1** through **5.2-3**. The projects that are located entirely or partially within the CISA are detailed in **Tables 5.2-1** through **5.2-5**.

Past, present, and reasonably foreseeable future actions, excluding the proposed Project, have resulted, or would result, in surface disturbance within the CCPA totaling 36,842 acres, which is approximately 2.5 percent of the CCPA. The total quantifiable surface disturbances are related to oil and gas development, mining, wind energy projects, power plants, transmission lines, pipelines, and railroads. **Table 5.3-10** provides a summary of the surface disturbance within the CCPA from the other cumulative past, present, and reasonably foreseeable actions by project type. Oil and gas activities make up the majority of the cumulative activity in the CISA, followed by mining, and other types of developments. The other category includes wind energy centers and rail lines.

Table 5.3-10 Surface Disturbance within the Land Use CISA from Cumulative Actions

	Cumulative Projects in CISA					
	Past and Present		Reasonably Foreseeable		Total	
Project Type	acres	percent	acres	percent	acres	percent
Oil and Gas[1]	24,072	1.6	172	0.01	24,244	1.6
Mining	7,483	0.5	2,922	0.2	10,405	0.7
Other	2,193	0.2	0	0.0	2,193	0.2
Total	**33,748**	**2.3**	**3,094**	**0.2**	**36,842**	**2.5**

[1] Does not include the Converse County EIS Project alternatives.

Project-specific effects from Alternatives B and C would combine with other cumulative actions to result in potential direct disturbance to land uses within the CISA as shown in **Table 5.3-11**. Alternative B would disturb an additional 3.5 percent of the CISA while Alternative C would disturb an additional 2.5 percent of the CISA. This additional disturbance from Alternatives B and C would account for 58.8 and 50.3 percent of the total cumulative disturbance within the CISA, respectively. Lands affected by disturbance activities associated with Alternatives B and C would result in less acreage available for land uses such as recreation, grazing, and energy development.

Table 5.3-11 Cumulative Surface Disturbance including Alternatives B and C

	Disturbance (acres)	Percent of CISA
All Other Projects in CISA	36,842	2.5
Alternative B	52,667	3.5
Total Cumulative for Alternative B	**89,509**	**6.0**
Alternative C	37,267	2.5
Total Cumulative for Alternative C	**74,109**	**5.0**

As detailed in Section 4.5, the estimated new surface disturbance from Alternatives B or C would affect land in agricultural production. Additional surface disturbance from past, present, and reasonably foreseeable future actions also would affect land in agricultural production. Surface disturbance impacts from all cumulative actions to grazing allotments would include the loss of forage, impacts to lambing areas, potential disruption of lambing periods, and increased potential for mortality and injuries to livestock resulting from increased vehicle traffic. In addition, livestock could be displaced from preferred grazing areas and range improvements (including water sources) by construction and production activities.

Cumulative actions contained within or that intersect with the CISA also would overlap with multiple other types of energy production occurring within the CISA, including wind energy and uranium mining. Ultimately, cumulative actions would result in less available acreage for land uses such as recreational, grazing uses, and energy development, and degradation of the recreational setting within the CCPA and the Sand Hills Management Area from adjacent development activities.

5.3.6 Lands and Realty

The CISA for lands and realty as defined in **Table 5.1-1** is the CCPA boundary with a total area of 1,502,381 acres. Past, present, and reasonably foreseeable future actions that occur within the CCPA are discussed in Section 5.2 and their locations are illustrated on **Figures 5.2-1** through **5.2-3**. The projects that are located entirely or partially within the CISA are detailed in **Tables 5.2-1** through **5.2-5**.

Past, present, and reasonably foreseeable future actions, excluding the proposed Project, have resulted, or would result, in surface disturbance within the CCPA totaling 36,842 acres, which is approximately 2.5 percent of the CCPA. The total quantifiable surface disturbances are related to oil and gas development, mining, energy development, and railroads. **Table 5.3-12** provides a summary of the surface disturbance within the CCPA from the other cumulative past, present, and reasonably foreseeable actions by project type. Oil and gas activities make up the majority of the other cumulative activity in the CISA, followed by mining, and other types of developments. The other category includes wind energy centers and rail lines.

Table 5.3-12 Surface Disturbance within the Lands and Realty CISA from Other Cumulative Actions

	Other Cumulative Projects in CISA				Total	
	Past and Present		Reasonably Foreseeable			
Project Type	acres	percent	acres	percent	acres	percent
Oil and Gas[1]	24,072	1.6	172	0.01	24,244	1.6
Mining	7,483	0.5	2,922	0.2	10,405	0.7
Other	2,193	0.2	0	0.0	2,193	0.2
Total	**33,748**	**2.3**	**3,094**	**0.2**	**36,842**	**2.5**

[1] Does not include the Converse County EIS Project alternatives.

Project-specific effects from Alternatives B and C would combine with other cumulative actions to result in potential direct impacts to the placement of lands and realty authorizations within the CISA as shown in **Table 5.3-13**. Alternative B would disturb an additional 3.5 percent of the CISA, while Alternative C would disturb an additional 2.5 percent of the CISA. This additional disturbance from Alternatives B and C would account for 58.8 and 50.3 percent of the total cumulative disturbance within the CISA, respectively. Lands affected by disturbances activities associated with Alternatives B and C would result in less acreage available for land tenure adjustments and realty authorizations. Approximately 10 percent of the surface within the CCPA is administered by the BLM and USFS;

therefore, subsequent lands and realty authorization requests associated with cumulative actions would only occur on federal surface estate.

Table 5.3-13 Cumulative Surface Disturbance including Alternatives B and C

	Disturbance (acres)	Percent of CISA
All Other Projects in CISA	36,842	2.5
Alternative B	52,667	3.5
Total Cumulative for Alternative B	**89,509**	**6.0**
Alternative C	37,267	2.5
Total Cumulative for Alternative C	**74,109**	**5.0**

As detailed in Section 4.6 the areas within the CISA currently identified as avoidance and exclusion areas or land under NSO, CSU, or timing limit stipulations, combined with other cumulative actions requiring lands and realty authorizations could result in elevated costs of lands and realty actions associated with development activities. It also would likely concentrate cumulative activities and associated infrastructure requiring lands and realty authorizations into certain areas.

Land under NSO or CSU stipulations could result in project components from the Project or from other cumulative actions being sited along alternative routes or sites. This could increase the number of lands and realty authorizations in other areas possibly necessitating development in alternate locations and alter the cost of lands and realty actions related to previous and future projects.

Acreage used by the Project and other cumulative actions would limit the BLM and USFS from providing unrestricted opportunities for lands and realty authorizations and ROWs throughout the BLM- and USFS-administered land within the CISA. Additionally, the use of land by the Project and these cumulative actions likely would increase the potential for conflict with other lands and realty actions, potentially resulting in increased costs for lands and realty authorizations. The BLM and USFS would continue to process land tenure adjustments and grant lands and realty authorizations on a case-by-case basis, although surface disturbance from all combined cumulative actions (including Alternative B or C) would result in less land available for lands and realty authorizations.

5.3.7 Noise

The CISA for noise as defined in **Table 5.1-1** is the CCPA boundary plus a 1-mile buffer, for a total area of 1,650,663 acres. Past, present, and reasonably foreseeable future actions that are located within the CCPA as discussed in Section 5.2 are shown on **Figures 5.2-1** through **5.2-3**. In addition to the projects that are located entirely or partially within the CCPA as detailed in **Tables 5.2-1** through **5.2-5**, the following projects also fall within the additional 1-mile buffer and are included in the cumulative analysis for noise:

- Oil and Gas: Cole Creek Exploratory Drilling, Marys Draw Exploration, and BLM Buffalo Field Office Active Coalbed Natural Gas Projects.

Surface disturbance is used as a basis for quantifying the potential for noise impacts with the CISA. **Table 5.3-14** provides a summary of the surface disturbance within the CCPA from the other cumulative actions, excluding the proposed Project, by project type. The total quantifiable surface disturbances are related to oil and gas development, mining, wind energy projects, power plants, transmission lines, pipelines, and railroads. Other past, present, and reasonably foreseeable future actions have resulted, or would result, in surface disturbance within the noise CISA totaling 38,347 acres, which is approximately 2.3 percent of the CISA for noise. Oil and gas activities make up the majority of the cumulative activity in the CISA, followed by mining, and other types of developments. The other category includes wind energy centers and rail lines.

Table 5.3-14 Surface Disturbance within the Noise CISA from Other Cumulative Actions

Project Type	Cumulative Projects in CISA				Total	
	Past and Present		Reasonably Foreseeable			
	acres	percent	acres	percent	acres	percent
Oil and Gas[1]	24,446	1.5	811	0.05	25,257	1.5
Mining	7,483	0.4	2,979	0.2	10,462	0.6
Other	2,628	0.2	0	0.0	2,628	0.2
Total	**34,557**	**2.1**	**3,790**	**0.2**	**38,347**	**2.3**

[1] Does not include the Converse County EIS Project alternatives.

Project-specific effects from Alternatives B and C would combine with other cumulative actions to result in potential direct disturbance to sensitive receptors from noise producing activities within the noise CISA as shown in **Table 5.3-15**. Alternative B would disturb an additional 3.2 percent of the CISA, while Alternative C would disturb an additional 2.3 percent of the CISA. This additional disturbance from Alternatives B and C would account for 57.9 and 49.3 percent of the total cumulative disturbance within the CISA, respectively.

Table 5.3-15 Cumulative Surface Disturbance in Noise CISA including Alternatives B and C

	Disturbance (acres)	Percent of CISA
All Other Projects in CISA	38,347	2.3
Alternative B	52,667	3.2
Total Cumulative for Alternative B	**91,014**	**5.5**
Alternative C	37,267	2.3
Total Cumulative for Alternative C	**75,614**	**4.6**

As discussed for direct and indirect impacts from noise in Section 4.7, cumulative impacts from noise as a result of the proposed Project as well as other cumulative actions would include noise impacts from road construction and traffic on local sensitive receptors as well as the recreational setting. Associated noise levels related to traffic along roads potentially would increase and decrease rapidly. Both hunters and visitors to historic trails also could experience a diminished recreational and/or tourist experience due to increased noise from cumulative actions. Additional noise from cumulative oil and gas projects would include noise from compressors, pump jacks, ancillary facilities such as gas plants and compressor stations, and gas flaring. Flaring typically is allowed for short-term emergency situations to relieve system pressure or during the drilling and completion phases of well development when gas should be released to reduce safety risks. Flaring activity would combine with the noise from other activities from the cumulative projects in the CISA and could result in noise impacts to nearby sensitive receptors.

5.3.8 Paleontological Resources

The CISA for paleontological resources as defined in **Table 5.1-1** is the CCPA boundary, for a total area of 1,502,381 acres. Past, present, and reasonably foreseeable future actions that occur within the CCPA are discussed in Section 5.2 and their locations are illustrated on **Figures 5.2-1** through **5.2-3**. The projects that are located entirely or partially within the CISA are detailed in **Tables 5.2-1** through **5.2-5**.

Cumulative impacts to paleontological resources would result from surface disturbance related to industrial developments in the CCPA (primarily oil and gas, mining, and wind energy), which could result in the destruction and unauthorized collection of fossil resources. In addition to anthropomorphic activities, natural erosion processes also could result in the loss or degradation of the resource. With the implementation of the recommended ***protection*** measures, when added to past, present, and reasonably foreseeable future actions, Alternative B would not materially contribute to cumulative impacts to paleontological resources in the CCPA.

Cumulative impacts under Alternative C would potentially be less than Alternative B because there would be less overall ground disturbance. When added to other cumulative actions, the proposed Project would not materially contribute to cumulative impacts to paleontological resources in the CCPA.

5.3.9 Range Resources

The CISA for range resources is defined in **Table 5.1-1**, with an area that ***includes both BLM- and USFS-managed allotments containing a total of 271,943*** acres of ***federal surface and*** providing a total of approximately ***46,091 federally*** permitted AUMs. Past, present, and reasonably foreseeable future actions that occur within the CCPA are discussed in Section 5.2 and their locations are illustrated on **Figures 5.2-1** through **5.2-3**. The other cumulative projects that are located within the CISA are detailed in **Tables 5.2-1** through **5.2-5**.

Other cumulative projects contained within or intersecting with the CISA for range resources include:

- Oil and Gas Development: Cole Creek, East Converse, Highland Loop, Hornbuckle, Marys Draw, Mohawk, PRCC, Scott Field, Spearhead Ranch, Wold East, BLM Buffalo Field Office Coalbed Natural Gas Projects, and Greater Crossbow.
- Uranium Mining: Highland Ranch, Ludeman, Smith Ranch, and Reynolds Ranch.
- Coal and Other Mining: Antelope Coal Mine and Black Hills ***Leonardite***.
- Wind Energy: Campbell Hill, Glenrock/Rolling Hills, and Top of the World.
- Power Plants and Linear: BNSF/UP Rail Line and High Plains Express Transmission Line.

Table 5.3-16 provides a summary of the surface disturbance and ***loss of federally permitted*** AUMs for all other cumulative actions within the CISA (i.e., excluding the proposed Project).***Table 5.3-17 provides a summary of*** the incremental ***impacts*** due to both Alternative B and Alternative C. All other cumulative projects would result in a loss of approximately ***0.9*** percent of the federally permitted AUMs within the CISA. Alternative B would contribute an additional 2.4 percent loss of ***federal*** AUMs, for a total cumulative loss of approximately ***3.3*** percent when combined with the other cumulative actions. Alternative C would contribute an additional ***1.7*** percent loss of ***federal*** AUMs, for a total cumulative loss of approximately ***2.6*** percent when combined with the other cumulative actions.

Table 5.3-16 Impacts to Federal Grazing Allotments from other Cumulative Actions

Allotments	***Total Acres in CISA[1]***	***Total Surface Disturbance in CISA (acres)[2]***	***Total Federally Permitted AUMs in CISA[1]***	***Loss of Federally Permitted AUMs[3]***	***Percent of Federally Permitted AUMs Lost***
BLM Grazing Allotments	***1,116,674***	***14,220***	***19,229***	***245***	***1.3***
USFS Range Management Units	***233,867***	***1,680***	***26,862***	***193***	***0.7***

[1] Values can be found on Table 3.9-1.

[2] Calculations are based on the sum for each cumulative project total disturbance times the percent of that project in the CISA.

[3] Calculated as the percent of total surface disturbance within the CISA times the total federally permitted AUMs in the CISA.

Table 5.3-17 Cumulative Impacts to Federal Grazing Allotments *including Alternatives B and C*

	Surface Disturbance (acres)	***Loss of Federally* Permitted AUMs**	**Percent of Total *Federally* Permitted AUMs *Lost***
All* Other *Projects in CISA			
BLM Allotments	***14,220***	***245***	***1.3***
USFS ***Units***	***1,680***	***193***	***0.7***
Total Federal Allotments	***15,900***	***438***	***0.9***
Alternative B			
BLM Allotments	***27,600***	***573***	***3.0***
USFS ***Units***	***4,454***	***511***	***1.9***
Total Federal Allotments	***32,054***	***1,084***	2.4
Cumulative with Alternative B			
BLM Allotments	***41,820***	***817***	***4.3***
USFS ***Units***	***6,134***	***704***	***2.6***
Total Federal Allotments	***47,954***	***1,522***	***3.3***
Alternative C			
BLM Allotments	***19,530***	***405***	***2.1***
USFS ***Units***	3,152	***362***	***1.4***
Total Federal Allotments	***22,682***	***767***	***1.7***
Cumulative with Alternative C			
BLM Allotments	***33,750***	***650***	***3.4***
USFS ***Units***	***4,832***	***555***	***2.1***
Total Federal Allotments	***38,582***	***1,205***	***2.6***

Other impacts to allotments, livestock, and livestock operators would include the generation of fugitive dust emissions, preclusion of use or damage to rangeland improvements, increase in the potential for injury or stress to livestock, increase in the potential for health issues to livestock, increase in potential for trespass, and the invasion and spread of noxious weeds and invasive plant species. Cumulative actions, including the proposed Project, likely would result in some or all of these impacts. As mentioned in Section 4.9 the proliferation of roads increases the potential for livestock/vehicle collisions, livestock stress, fugitive dust deposition, and the spread of noxious weeds and invasive plant species; however, the type of project would determine the frequency or intensity of the impact. For instance, a transmission line would produce little surface disturbance related to construction and operation compared to mining or oil and gas development. The phase of the project also would affect the frequency and intensity of the impact. An existing project likely would create a lower level of impact than one in the process of being constructed or decommissioned. Although these impacts cannot be analyzed quantitatively, it is reasonable to assume that the proposed Project would incrementally add to their frequency or intensity.

5.3.10 Recreation

The CISA for recreation as defined in **Table 5.1-1** is the CCPA boundary plus a 2-mile buffer, for a total area of 1,797,822 acres. Past, present, and reasonably foreseeable future actions that occur within the CISA are discussed in Section 5.2 and their locations are illustrated on **Figures 5.2-1** through **5.2-3**. In addition to the projects that are located entirely or partially within the CCPA as detailed in **Tables 5.2-1** through **5.2-5**, the following projects also fall within the additional 2-mile buffer and are included in the cumulative analysis for recreation:

- Oil and Gas: Cole Creek Exploratory Drilling, Marys Draw Exploration, BLM Buffalo Field Office Active Coalbed Natural Gas Projects, and Bucking Horse Gas Plant.
- Power Plants and Linear: Dave Johnston Power Plant.

Other cumulative actions (excluding the proposed Project) total approximately 40,122 acres within the CISA. The total quantifiable surface disturbances are related to oil and gas development, mining, wind energy projects, power plants, transmission lines, pipelines, and railroads. **Table 5.3-*18*** provides a summary of the surface disturbance within the CISA from the past, present, and reasonably foreseeable actions by projects type. Oil and gas activities make up the majority of the cumulative activity in the CISA, followed by mining, and other types of developments. The other category includes wind energy centers, a power plant, and railroads.

Table 5.3-18 Surface Disturbance within the Recreation CISA from Cumulative Actions

	Cumulative Projects in CISA				Total	
	Past and Present		Reasonably Foreseeable			
Project Type	acres	percent	acres	percent	acres	percent
Oil and Gas[1]	24,962	1.4	1,554	0.1	26,516	1.5
Mining	7,483	0.4	2,979	0.2	10,462	0.6
Other	3,144	0.2	0	0.0	3,144	0.2
Total	**35,589**	**2.0**	**4,533**	**0.3**	**40,122**	**2.3**

[1] Does not include the Converse County EIS Project alternatives.

Project-specific effects from Alternatives B and C would combine with other cumulative actions to result in potential direct impacts to recreational activities within the recreation CISA as shown on **Table 5.3-*19***. Alternative B would disturb an additional 2.9 percent of the CISA, while Alternative C would disturb an additional 2.1 percent of the CISA. This additional disturbance from Alternatives B and C would account for 56.8 and 48.2 percent of the total cumulative disturbance within the CISA, respectively. Lands affected by disturbance activities associated with Alternatives B and C would result in less acreage available for recreational activities, and the additional surface disturbing activities also would affect the recreational setting on adjacent lands.

Table 5.3-19 Cumulative Surface Disturbance including Alternatives B and C

	Disturbance (acres)	Percent of CISA
All Other Projects in CISA	40,122	2.3
Alternative B	52,667	2.9
Total Cumulative for Alternative B	**92,789**	**5.2**
Alternative C	37,267	2.1
Total Cumulative for Alternative C	**77,389**	**4.4**

As detailed in Section 4.10 the total cumulative disturbance including the proposed Project would include modifications to the recreational setting from development activities and increased traffic levels as well as visual impairment to the recreational setting from surface disturbance and new facilities. The Bixby Public Access Area is a designated recreation area within the CISA just outside of the CCPA along the North Platte River (**Figure 3.5-4**). This recreation area is transected by the Highland Loop Road oil and gas development. Development activities could affect the recreational setting at this recreation area.

Impacts would be similar to those outlined in Section 4.10. Impacts to dispersed recreation such as fishing, hunting, hiking, and dispersed camping activities could occur. Cumulative disturbance would lead to a decrease in the amount of habitat available in the CISA, thereby reducing hunting opportunities for pronghorn, mule deer, and elk, as well as small game and upland birds. Cumulative development activities adjacent to the area could affect the quality of the hunting experience within the Sand Hills Management Area. Erosion and surface disturbance from cumulative development could increase sediment input to waterbodies, resulting in changes to water quality that could impact game fish and associated fishing opportunities. Also, the decrease in available acreage due to cumulative development could reduce dispersed camping opportunities as well as modify the dispersed camping setting when adjacent to development activities. The creation of new access roads could increase OHV access; however, increased traffic and the potential presence of new aboveground facilities would balance any perceived gains for OHV users and dispersed recreationists. Cumulative development activities also could impact visitors to historic trails as new facilities would alter the viewshed from historical trails, and development noise would affect the historical trail setting.

5.3.11 Socioeconomics and Environmental Justice

The CISA for socioeconomics and environmental justice encompasses Converse, Natrona, and Campbell counties, in geographic terms*. **as these counties contain abundant mineral and energy resources, raising the potential for cumulative socioeconomic effects within the CISA associated with the past, present, and reasonably foreseeable future actions summarized in Tables 5.2-1 through 5.2-5. The focus of the assessment is*** on the respective county governments and the larger communities in these counties. These communities would be expected to function as places of residence, retail, and service centers, as well as operational bases for the majority of the ***oil and gas firms and service companies and*** workforces for the cumulative projects, ***thereby creating*** the potential for cumulative effects. ***The affected county and municipal governments would be called on to provide services to development-related businesses and temporary and long-term residents.*** Minor socioeconomic effects related to the proposed Project may occur in Platte, Niobrara, or Weston counties as well; however, the timing, magnitude, and duration of those effects would be so limited that they would not result in any meaningful contribution to cumulative effects.

While contributing substantially to the personal income and public sector revenues, either Alternative B or Alternative C likely would result in substantial workforce competition, housing shortages, strains on many local government services, and dissatisfaction for some residents. The reasonably foreseeable future actions that most likely would result in cumulative impacts in combination with Alternative B or Alternative C, intensifying the socioeconomic effects described in Section 4.11, include the following:

- Ongoing (i.e., present) and future oil and gas projects, including wells previously approved by the projects listed in **Table 5.2-1**, as well as the oil and gas activity to the north and to the west of the CCPA in Campbell and Natrona counties;
- Expansion of the region's uranium mining industry;
- Future production by the coal mining industry in the Powder River Basin; and
- Transmission line projects including those listed in **Table 5.2-5**.

Potential cumulative socioeconomic effects include changes in employment; ***unemployment,*** workforce and household migration; and housing, public facilities, and services demand. Fiscal effects, including those on public revenues and expenditures to serve demand for public facilities and services, also would be foreseeable. Most of the cumulative developments would involve temporary drilling and construction workforces that would be larger than the corresponding production and operational workforces; therefore, the potential for adverse cumulative socioeconomic effects within the CISA primarily would arise during periods of concurrent drilling and/or construction activity of two or more projects. In contrast, the effects on public sector revenues would tend to be more favorable over the period of operations. Similarly, cumulative effects also could occur in association with future reclamation or abandonment activity if such activities overlap in time and proximity with construction and production/operation of other activities. However, assessing the ***potential socioeconomic*** cumulative effects is difficult due to the substantial uncertainties regarding the scope***, location,*** and timing of the activity and that associated with other development activities.

Like Alternatives B and C, substantial rises in crude oil prices would likely be necessary to support renewed drilling and development at or above historical levels for the other cumulative oil and gas projects in the three-county area. Although higher prices would support renewed development, the level of drilling at any given price is unclear. Also unclear is how the potential development economics associated with other oil and gas project opportunities compare to those associated with Alternative B or C, or possible constraints on drilling levels, for example, the inability to contract for a sufficient number of drilling rigs, completion equipment, and workers due to competition from other oil plays in the region and across the country. Consequently, it is unclear whether higher prices would result in cumulative development above the level of development assumed for Alternative B and C., particularly in the early years of any substantial price increase. Other scenarios are also possible, for example, sustained drilling over a longer period of time. Although simultaneous development on different projects would be considered as cumulative development, in practical terms, unless the overall pace of drilling exceeds the levels assumed under Alternative B, the cumulative impacts would not differ substantially from those described for Alternative B.

As of January 2015, approximately 1,520 productive wells had been drilled within the CCPA. Well access roads and other infrastructure to support that development had also taken place. Other examples of infrastructure put in place to support past and ongoing development include oil and gas service company operations yards in Casper and Evansville, and railroad trans-loading facilities near Douglas. In some cases, that infrastructure may have excess capacity relative to the existing levels of development. The infrastructure to support some level of development and production is in place; therefore, ongoing production activities, expenditures, and employment associated with wells currently in production were considered part of the cumulative assessment.

Production activities, well maintenance and workovers, production employment, royalties, and tax revenues associated with these wells has occurred and would continue, regardless of the alternative selected. Finally, mineral, wind, and other industrial development has supported construction and operation of substantial commercial and public infrastructure in communities in the CISA. This industrial, human, commercial, and public infrastructure ***can support*** a certain level of ongoing and future mineral, wind, and other industrial development activity and serves as a foundation for expansion of capacities to support higher levels of development.

Additional regulatory approvals would be required for ***several*** of the foreseeable projects identified in Section 5.2 to proceed. If approved, the projects could contribute to cumulative socioeconomic effects in specific areas of the CISA, with each project having its independent drilling and development program. Adverse cumulative socioeconomic effects such as labor force competition, housing shortages, and strained community infrastructure and services could occur primarily in the event of concurrent construction of these projects. Such adverse cumulative socioeconomic effects likely would be temporary, lasting through the drilling and construction phases of the projects. Cumulative socioeconomic effects, including increases in employment, economic activity and tax revenues, would be longer-term, extending through the production and operations phases. As noted in Section 4.11, the actual pace of oil and gas development in central Wyoming is unpredictable. Consequently, the potential for cumulative socioeconomic effects would increase during periods of elevated commodity prices and demand, which would tend to spur development. If construction for all or some of these projects were to overlap concurrently with future increases in oil and gas drilling levels to 2013/2014 levels, another “boom” could ensue in the CISA.

The proposed Project primarily would affect the Douglas, Glenrock, and Casper areas of the socioeconomic CISA, although some drilling and construction workers also could seek housing in Wright, Gillette, and other nearby communities. Consequently, the potential for temporary and short-term cumulative socioeconomic effects associated with a resumption in high levels of oil and gas drilling and construction would be high. Once construction is complete, cumulative socioeconomic effects would be largely favorable.

Construction of the transmission lines listed in **Table 5.2-5** ***tends to be of a relatively short duration*** affect***ing*** one or more communities in the region as the construction workforce moves through the area. The effects would be associated with temporary demands for housing and community services as well as fiscal effects related to project activity and the construction workforces. Operating work-force requirements for transmission lines are considerably lower than the construction workforce needs.

Some past and continuing effects of the PRB coal mining industry are evident in regional population levels, housing demand, highway and rail transportation networks that serve and/or cross the CCPA, and community infrastructure and public service levels. Recent reductions in staffing and coal production by the coal mines have increased housing and workforce availability in the Gillette area, which could contribute to a lessening of some socioeconomic impacts. Transportation effects associated with cumulative activities would include increases in highway traffic in the CCPA, primarily on US 59 north of and through Douglas; I-25 north and east of Casper; and Wyoming SH 93, SH 95, and SH 387. However, some reductions in motor vehicle traffic volumes and the number of coal unit train movements headed south from Gillette have resulted from the reductions in the tonnage of coal mined and the number of employees employed in mining.

Temporary socioeconomic effects associated with construction of new wind energy developments are not foreseen in the CISA as there currently are no wind energy projects anticipated in the area. Socioeconomic effects of existing wind energy development in the CISA would continue to include local employment and income and economic effects associated with ongoing operations and maintenance. Local ad valorem, state wind energy production, and sales and use tax revenues generated by the wind energy projects would continue. Direct and indirect demands on local facilities and services also would continue, albeit such demands would be limited in scale and scope.

Adverse future cumulative socioeconomic effects could include demand for temporary and long-term housing resources that exceed local availability, demand for local government services that exceed some service capacities, and changes in local social conditions that could include social disruption in some communities, and a reduction in quality of life for some residents. One workforce facility has been proposed under Alternatives B and C to accommodate construction workers within the CCPA. The pace of residential construction in most communities within the CISA would need to increase substantially to accommodate demand related to Alternatives B or C for longer-term housing units, and would have to increase even more to accommodate cumulative demand if several of the projects listed in Section 5.2 were to overlap with an increase in oil and gas development activities. The ***recent*** annexation and ***future*** development approval for the Seven Trails subdivision in Douglas could provide some capacity for development of housing in the CISA. The contributions of existing wind energy operations to cumulative socioeconomic effects would be limited because of the relatively small number of jobs, traffic, and other socioeconomic parameters. Contributions from wind energy operations to cumulative fiscal effects primarily would result from higher revenues.

Long-term effects on area housing conditions may depend on whether the construction and oil and gas development demands were accommodated in temporary housing. In the case of the latter, communities within the CISA could reduce the amount of unoccupied temporary housing after construction is completed or if a slowdown in energy resource development were to occur.

Increased employment opportunities in relatively high-paying construction and energy development jobs would result in competition for workers to the detriment of existing businesses and government agencies that could lose existing employees and experience difficulty recruiting new employees. However, workers could realize increased wages that would result from this competition, while simultaneously facing higher costs of housing and other living expenses.

Demands on local government services associated with the transmission line projects and oil and gas development could be seasonal, which would present staffing challenges for counties and communities. Excess capacity exists in most public utility infrastructure systems (e.g., water and wastewater systems) in the communities that likely would host the bulk of the construction and oil and gas development workforce; although, improvements could be required to extend those systems to new areas of residential development.

Recent experience in the CISA was that relatively few families and school-age children have accompanied construction and oil and gas workers to the area; consequently, local school districts likely could accommodate some cumulative enrollment gains with existing facilities. In the longer term, some schools may need to secure approval and funding from the Wyoming School Facilities Commission to plan and construct school facilities. This would mean that certain facilities would experience short-term crowding.

Community services such as law enforcement, emergency response, social services, and road and bridge departments have periodically experienced reductions in funding levels, service provision, and staff cutbacks in recent years. These services initially could face constraints in responding to increased demand as local receipts of sales and use tax revenues lag the elevated demand. For many projects, substantial sales and use tax revenues would not be realized until well into the drilling/construction phase. This coupled with a 2-month lag in distribution of revenues from the state to local governments would require local governments to respond to increased demand without a corresponding increase in revenues in the beginning months of the boom. In other cases, a mismatch could occur between jurisdictions receiving and accruing tax revenues and those facing demands but without receiving corresponding revenues. Revenue shortfalls coupled with competition for workers and the difficulty in staffing for seasonal demand would present substantial challenges for local governments in the early years of a boom.

When ad valorem and production-related revenues begin flowing from the cumulative projects, counties and special districts (and in some instances, school districts) would receive substantial revenues. However, only limited revenues would occur to municipalities.

Cumulative development in the CISA also holds potential to affect local attitudes, opinions, and lifestyles; however, these effects likely would be mixed. Development of additional transmission lines and pipelines, uranium and other mining, and other projects coupled with the increase in oil and natural gas development would result in economic growth and increased employment opportunities in relatively high-paying jobs. These changes would create the prospect for improved financial status of many residents, which would correspondingly increase support for cumulative development activities, particularly among those segments of the community that would benefit directly or indirectly from the increased economic activity. However, dissatisfaction may occur among those residents whose homes are located near or within the CCPA or whose economic activities and/or recreation activities occur in the same areas as the other cumulative projects. This likely would include ranchers, grazing operators, outfitters, hunters, and other recreationists. Moreover, if residents perceive that wildlife habitat, scenic vistas, and other resources are being degraded by development, levels of dissatisfaction could become greater and more widespread.

Given the cyclical nature of oil and gas development and the potential for other energy development to occur, regional population gains in response to cumulative construction activities in the CISA likely would be followed by decline as construction and development is completed. If employment and population were to decline dramatically, businesses that expanded or opened to accommodate the temporary population influx would need to transition in response to decreased demand. Some business closures likely would occur. Most community infrastructure, including long-term water and sewer systems, is already in place, which should help communities avoid taking on substantial debt that would be difficult to service when population levels decrease.

Challenges in assessing potential cumulative socioeconomic effects also arise in conjunction with the influence of the changing economics of resource development and production in response to market prices and decisions of whether to proceed, postpone, or continue operations. A delay or postponement of a project because of such factors could substantially increase or diminish the potential for cumulative socioeconomic effects with Alternative B or C. The drilling and field development activities associated with the previously disclosed oil and gas development projects could all increase rapidly in response to higher oil and natural gas prices. Increases in employment, workforce immigration, population, and demands on temporary housing and public facilities and services would accompany such resurgence in activity, substantially altering the socioeconomic setting in which the Project would occur.

Cumulative fiscal effects also would be foreseeable, including both additional revenues and increases in public expenditures to serve demand for public facilities and services. State and local sales tax revenues generally are higher during construction but then decrease, while ad valorem (property) tax revenues become more important over time. However, ad valorem tax revenues associated with energy production in unincorporated areas primarily accrue to counties, school districts, other districts, and the state rather than to the municipalities in which most energy-related workers live and generate demand for services.

Concurrent development of two or more of the cumulative projects would result in a greater temporary population influx, with potentially adverse cumulative effects including demand for temporary and long-term housing resources that exceed local supplies by a substantial margin*;* demand for local government ***and community*** services ***and infrastructure*** that may exceed current service capacities*;* and*,* changes in local social conditions that could include social disruption in some communities.

Increased employment opportunities in relatively high paying construction and energy development jobs would result in competition for workers to the detriment of private and public sector employers that could lose existing employees, then experience difficulty in recruiting new employees. However, workers could realize higher wages and salaries resulting from such competition. ***Potential cumulative effects on income could include short and long-term effects on agricultural income due to changes in land use associated with the cumulative development. Such changes would include reductions in authorized grazing, short-term or long-term loss of production from private crop or grazing lands, and other indirect effects including changes in operating practices and operating costs. Reductions in federally authorized grazing and the associated effects on ranch income would continue long-term, decreasing in magnitude over time as reclamation occurs. Surface use and damage payments would offset some or all of the economic losses from grazing reductions for affected landowners. Tenants who lease grazing or cropland on non-federal surface affected by cumulative development would not receive compensation under surface use agreements. The number of tenants that would be affected is unknown.***

5.3.11.1 Environmental Justice

As noted in Section 3.11.13, Environmental Justice, the percentage of minority and low-income populations within communities and census block groups in the socioeconomic and environmental justice CISA (i.e., Converse, Natrona, and Campbell counties) is below the statewide and national percentages for those populations, and no concentrations of minority, low-income, or American Indian residents have been identified within or near the CCPA. Therefore, no disproportionately high and adverse human health or environmental effects on an identified minority, low-income, or American Indian environmental justice population would be anticipated under any of the alternatives, and no alternative would contribute disproportionately high human health or environmental cumulative effects on any of these populations.

Conversely, the job opportunities in the CISA associated with the Project and the reasonably foreseeable future projects outlined in Section 5.2 could be beneficial to some low-income residents who may gain employment or find higher paying jobs.

Cumulative impacts on resources of Native American concern within the CCPA would include those from the past, present, and reasonably foreseeable impacts identified in Section 5.3.2.3 as well as the potential for cumulative impacts to ***settings*** relevant to resources or Native American concern (Section 5.3.15). As noted in Section 5.3.2.3, Alternative C would have relatively less potential to cause additional incremental cumulative impacts, which could be further reduced by compliance with BLM and USFS reclamation requirements. The impact avoidance, minimization, and mitigation measures and tribal monitoring of sediment disturbing activities required for cultural resources would help avoid contributions of any alternative to cumulative impacts on resources of Native American concern.

Several Tribes have commented that increased development activity, including the cumulative effects of those activities, in the project area could impact water and air quality on reservations that are downstream and downwind from this project area.

5.3.12 Soil Resources

The CISA for soil resources as defined in **Table 5.1-1** is the CCPA boundary, with a total area of 1,502,381 acres. Past, present, and reasonably foreseeable future actions that would occur within the CCPA are discussed in Section 5.2 and their locations are illustrated on **Figures 5.2-1** through **5.2-3**. The projects located entirely or partially within the CISA are detailed in **Tables 5.2-1** through **5.2-5**. These cumulative projects would contribute incremental changes to the current level of effects to soil resources in the analysis area from historic and ongoing management activities.

Past, present, and reasonably foreseeable future actions, excluding the proposed Project, have resulted, or would result, in surface disturbance within the CCPA totaling 36,842 acres, which is approximately 2.5 percent of the CCPA. The total quantifiable surface disturbances are related to oil and gas development, mining, wind energy projects, power plants, transmission lines, pipelines, and railroads. **Table 5.3-20** provides a summary of the surface disturbance within the CCPA from the other cumulative past, present, and reasonably foreseeable actions by project type.

Table 5.3-20 Cumulative Surface Disturbance to Soils in CISA

Projects	Disturbance (acres)	Percent of CISA
Oil and gas projects	24,244	1.6
Mining	10,405	0.7
Other	2,193	0.2
All Other Cumulative Projects	**36,842**	**2.5**
Alternative B	52,667	3.5
Total Cumulative for Alternative B	**89,509**	**6.0**
Alternative C	37,267	2.5
Total Cumulative for Alternative C	**74,109**	**5.0**

Construction of the proposed Project would occur in an area already impacted by oil and gas development, mining, wind power facilities, and other associated infrastructure. As shown in **Table 5.3-20**, Alternative B would disturb an additional 3.5 percent of the CISA, while Alternative C would disturb an additional 2.5 percent of the CISA. This additional disturbance from Alternatives B and C would account for 58.8 and 50.3 percent of the total cumulative disturbance within the CISA, respectively.

The cumulative effects of soil disturbance could include soil compaction from vehicle traffic leading to increased surface runoff, accelerated water erosion resulting in contributions of sediment into waters of the state, and accelerated wind erosion resulting in contributions to fugitive dust emissions. Cumulative disturbance also could lead to an increase in noxious weeds and invasive plants species; establishment which could result in a decline in native vegetation species. These impacts, singularly or in combination, could increase the potential for valuable soil loss and a long-term decline in productivity and soil quality within the CISA.

5.3.13 Transportation and Access

The CISA for transportation as defined in **Table 5.1-1** is the CCPA boundary, City of Douglas, and the federal/state highways, and Converse County and BLM roads providing access to the site within a 10-mile buffer, for a total of 3,055,147 acres. Past, present, and reasonably foreseeable future actions that occur within the CISA are discussed in Section 5.2 and their locations are illustrated on **Figures 5.2-1** through **5.2-3**. In addition to the projects that are located entirely or partially within the CCPA as detailed in **Tables 5.2-1** through **5.2-5**, the following projects also fall outside the CCPA but within the 10-mile buffer and are included in the cumulative analysis for transportation:

- Oil and Gas: Cole Creek Exploratory Drilling, Marys Draw Exploration, Salt Creek Fieldwide Expansion, BLM Buffalo Field Office Active Coalbed Natural Gas Projects, Buck Draw North Gas Plant, Bucking Horse Gas Plant, Buckshot Treating Facility, and Fort Union Treating Facility.
- Uranium Mining: Moore Ranch and Reno Creek.

- Coal and Other Mining: Antelope Coal, North Antelope Rochelle Coal, Knife River Stone Quarry, and Willis Sand and Gravel.
- Wind Energy: Pioneer Wind Park I and II.
- Power Plants and Linear: Dave Johnston Power Plant, Teckla to Osage Transmission, Gateway West Transmission, and High Plains Express Transmission.

The other cumulative projects that are located entirely or partially within the CISA are detailed in **Tables 5.2-1** through **5.2-5**. A notable difference between the cumulative impact analyses relative to direct and indirect impacts analysis in Section 4.13 is that surface acreage impacts were used to quantify access road development and subsequent traffic impacts.

Table 5.3-*21* provides a summary of the surface disturbance within the CISA from the other cumulative past, present, and reasonably foreseeable actions in the CISA by project type. Acreage from new road development is incorporated within the surface disturbance acreage and accounts for approximately 25 percent of the total disturbance.

Mining activities make up the majority of cumulative activity in the CISA, followed by oil and gas, and other types of developments. The other category includes wind energy centers, a power plant, transmission lines, and rail lines. Acreage disturbance from increased roads has been included in the acreages portrayed in **Table 5.3-*21***.

Project-specific effects from Alternatives B and C would combine with other cumulative actions to result in potential direct impacts to transportation resources within the transportation CISA as shown in **Table 5.3-*22***. Alternative B would disturb an additional 1.7 percent of the CISA, while Alternative C would disturb an additional 1.2 percent of the CISA. This additional disturbance from Alternatives B and C would account for 39.4 and 31.6 percent of the total cumulative disturbance within the CISA, respectively with 25 percent of that total associated with the construction of well pad access roads and primary collector roads. More acreage would be attributed to road disturbance and construction from Alternative B than Alternative C.

Table 5.3-21 Surface Disturbance within the Transportation CISA from Cumulative Actions

Project Type	Cumulative Projects in CISA				Total	
	Past and Present		Reasonably Foreseeable			
	acres	percent	acres	percent	acres	percent
Oil and Gas[1]	29,672	1.0	6,064	0.2	35,736	1.2
Mining	37,463	1.2	3,076	0.1	40,539	1.3
Other	3,946	0.1	626	0.0	4,572	0.1
Total	**71,081**	**2.3**	**9,766**	**0.3**	**80,847**	**2.6**

[1] Does not include the Converse County EIS Project alternatives.

Table 5.3-22 Cumulative Surface Disturbance within Transportation CISA including Alternatives B and C

	Disturbance (acres)	Percent of CISA
All Other Projects in CISA	80,477	2.6
Alternative B	52,667	1.7
Total Cumulative for Alternative B	**133,514**	**4.3**
Alternative C	37,267	1.2
Total Cumulative for Alternative C	**118,114**	**3.8**

As detailed in Section 4.13, the action alternatives would impact transportation resources by increasing traffic from construction, production, and decommissioning activities. These impacts would occur in conjunction with increased traffic from construction, operations, and decommissioning activities from other cumulative projects. **Table 4.13-4** provides the estimated increases in traffic from Alternative B on local area roads. Anticipated percent increases in traffic from cumulative projects would further add to the estimates in **Table 4.13-4**. Increased traffic could cause delays on local roads and safety concerns to local road users such as ranchers and recreationists. Potential impacts from the increased traffic levels on state roads could include increased maintenance costs and safety hazards. In particular, the City of Douglas could experience increased safety hazards from elevated levels of cumulative project-related traffic as it is a key access point to the CISA. However, the increase would not be anticipated to affect the free-flowing nature of the state highways within and near the CISA as a result of the already light traffic on the rural roads in the area. These impacts would be greatest during the construction phase of cumulative projects, but would diminish during production and decommissioning.

The total cumulative increase in traffic also would require more extensive maintenance and associated increased costs. The leading reasons these roads would require improvements would be for dust control and to alleviate wash-boarding. If there is an increase in heavy truck use, some roads may need to be upgraded. Estimated costs related to increased road maintenance for Alternative B are detailed in Section 4.13.2.1.

5.3.14 Vegetation Resources

The CISA for vegetation resources, as defined in **Table 5.1-1**, is the CCPA boundary for a total of approximately 1,502,381 acres. Past, present, and reasonably foreseeable future actions that occur within the CISA are discussed in Section 5.2 and their locations are illustrated on **Figures 5.2-1** through **5.2-3**. The other cumulative projects that are located entirely or partially within the CISA are detailed in **Tables 5.2-1** through **5.2-5**.

5.3.14.1 General Vegetation

Construction of the proposed Project would occur in an area already impacted by oil and gas development, mining, wind power facilities, and railroads. Direct impacts from these past, present, and reasonably foreseeable future actions within the CISA, excluding the proposed Project, would result in the potential cumulative disturbance of approximately 2.5 percent of the CCPA (**Table 5.3-*23***). Disturbance associated with Alternative B alone would add approximately 1.5 times the amount of disturbance from other cumulative projects for a total cumulative impact that would disturb approximately 6.0 percent of the CCPA. Alternative C would double the amount of cumulative surface disturbance, for a total cumulative disturbance to approximately 5.0 percent of the CCPA.

Table 5.3-23 Cumulative Surface Disturbance to Vegetation within CISA

Projects	Disturbance (acres)	Percent of CISA
Oil and gas projects	24,244	1.6
Mining	10,405	0.7
Other	2,193	0.2
All Other Cumulative Projects	**36,842**	**2.5**
Alternative B	52,667	3.5
Total Cumulative for Alternative B	**89,509**	**6.0**
Alternative C	37,267	2.5
Total Cumulative for Alternative C	**74,109**	**5.0**

Grassland communities are the most abundant within the CISA, representing approximately 66 percent of vegetation communities present. Sagebrush shrubland dominates approximately 22 percent of the CISA and is the second most abundant vegetation community. Barren/sparsely vegetated habitat covers approximately eight percent of the CISA, making it the third most abundant vegetation community. The remaining vegetation communities are fairly evenly distributed within the CISA. As described in Section 4.14, impacts were estimated by multiplying the total disturbance as a percentage of the CCPA times the total acres of each vegetation community within the CISA for a proportional estimate for disturbance. Based on proportionality, grassland, sagebrush shrubland, and barren/sparsely vegetated communities would be the most likely vegetation communities to be disturbed by cumulative impacts. Alternative B, with more surface disturbance than Alternative C, would proportionally impact more vegetation communities than Alternative C.

Private land ownership represents approximately 83 percent of the CISA. Using the same proportional formula to analyze impacts, the majority of cumulative development likely would occur on private lands. Reclamation on private lands is not required to meet BLM or USFS standards, resulting in the majority of vegetation communities not being returned to their preconstruction state under Alternative B.

All cumulative activities, including the proposed Project, would require access roads for operation and maintenance. The cumulative proliferation of roads during development would increase the potential for fugitive dust deposition on vegetation and the spread of noxious weeds and invasive plant species. In addition to roads, existing rail corridors would continue to contribute to dust generation, which would increase the potential for fugitive dust and the spread of noxious weeds and invasive plant species within the CISA. It was assumed that existing projects would generate less fugitive dust emissions than projects under construction or decommissioning phases. Additionally, the type of project would affect the frequency and intensity of fugitive dust. Fugitive dust from transmission line construction presumably would not generate a large amount of dust compared to mining or oil and gas development. Fugitive dust cannot be analyzed quantitatively; however, it was assumed that development under Alternative B would incrementally add to the frequency and/or intensity of fugitive dust emissions. Cumulative fugitive dust emissions would be less under Alternative C when compared to Alternative B.

In addition to direct impacts due to loss of vegetation communities and the generation of fugitive dust, cumulative activities could impact vegetation through landscape fragmentation, changes in fire regime, erosion, sedimentation, and the invasion and spread of noxious weeds and invasive plant species. These impacts would be the same as described in Section 4.14.

5.3.14.2 Noxious Weeds and Invasive Plant Species

Cumulative activities and their effects on noxious weeds and invasive plant species would be the same as impacts described in Section 4.14 and would include competition with native plants through degradation and modification of native communities and the reduction in resources for native species (e.g., moisture, soil nutrients, and light). Noxious weeds and invasive plant species are spread by vehicles, construction equipment, and workers. The potential for invasion and spread of noxious weeds and invasive plant species would be greater during construction and decommissioning due to increased traffic and other project-related activity. The disturbance caused by cumulative activities in the CISA would increase the potential to spread noxious weeds and invasive plant species. There would be more cumulative surface disturbance under Alternative B than under Alternative C; therefore, cumulative impacts resulting in the spread of noxious weeds and invasive plant species would be greater under Alternative B than Alternative C.

5.3.14.3 Special Status Plant Species

Disturbance from the proposed Project would incrementally increase cumulative impacts to special status plant species. Alternative B would result in more surface disturbance than Alternative C; therefore, cumulative impacts would be greater under Alternative B than Alternative C for all special status plant species.

<u>Ute Ladies'-tresses Orchid – Federally Threatened</u>

Based on a predictive distribution model created by WYNDD for Ute ladies'-tresses orchid (WYNDD 2008a), approximately 6,675 acres of suitable habitat occur within the CCPA (**Figure 3.14-3**). Cumulative development within the CCPA from all other cumulative projects, excluding the proposed Project, would result in approximately 145 acres of disturbance to the species potential habitat in the CCPA, which would represent approximately 2.2 percent of the suitable habitat for Ute ladies'-tresses orchid in the CCPA. Alternative B would add an additional 234 acres of disturbance, resulting in total cumulative disturbance of approximately 379 acres or approximately 5.7 percent of the suitable habitat for Ute ladies'-tresses orchid in the CCPA. Similarly, Alternative C would add an additional 166 acres of disturbance, resulting in total cumulative disturbance of approximately 311 acres or approximately 4.7 percent of the suitable habitat for Ute ladies'-tresses orchid in the CCPA. The additional disturbance from Alternatives B and C would account for 61.7 and 53.4 percent of the total cumulative disturbance to suitable habitat within the CISA, respectively. Impacts to this species through cumulative activities would be the same as described in Section 4.14, Special Status Plant Species, and would result from fugitive dust deposition, crushing, and direct removal of habitat.

Development under Alternative C would involve reclamation to BLM and USFS suitable habitat on private lands underlain by federal minerals, which would not be required under Alternative B. However, Ute ladies'-tresses orchid primarily is found within wetlands, which are afforded extra protection as described in Section 3.17, Wetlands and Riparian Areas. Therefore, this reclamation requirement would have little effect in reducing impacts to Ute ladies'-tresses orchid.

Surface water use and groundwater pumping by past, present, and reasonably foreseeable future actions also could contribute impacts to wetland habitat, the habitat of this species. Surface water and groundwater impacts are discussed in detail in Section 4.16, Water Resources. Impacts to the quantity of available surface water and groundwater are not expected under Alternatives B or C.

<u>Western Prairie Fringed Orchid – Federally Endangered</u>

The western prairie fringed orchid is not present within the CISA, but may occur in downstream riparian habitats of the North Platte River. Water depletions upstream could impact these habitats. Cumulative surface and groundwater use in the CCPA could contribute to impacts of wetland and riparian habitat downstream. Surface water and groundwater impacts are discussed in detail in

Sections 4.16, Water Resources, impacts to the quantity of available surface water and groundwater are not expected under Alternative B or C.

Porter's Sagebrush – BLM Sensitive

There is approximately 74,233 acres of potentially suitable habitat for Porter's sagebrush along the western boundary of the CCPA (WYNDD 2008b) (**Figure 3.14-3**). Cumulative development within the CCPA from all other cumulative projects, excluding the proposed Project, would result in approximately 1,159 acres of disturbance to potentially suitable habitat for Porter's sagebrush in the CCPA, which would, represent approximately 1.6 percent of the suitable habitat for Porter's sagebrush in the CCPA. Alternative B would add an additional 2,602 acres of disturbance, resulting in total cumulative disturbance of approximately 3,761 acres or approximately 5.1 percent of the suitable habitat for Porter's sagebrush in the CCPA. Similarly, Alternative C would add an additional 1,841 acres of disturbance, resulting in total cumulative disturbance of approximately 3,000 acres or approximately 4.0 percent of the suitable habitat for Porter's sagebrush in the CCPA. The additional disturbance from Alternatives B and C would account for 69.2 and 61.4 percent of the total cumulative disturbance to suitable habitat within the CISA, respectively. Types of cumulative impacts to Porter's sagebrush would be the same as described in Section 4.14, Special Status Plant Species, and would result from fugitive dust deposition, crushing, and direct removal of habitat.

Barr's Milkvetch, Common Twinpod, Visher's Buckwheat, and Prairie Dodder – USFS Sensitive

There is approximately 126,016 acres of barren/sparsely vegetated habitat within the CCPA, which is potentially suitable habitat for Barr's milkvetch, common twinpod, and Visher's buckwheat. Cumulative disturbance within the CCPA from all other cumulative projects would result in approximately 4,315 acres of disturbance to this habitat, which would be approximately 3.4 percent of the barren/sparsely vegetated habitat within the CCPA. Alternative B would contribute an additional 4,418 acres of disturbance, resulting in total cumulative disturbance of approximately 8,733 acres or approximately 6.9 percent of the potentially suitable barren/sparsely vegetated habitat in the CCPA for Barr's milkvetch, common twinpod, and Visher's buckwheat. Disturbance under Alternative C would contribute an additional 3,126 acres of disturbance to barren/sparsely vegetated habitat, for a total cumulative disturbance of 7,441 acres or 5.9 percent of potentially suitable habitat for Barr's milkvetch, common twinpod, and Visher's buckwheat. The additional disturbance from Alternatives B and C would account for 50.6 and 42.0 percent of the total cumulative disturbance to suitable habitat within the CISA, respectively.

There is approximately 84,706 acres of sand prairie hill grassland habitat within the CCPA, which is potentially suitable habitat for prairie dodder. Cumulative disturbance within the CCPA from all other cumulative projects would result in approximately 1,607 acres of disturbance to this habitat, which would be approximately 1.9 percent of the sand prairie hill grassland habitat within the CCPA. Disturbance under Alternative B would contribute an additional 2,969 acres, for a total cumulative disturbance of approximately 4,576 acres of disturbance to sand prairie hill grassland, which would be approximately 5.4 percent of the potentially suitable habitat for prairie dodder in the CCPA. Disturbance under Alternative C would contribute an additional 2,101 acres of disturbance, for a total cumulative disturbance of approximately 3,707 acres, or 4.4 percent of the potentially suitable habitat for prairie dodder in the CCPA. The additional disturbance from Alternatives B and C would account for 64.9 and 56.7 percent of the total cumulative disturbance to suitable habitat within the CISA, respectively.

The types of cumulative impacts to these species due to cumulative activities would be the same as described in Section 4.14, Special Status Plant Species, which would include impacts from fugitive dust, crushing, and direct removal of habitat.

5.3.15 Visual Resources

The CISA for visual resources as defined in **Table 5.1-1** includes a 15-mile BLM VRM background distance zone around the CCPA for a total area of approximately 3,950,439 acres. Past, present, and reasonably foreseeable future actions that occur within the visual resources CISA are discussed in Section 5.2, and their locations are illustrated on **Figures 5.2-1** through **5.2-3**. In addition to the projects that are located entirely or partially within the CCPA as detailed in **Tables 5.2-1** through **5.2-5**, the following projects also fall within the additional 15-mile buffer and are included in the cumulative analysis for visual resources:

- Oil and Gas: Cole Creek Exploratory Drilling, Marys Draw Exploration, Salt Creek Fieldwide Expansion, BLM Buffalo Field Office Active Coalbed Natural Gas Projects, Buck Draw North Gas Plant, Bucking Horse Gas Plant, Buckshot Treating Facility, and Fort Union Treating Facility.
- Uranium Mining: Moore Ranch, Nichols Ranch Hank Unit, Nichols Ranch, Collins Draw, Nichols Ranch Jane Dough Unit, and Reno Creek.
- Coal and Other Mining: Antelope Coal, North Antelope Rochelle Coal, School Creek Coal, Knife River Stone Quarry, and Willis Sand and Gravel.
- Wind Energy: Pioneer Wind Park I and II and Reno Junction.
- Power Plants and Linear: Dave Johnston Power Plant, Teckla to Osage Transmission, Gateway West Transmission, and High Plains Express Transmission.

Past, present, and reasonably foreseeable future actions have resulted, or would result, in surface disturbance within the visual resources CISA totaling approximately 118,079 acres. The total quantifiable surface disturbances are related to oil and gas development, mining, wind energy projects, power plants, transmission lines, pipelines, and railroads.

All of the identified reasonably foreseeable actions would be located in BLM VRM Class II, III, and IV areas as well as USFS SIO High, Moderate, and Low areas (**Table 5.3-*24***). The disturbance would be anticipated to meet the standards of the VRM Class III and VRM Class IV objectives, which provide for moderate and major change in the landscape. The actions proposed for the immediate foreground of the historic trails areas would not be anticipated to meet the VRM Class II objective. Assuming that standard reclamation requirements would be adhered to for permitting of future projects, the cumulative effects to visual resources would be minimized to the degree possible after completion of future projects.

Table 5.3-24 Cumulative Impacts by VRM and SIO Class

	Disturbance (acres/percent of Class)					
	Acres	**Percent**	**Acres**	**Percent**	**Acres**	**Percent**
BLM VRM Class	**II**		**III**		**IV**	
All Other Projects in Visual CISA	448	0.3	10,836	1	72,650	4
Alternative B	2,475	1.3	12,956	1.3	26,860	1.3
Total Cumulative with Alternative B	**2,923**	**1.6**	**14,786**	**2**	**111,941**	**6**
Alternative C	1,752	0.9	9,168	0.9	19,006	0.9
Total Cumulative with Alternative C	**2,200**	**1.2**	**13,631**	**1**	**100,535**	**5**

Table 5.3-24 Cumulative Impacts by VRM and SIO Class

	Disturbance (acres/percent of Class)					
	Acres	Percent	Acres	Percent	Acres	Percent
USFS SIO	**High**		**Moderate**		**Low**	
All Other Projects in Visual CISA	19,986	69	20,155	42	88,089	13
Alternative B	369	1.3	632	1.3	9,375	1.3
Total Cumulative with Alternative B	**19,987**	**69**	**20,279**	**42**	**97,220**	**14**
Alternative C	261	0.9	447	0.9	6,633	0.9
Total Cumulative with Alternative C	**19,987**	**69**	**20,243**	**42**	**94,550**	**14**

Past, present, and reasonably foreseeable future actions, excluding the proposed Project, have resulted, or would result, in surface disturbance within the visual resources CISA totaling approximately 118,079 acres, which is approximately 3.0 percent of the CISA. Alternative B would disturb an additional 1.3 percent of the CISA, resulting in a total cumulative disturbance of approximately 170,745 acres or 4.3 percent of the CISA. The incremental 57,667 acres of disturbance from Alternative B would account for 30.8 percent of the total cumulative disturbance within the CISA. This would result in impacts to scenery for viewers in areas of dispersed recreation and viewers walking the historic trails and traveling the roads. Strong or moderate contrasts of form, line, and color would not be in compliance with VRM Class II or SIO High objectives. Strong contrasts also would not be in compliance with VRM Class III or SIO Moderate objectives, but would comply only with Class IV objectives or SIO Low and Very Low objectives. The type of impacts under Alternative C would be the same as for Alternative B; however, Alternative C would disturb 0.4 percent less of the CISA, resulting in disturbance to a total of 155,346 acres or 3.9 percent of the CISA. This additional disturbance from Alternative C would account for 24.0 percent of the total cumulative disturbance within the CISA. Mitigation measures VIS-1 through VIS-6 would minimize the visual impact of development within the CISA (see Section 4.15.2.2).

5.3.16 Water Resources

The CISA for surface water resources as defined in **Table 5.1-1** is the HUC-12 drainages within or intersected by the CCPA. This encompasses a total area of 2,206,155 acres. Past, present, and reasonably foreseeable future actions that occur within the CISA are discussed in Section 5.2 and their locations are illustrated on **Figures 5.2-1** through **5.2-3**. In addition to the projects that are located entirely or partially within the CCPA as detailed in **Tables 5.2-1** through **5.2-5**, the following projects also fall outside the CCPA but within the HUC-12 drainages and are included in the cumulative analysis for surface water:

- Oil and Gas: Cole Creek Exploratory Drilling, Marys Draw Exploration, BLM Buffalo Field Office Active Coalbed Natural Gas Projects, Buck Draw North Gas Plant, Bucking Horse Gas Plant, Buckshot Treating Facility, and Fort Union Treating Facility.
- Uranium Mining: Moore Ranch.
- Coal and Other Mining: Knife River Stone Quarry and Willis Sand and Gravel.
- Wind Energy: Pioneer Wind Park I and II.
- Power Plants and Linear: Dave Johnston Power Plant, Gateway West Transmission, and High Plains Express Transmission.

The CISA for groundwater resources as defined in **Table 5.1-1** is bounded on the north at Township 42 North (approximately 5 to 12 miles north of the CCPA), on the west and east by the outcrop of the Fox-Hills/Lance aquifer, and on the south by the structural limit of the Powder River Basin (the Fox Hills/Lance aquifer does not outcrop on the south). In addition to the projects that are located entirely or partially within the CCPA as detailed in **Tables 5.2-1** through **5.2-5**, the following projects also fall within the groundwater CISA and are included in the cumulative analysis for groundwater:

- Oil and Gas: Cole Creek Exploratory Drilling, Marys Draw Exploration, BLM Buffalo Field Office Active Coalbed Natural Gas Projects, and Buck Draw North Gas Plant.
- Uranium Mining: Moore Ranch, Collins Draw, and Reno Creek.
- Coal and Other Mining: Antelope Coal, Black Thunder Coal, North Antelope Rochelle Coal, School Creek Coal, and Knife River Stone Quarry.
- Wind Energy: Pioneer Wind Park I and II.
- Power Plants and Linear: Dave Johnston Power Plant, Greencore Pipeline, Teckla to Osage Transmission, Gateway West Transmission, and High Plains Express Transmission.

5.3.16.1 Surface Water Resources

Past, present, and reasonably foreseeable future actions, excluding the proposed Project, have resulted, or would result, in surface disturbance within the surface water CISA totaling 44,418 acres, which is approximately 2.0 percent of the CISA (**Table 5.3-*25***). The total quantifiable surface disturbances are related to oil and gas development, mining, wind energy projects, power plants, transmission lines, pipelines, and railroads.

Table 5.3-25 Cumulative Surface Disturbance within the Surface Water CISA by Project Type

	Cumulative Projects in CISA				Total	
	Past and Present		Reasonably Foreseeable			
Project Type	**acres**	**percent**	**acres**	**percent**	**acres**	**percent**
Oil and Gas[1]	25,867	1.2	2,555	0.1	28,422	1.3
Mining	9,194	0.4	2,979	0.1	12,173	0.5
Other	3,388	0.1	435	<0.1	3,823	0.2
Total	**38,449**	**1.7**	**5,969**	**0.3**	**44,418**	**2.0**

[1] Does not include the Converse County EIS Project alternatives.

As shown on **Table 5.3-*26***, Alternative B would disturb an additional 2.4 percent of the CISA, while Alternative C would disturb an additional 1.7 percent of the CISA. This additional disturbance from Alternatives B and C would account for 54.2 and 45.6 percent of the total cumulative disturbance within the CISA, respectively.

Potential cumulative effects to surface water resources as a result of cumulative actions in the area would be similar to the Project-specific impacts discussed in Section 4.16, including increased erosion and sedimentation from areas of upland surface disturbance, stream bank instability from linear development stream crossings, or from potential leaks and spills of hazardous materials. The impact indicator presented for a quantitative comparison of the cumulative impacts considering Project alternatives is surface disturbance. The impact potential to surface water resources would be more concentrated within any given drainage containing active coal mines, other mines, or power plants because the disturbance for these project types would be denser than other project types such as oil and gas, uranium, or wind power.

Table 5.3-26 Total Cumulative Surface Disturbance in the Surface Water Resources CISA

Projects	Disturbance (acres)	Percent of CISA
All Other Projects in CISA	44,418	2.0
Alternative B	52,667	2.4
Total Cumulative for Alternative B	**97,085**	**4.4**
Alternative C	37,267	1.7
Total Cumulative for Alternative C	**81,685**	**3.7**

BMPs and land management requirements on BLM and USFS lands would minimize risk of impact to surface water resources from development of those lands. Additional mitigation recommended for the Alternatives B and C would minimize effects from construction of stream crossings and pipeline operation.

5.3.16.2 Groundwater

Groundwater Drawdown

The pumping scenarios modeled (Section 4.16.2.2) indicated that the maximum drawdown effects would be limited to the areas directly adjacent to the source wells and would rapidly diminish to 10 feet within approximately 1,000 feet from the well. Unless wells are located within 1,000 feet of the CCPA boundary, drawdown effects likely would not occur beyond the CCPA boundary. ***Placement of*** new water supply wells 2,000 feet or more from existing wells, would further decrease potential drawdown effects. In addition, new water supply wells likely would be dispersed (as discussed for the Dispersed Pumping Scenario in the groundwater model), thereby further limiting the effects of drawdown. Based on this analysis, the drawdown impacts from the Project would not interact with nearby cumulative projects within the groundwater resources CISA.

Groundwater Depletion

The most recent available information from the USGS (2010) indicates that the overall annual groundwater use (including oil and gas) in Converse County in 2010 was approximately 12,900 acre-feet (100 million barrels) per year. Overall groundwater use likely increased from 2010 to 2014; however, it is probable that use has receded in recent years due to the downturn in oil and gas drilling since 2014. Therefore, 12,900 acre-feet per year of groundwater use would be a reasonable estimate of current groundwater consumption in Converse County for use in this cumulative analysis.

The estimated annual consumption of approximately ***14,000*** acre-feet per year of groundwater for Alternative B would represent an additional use of groundwater over the annual groundwater use for Converse County (12,900 acre-feet). The drilling of 50 new water supply wells by the OG under Alternative B would provide an additional source of groundwater. The amount of water consumed under Alternative B likely would put pressure on existing supplies, although the addition of the new water supply wells would help alleviate pressure on groundwater resources. Alternative B would consume a total of ***140,000*** acre-feet (***1.1 billion*** barrels) of water over the 10 years of active drilling and completion, and the total groundwater use in the county from other activities during the same 10-year period would be 129,000 acre-feet (1.0 billion barrels).

In addition to the water use for Alternative B and the estimated use for the county, the Greater Crossbow Oil and Gas Development Project to the north of the CCPA would consume approximately 6,000 acre-feet (47 million barrels) per year or 60,000 acre-feet (470 million barrels) over 10 years

(EOG Resources, Inc. 2015). Therefore, total cumulative water usage over the 10-year active drilling and completion period would be ***329,000*** acre-feet (***2.6*** billion barrels) (**Table 5.3-*27***). This total cumulative water demand over a 10-year time period (assuming that the Greater Crossbow Project would run concurrently), would represent less than one-percent of the available groundwater resource (261 million acre-feet, Section 4.16.2.2).

Table 5.3-27 Total Estimated Cumulative Groundwater Withdrawal

Water User	Water Use (acre-feet)			
	Alternative B		Alternative C	
	Annual	10-year Total	Annual	10-year Total
Converse County All Other Uses	12,900	129,000	12,900	129,000
Greater Crossbow Oil and Gas Project	6,000	60,000	6,000	60,000
Converse County Oil and Gas Project	***14,000***	***140,000***	***8,400***	***84,000***
Total Use	***32,900***	***329,000***	***27,300***	***27,000***

Alternative C would consume ***approximately 84,000*** acre-feet of water during the 10 years of active drilling and completion***. This would be less than the 140,000 acre-feet consumed in 10 years under Alternative B due to*** recycling of fracturing or produced water. Therefore, overall consumption in the county during the same period ***also*** would be less than Alternative B or an estimated ***273,000*** acre-feet.

Groundwater Contamination from Surface Spills and Leaks of Fuels and Chemicals

Reasonably foreseeable future oil and gas actions, including the proposed Project, would represent a total of 6,500 production wells. At an assumed spill rate of 0.5 percent applied to that total, there would be an estimated 33 spills to groundwater (Section 4.16.1.2). Most of the spills would be small and the existing regulatory framework would address such spills; therefore, the cumulative impacts would be minor. The impacts of spills and leaks under Alternative C would be the same as Alternative B.

Contamination of Usable Waters Due to Hydraulic Fracturing

As discussed in Section 4.16.1.2, the contamination of usable waters by hydraulic fracturing likely would not occur in the CCPA under any Project alternative. Therefore, there would be no cumulative impacts due to hydraulic fracturing.

Contamination of Usable Waters Due to Subsurface Injection of Wastewater

Impacts to usable waters due to disposal injection would be negligible under any Project alternative; therefore, the proposed Project likely would not result in measurable contribution to cumulative impacts.

Disposal of Produced Water

Based on the analysis in Section 4.16.1.2, there could be a shortage of injection disposal capacity in the CISA. However, the precise quantity of disposal facilities that could be needed cannot be determined at this time.

Induced Seismicity

It is not known when the volume of injected fluids would reach a threshold that would result in felt or damaging induced seismicity; therefore, cumulative impacts from injection disposal cannot be quantified or predicted at this time.

5.3.17 Wetlands and Riparian Areas

The CISA for wetland and riparian resources as defined in **Table 5.1-1** is the HUC-12 drainages within or intersected by the CCPA boundary. This encompasses approximately 2,206,155 acres. Past, present, and reasonably foreseeable future actions that occur within the CISA are discussed in Section 5.2 and their locations are illustrated on **Figures 5.2-1** through **5.2-3**. In addition to the cumulative projects that are located entirely or partially within the CCPA as detailed in **Tables 5.2-1** through **5.2-5**, the following projects also fall outside of the CCPA but within the HUC-12 drainages and are included in the cumulative analysis for wetlands and riparian areas:

- Oil and Gas: Cole Creek Exploratory Drilling, Marys Draw Exploration, BLM Buffalo Field Office Active Coalbed Natural Gas Projects, Buck Draw North Gas Plant, Bucking Horse Gas Plant, Buckshot Treating Facility, and Fort Union Treating Facility.
- Uranium Mining: Moore Ranch.
- Coal and Other Mining: Knife River Stone Quarry, and Willis Sand and Gravel.
- Wind Energy: Pioneer Wind Park I and II.
- Power Plants and Linear: Dave Johnston Power Plant, Gateway West Transmission, and High Plains Express Transmission.

The cumulative impact analysis for wetlands and riparian areas focuses on the regional wetland and riparian resources and how they could be susceptible to the cumulative actions identified within the CISA. There is approximately 21,593 acres of wetland/riparian area within the CISA, which represents approximately 0.7 percent of the vegetative communities present in the CISA.

As shown on **Table 5.3-*28***, cumulative development within the CISA from all other cumulative projects, excluding the proposed Project, would result in approximately 305 acres of disturbance to wetlands in the CISA, which would represent approximately 1.4 percent of the wetlands in the CISA. Alternative B would disturb an additional 1.6 percent, resulting in total cumulative disturbance to approximately 3.0 percent of the wetlands in the CISA. Alternative C would disturb an additional 1.1 percent, resulting in total cumulative disturbance to approximately 2.5 percent of the wetlands in the CISA. The additional disturbance from Alternatives B and C would account for 52.9 and 44.3 percent of the total cumulative disturbance to suitable habitat within the CISA, respectively.

Table 5.3-28 Cumulative Surface Disturbance to Wetlands in the HUC-12 CISA

Projects	Disturbance of Wetlands in CISA	
	Acres	**Percent**
Other Oil and Gas Projects	200	0.9
Mining Projects	17	0.1
Other Energy and Linear Projects	88	0.4
Total Other Cumulative	**305**	**1.4**
Alternative B	343	1.6
Total Cumulative for Alternative B	**648**	**3.0**
Alternative C	243	1.1
Total Cumulative for Alternative C	**547**	**2.5**

Accurate quantitative calculations of cumulative wetland and riparian losses cannot be determined because the disturbance impacts would be site-specific and dependent on several factors including the status and condition of wetland and riparian areas affected; seasonal timing of the disturbances;

physical parameters of the affected and nearby habitats (e.g., extent of topographical relief and vegetative cover); the value or quality of adjacent habitats; the type of surface disturbance; and other variables that are difficult to quantify (e.g., human presence).

Indirect cumulative impacts associated with human presence would increase in the CISA during the life of the Project. In general, impacts from development under Alternative B or Alternative C would combine with impacts from the other cumulative actions possibly affecting wetland and riparian habitat through the alteration or loss of wetlands and riparian areas as a result of surface disturbance; changes in water quality as a result of surface disturbance or introduction of contaminants into drainages; and changes in available wetland/riparian habitat as a result of water withdrawals or discharge.

Potential cumulative effects to wetland and riparian resources as a result of past, present, and reasonably foreseeable future activities would closely relate to impacts discussed in Section 4.17. Cumulative impacts to wetland and riparian resources primarily would be related to indirect effects rather than direct habitat loss because wetlands would be avoided if possible. Cumulative surface disturbance would add to wetland and riparian impacts and overall habitat fragmentation. In areas where development occurs without reclamation, habitat fragmentation could result in the disruption of seasonal wetland patterns.

If new roads or gas-gathering pipelines, water pipelines, or overhead electrical distribution lines cross wetlands and riparian habitats, the potential disturbance to these areas likely would be less under Alternative C due to the approximately 33 percent fewer facilities. However, it is assumed that surface disturbance activities would not be allowed directly within wetland areas per the BLM Casper RMP and the USFS TBNG LRMP. Linear facilities or new access roads could involve crossings of wetlands, only if the impacts were deemed acceptable or are capable of being adequately mitigated. BMPs and land management requirements on BLM and USFS lands would minimize loss of wetland and riparian habitats.

5.3.18 Wildlife and Aquatic Biological Resources

With the exception of big game species and greater sage-grouse, the CISA for most terrestrial and aquatic wildlife as defined in **Table 5.1-1** is the HUC-12 drainages within or intersected by the CCPA. This encompasses approximately 2,206,155 acres. The CISA for big game is the WGFD herd units (based on pronghorn herd units) that intersect the CCPA, which is an area totaling approximately 6,208,944 acres. For greater sage grouse, the CISA is the CCPA plus an 11-mile buffer, which is an area totaling approximately 3,226,826 acres.

Past, present, and reasonably foreseeable future actions that occur within the CISAs are discussed in Section 5.2 and their locations are illustrated on **Figures 5.2-1** through **5.2-3**. In addition to the projects that are located entirely or partially within the CCPA as detailed in **Tables 5.2-1** through **5.2-5**, the following projects also fall outside the CCPA but within the HUC-12 drainages and are included in the cumulative analysis for most terrestrial and aquatic species:

- Oil and Gas: Cole Creek Exploratory Drilling, Marys Draw Exploration, BLM Buffalo Field Office Active Coalbed Natural Gas Projects, Buck Draw North Gas Plant, Bucking Horse Gas Plant, Buckshot Treating Facility, and Fort Union Treating Facility.
- Uranium Mining: Moore Ranch.
- Coal and Other Mining: Knife River Stone Quarry, and Willis Sand and Gravel.
- Wind Energy: Pioneer Wind Park I and II.
- Power Plants and Linear: Dave Johnston Power Plant, Gateway West Transmission, and High Plains Express Transmission.

In addition to the projects that are located entirely or partially within the CCPA as detailed in **Tables 5.2-1** through **5.2-5**, the following projects also fall outside the CCPA but within the WGFD herd units and are included in the cumulative analysis for big game species:

- Oil and Gas: Cole Creek Exploratory Drilling, Marys Draw Exploration, Salt Creek Fieldwide Expansion, BLM Buffalo Field Office Active Coalbed Natural Gas Projects, Buck Draw North Gas Plant, Bucking Horse Gas Plant, Buckshot Treating Facility, and Fort Union Treating Facility.
- Uranium Mining: Moore Ranch and Reno Creek.
- Coal and Other Mining: Antelope Coal, Black Thunder Coal, Jacobs Ranch Coal, North Antelope Rochelle Coal, School Creek Coal, Guernsey Quarry, Knife River Stone Quarry, and Willis Sand and Gravel.
- Wind Energy: Pioneer Wind Park I and II.
- Power Plants and Linear: Dave Johnston Power Plant, Teckla to Osage Transmission, Gateway West Transmission, and High Plains Express Transmission.

In addition to the projects that are located entirely or partially within the CCPA as detailed in **Tables 5.2-1** through **5.2-5**, the following projects also fall outside the CCPA but within the 11-mile buffer and are included in the cumulative analysis for greater sage-grouse:

- Oil and Gas: Cole Creek Exploratory Drilling, Marys Draw Exploration, Salt Creek Fieldwide Expansion, BLM Buffalo Field Office Active Coalbed Natural Gas Projects, Buck Draw North Gas Plant, Bucking Horse Gas Plant, Buckshot Treating Facility, and Fort Union Treating Facility.
- Uranium Mining: Moore Ranch, Collins Draw, Nichols Ranch Jane Dough Unit, and Reno Creek.
- Coal and Other Mining: Antelope Coal, North Antelope Rochelle Coal, Knife River Stone Quarry, and Willis Sand and Gravel.
- Wind Energy: Pioneer Wind Park I and II and Reno Junction Wind Energy.
- Power Plants and Linear: Dave Johnston Power Plant, Teckla to Osage Transmission, Gateway West Transmission, and High Plains Express Transmission.

5.3.18.1 Terrestrial Wildlife

The cumulative impact analysis for terrestrial wildlife focuses on the regional wildlife resources and how they may be susceptible to the cumulative actions identified for the proposed Project using the same assumptions and methodologies as presented in Section 4.18.1 to assess the impacts of the project along with the assumptions that: 1) human use of the CISA would increase with the implementation of the proposed project; 2) wildlife habitats currently are at their respective carrying capacities in and adjacent to the CCPA; and 3) the overall region has been previously affected by historic and current oil and gas development activities.

Past, present, and reasonably foreseeable future actions, excluding the proposed Project, have resulted, or would result, in surface disturbance within the terrestrial wildlife (i.e., HUC-12) CISA totaling approximately 44,418 acres, which is approximately 2.0 percent of the CISA (**Table 5.3-*29***). Oil and gas activities make up the majority of the cumulative activity in the CISA, followed by mining and other types of developments (i.e., wind energy, power plants, and linear projects).

Table 5.3-29 Cumulative Surface Disturbance within the Terrestrial Wildlife CISA by Project Type

Project Type	Cumulative Projects in CISA				Total	
	Past and Present		Reasonably Foreseeable			
	acres	percent	acres	percent	acres	percent
Oil and Gas[1]	25,867	1.2	2,555	0.1	28,422	1.3
Mining	9,194	0.4	2,979	0.1	12,173	0.5
Other	3,388	0.1	435	<0.1	3,823	0.2
Total	**38,449**	**1.7**	**5,969**	**0.3**	**44,418**	**2.0**

[1] Does not include the Converse County EIS Project alternatives.

As shown on **Table 5.3-30**, Alternative B would disturb an additional 2.4 percent of the CISA, while Alternative C would disturb an additional 1.7 percent of the CISA. This additional disturbance from Alternatives B and C would account for 54.2 and 45.6 percent of the total cumulative disturbance within the CISA, respectively.

Table 5.3-30 Total Cumulative Surface Disturbance in the Terrestrial Wildlife CISA

Projects	Disturbance (acres)	Percent of CISA
All Other Projects in CISA	44,418	2.0
Alternative B	52,667	2.4
Total Cumulative for Alternative B	**97,085**	**4.4**
Alternative C	37,267	1.7
Total Cumulative for Alternative C	**81,685**	**3.7**

Potential cumulative effects to terrestrial wildlife, including special status species, as a result of cumulative activity in the CISA would closely relate to impacts discussed in Sections 4.18.1***, 4.18.2,*** and 4.18.3. Cumulative impacts to wildlife resources primarily would be directly related to habitat loss, habitat fragmentation, and animal displacement. Surface disturbance would incrementally add to wildlife habitat losses, overall habitat fragmentation, and animal displacement. In areas of existing development, habitat fragmentation could have resulted in the disruption of seasonal patterns or migration routes. Cumulative developments in the vicinity of the CCPA have resulted, or would result, in the reduction of carrying capacities as characterized by the amount of available cover, forage, and breeding areas for wildlife species. Wildlife species, such as raptor species, would be susceptible to these cumulative impacts because encroaching human activities in the region resulted, or would result, in habitat loss and fragmentation and animal displacement in areas that may be at their relative carrying capacity for these resident species. Under Alternative B, ***relief from timing limit stipulations***, if allowed, ***could*** adversely impact raptor and other migratory bird species by causing nest abandonment. Many of the local wildlife populations (e.g., small game, migratory birds) that occur in the CISA likely would continue to occupy their respective ranges and breed successfully, although population numbers may decrease relative to the amount of cumulative habitat loss and disturbance from incremental development.

While surface disturbance generally corresponds to associated wildlife habitat loss, accurate calculations of the full extent of cumulative wildlife habitat loss cannot be determined because the direct impacts of habitat disturbance are species-specific and dependent upon the following factors:

- The status and condition of the population(s) or individual animals being affected;
- Seasonal timing of the disturbances (exceptions to timing limit stipulations would result in greater impacts to wildlife resources including occupied raptor and other migratory bird nests and seasonal wildlife habitats under Alternative B);
- The value or quality of the disturbed sites;
- The physical parameters of the affected and nearby habitats (e.g., extent of topographical relief and vegetative cover);
- The value or quality of adjacent habitats; the type of surface disturbance; and
- Indirect impacts that are difficult to quantify, such as increased noise and human presence.

However, surface disturbance calculations are still a useful indicator of habitat loss because as forage; foraging and/or hunting habitats; and breeding, nesting, and rearing habitats are removed, overall quality of wildlife habitat also will decrease.

Indirect impacts associated with human presence and noise incrementally would increase in the CISA during the life of the proposed Project. Indirect cumulative impacts from oil and gas development and other activities within the CISA would include:

- Animal displacement: Displaced individuals could be forced into less suitable habitats possibly resulting in subsequent effects of deteriorated physical condition, reproductive failure, mortality, and general distress as important habitat is reduced along with the carrying capacity of the landscape. Loss of habitat/forage consequently could result in increased competition between and among species for available resources.
- Decreased reproduction success: A decrease in reproductive success and physical condition from increased energy expenditure due to physical responses to disturbance, which may lead to mortality.
- Increased traffic levels: An increase in traffic levels associated with development on roadways ***would*** increase the risk of vehicle/wildlife collisions and increased human utilization of resources through hunting and other recreational activities that would expose wildlife to potential human harassment, either inadvertent or purposeful.

Based on these direct and indirect cumulative impacts, ongoing and future well development within the terrestrial wildlife CISA would cumulatively and incrementally reduce the ability of wildlife habitats to support wildlife and special status species at their current levels for the lifetime of the proposed Project.

Under Alternative B, exceptions to timing stipulations would be sought in the vicinity of raptor nests and greater sage-grouse leks outside PHMA. However, such exceptions generally would be granted on a case-by-case basis. Where exceptions would not be granted under Alternative B or where adherence to timing stipulations would occur under Alternative C, drilling and completion of wells would be scheduled to occur outside of the stipulation windows. This would result in varying construction schedules around the variable timing stipulations designed to protect sensitive wildlife resources including greater sage-grouse leks, seasonal wildlife habitats, mountain plover nests, swift fox dens, and occupied raptor nests. ***Relief from timing limit stipulations*** under Alternative B ***could*** impact wildlife species by causing nest abandonment, reduced reproductive success, a reduction in lek attendance, and displacements of animals from other sensitive seasonal ranges.

Cumulative impacts would continue until such time that reclamation of wildlife habitat is deemed successful (approximately 10 to 100 years, depending on the vegetation cover type; see Section***s*** 4.14 ***and 4.18***). Under Alternative B, the actual amount of wildlife habitat to be reclaimed on private land (approximately 83 percent of the CCPA) would be dependent on landowner agreements; however, under Alternative C, reclamation would occur as recommended by the BLM and USFS on federal surface as well as on private surface underlain by federal mineral estate (i.e., approximately 64 percent of the CCPA), increasing the opportunity for wildlife habitats to be reclaimed to suitable wildlife habitat.

Big Game

Past, present, and reasonably foreseeable future actions, excluding the proposed Project, have resulted, or would result, in surface disturbance within the big game CISA, totaling approximately 140,612 acres, which is approximately 2.3 percent of the CISA (**Table 5.3-*31***).

As shown in **Table 5.3-*32***, Alternative B would disturb an additional 0.8 percent of the CISA, while Alternative C would disturb an additional 0.6 percent of the CISA. This additional disturbance from Alternatives B and C would account for 27.2 and 21.0 percent of the total cumulative disturbance within the big game CISA, respectively.

Table 5.3-31 Cumulative Surface Disturbance within the Big Game CISA by Project Type

Project Type	Cumulative Projects in CISA				Total	
	Past and Present		Reasonably Foreseeable			
	acres	percent	acres	percent	acres	percent
Oil and Gas[1]	31,997	0.5	6,131	0.1	38,128	0.6
Mining	97,750	1.6	3,351	<0.1	101,101	1.6
Other	1,313	<0.1	70	0.0	1,383	<0.1
Total	**131,060**	**2.1**	**9,552**	**0.2**	**140,612**	**2.3**

[1] Does not include the Converse County EIS Project alternatives.

Table 5.3-32 Total Cumulative Surface Disturbance in the Big Game CISA

Projects	Disturbance (acres)	Percent of CISA
All Other Projects in CISA	140,612	2.3
Alternative B	52,667	0.8
Total Cumulative for Alternative B	**193,279**	**3.1**
Alternative C	37,267	0.6
Total Cumulative for Alternative C	**177,879**	**2.9**

Potential cumulative effects to big game as a result of cumulative activity in the CISA would closely relate to impacts discussed in Section 4.18.1 and as described for all terrestrial wildlife. Under Alternative B, exceptions to timing stipulations would be sought in the vicinity of raptor nests and greater sage-grouse leks outside PHMA. ***Relief from timing limit stipulations*** under Alternative B would impact big game species by displacing animals from or prohibiting the use of seasonal ranges. Adherence to timing stipulations for raptors and greater sage-grouse under Alternative C ***also*** would result in the protection of seasonal big game ranges that overlap with these areas.

Table 5.3-*33* provides the cumulative surface disturbance acreages for big game species' ranges for all other cumulative actions as well as the total cumulative disturbance that would result under each alternative. **Figures 5.3-2** through **5.3-5** display big game ranges within the CISA and the locations of past, present, and reasonably foreseeable actions within those ranges. Both pronghorn and mule deer winter/yearlong and yearlong ranges would result in the greatest impacts due to disturbance from other cumulative projects. Impacts to all other big game ranges within the big game CISA as a result of cumulative disturbances would be less than 10 percent of their ranges. A portion of the cumulative disturbance has been, or would be, reclaimed or has recovered materially (i.e., wildfire areas). The reclaimed areas and areas associated with habitat conversion would be capable of supporting wildlife use (including big game); however, species composition and densities likely would change. Under Alternative B, the actual amount of big game habitat to be reclaimed on private land (approximately 83 percent of the CCPA) would be dependent on landowner agreements. However, reclamation under Alternative C would occur as recommended by the BLM and USFS on federal surface as well as on private surface underlain by federal mineral estate (i.e., approximately 65 percent of the CCPA), increasing the opportunity for big game habitats to return to suitable wildlife habitat.

Table 5.3-33 Cumulative Surface Disturbance to Big Game Ranges

Species – Range[1]	Total Acres within Big Game CISA[2]	Estimated Cumulative Habitat Disturbed[3]					
		Other Cumulative Projects		Total with Alternative B		Total with Alternative C	
		Acres	Percent	Acres	Percent	Acres	Percent
Mule Deer – Winter/Yearlong	1,479,228	343,750	23.2	354,322	24.0	350,484	23.7
Mule Deer – Yearlong	3,646,653	1,097,470	30.1	1,129,163	31.0	1,117,656	30.6
Pronghorn – Severe Winter Relief	94,990	5,651	5.9	5,835	6.1	5,768	6.1
Pronghorn – Winter/Yearlong	1,862,606	397,270	21.3	408,777	21.9	404,599	21.7
Pronghorn – Yearlong	3,336,967	1,193,703	35.8	1,224,022	36.7	1,213,014	36.4
White-tailed Deer – Winter/Yearlong	268,370	1,320	0.5	1,374	0.5	1,355	0.5
White-tailed Deer – Yearlong	1,522,729	37,260	2.4	37,260	2.4	37,260	2.4
Elk – Yearlong	1,018,922	95,035	9.3	96,146	9.4	95,742	9.4

1 Ranges designated by WGFD.

2 The big game CISA encompasses the entire WGFD herd units based on pronghorn herd units and is a total of approximately 6,208,449 acres.

3 Values include impacts associated with the incremental addition of the Project alternatives as well as other cumulative projects in the big game CISA.

5.3.18.2 Migratory Birds

Cumulative impacts to migratory birds would be the same as described for all terrestrial wildlife (Section 5.3.18.1) ***and those discussed in Section 4.18.2***. Based on the MBTA, additional surveys typically are required in potential or known habitats of migratory birds prior to disturbance during the nesting period. These surveys would help determine the presence of nesting birds or the extent of habitat, and protective measures generally would be taken to avoid or minimize direct disturbance in these important areas. However, due to the direct and indirect cumulative impacts, ongoing and future well development within the terrestrial wildlife CISA would cumulatively and incrementally reduce the ability of habitats to support migratory bird species at their current levels for the lifetime of proposed Project. Cumulative impacts would continue until such time that reclamation is deemed successful (approximately 10 to 100 years, depending on the vegetation cover type; see Section***s*** 4.14 ***and 4.18***). Under Alternative B, the actual amount of migratory bird habitat to be reclaimed on private land (approximately 83 percent of the CCPA) would be dependent on landowner agreements. However, reclamation under Alternative C would occur as recommended by the BLM and USFS on federal surface as well as on private surface underlain by federal mineral estate (i.e., approximately 64 percent of the CCPA), increasing the opportunity for migratory bird habitats to return to suitable wildlife habitat.

Under Alternative B, the current raptor timing limit stipulation (Option 1) along with five non-eagle raptor amendment options were analyzed in terms of potential effects resulting from either following the current raptor stipulations or various means for the BLM to grant relief from timing limit stipulations on non-eagle raptors. Two raptor amendment options proposed by the applicant include Option 2 (timing limit stipulations will not apply to non-eagle raptor nests within the CCPA) and Option 3 (applicant applies conservation measures involving additional applicant-committed design features). Three other amendment options included Option 4 (BLM proposal to implement a Raptor Management Plan), Option 5 (USFWS proposal to implement a MBCP), and Option 6.

The contributing effect of the amendment options to cumulative impacts would vary under Alternative B. The lowest level of cumulative impact would occur under Option 1, whereas, the greatest level of cumulative impact would occur under Option 2. Options 3, 4, 5, or 6 would result in a level of cumulative impact to non-eagle raptors less than Option 2 but greater than Option 1.

Option 2 would eliminate BLM's ability to avoid and minimize impacts to non-eagle raptors resulting in the largest contribution to cumulative impacts to raptors. Options 3, 4, 5, and 6 would moderate the contribution to cumulative impacts to non-eagle raptors by applying one of the conservation measures presented in Appendix G. However, under these options development activity would take place within the stipulation buffer for some non-eagle raptor nests within the CCPA over the 10-year development portion of the Project. As a result, development under these options has the potential to adversely impact non-eagle raptor species by causing nest abandonment, reduced reproductive success, and displacement of individuals from nesting territories.

5.3.18.3 Special Status Terrestrial Species

Cumulative impacts for special status terrestrial species would be the same as described for all terrestrial wildlife (Section 5.3.18.1). However, additional surveys typically are required in potential or known habitats of threatened, endangered, or otherwise special status species. These surveys would help determine the presence of any special status wildlife species or extent of habitat, and protective measures generally would be taken to avoid or minimize direct disturbance in these important areas. Given the declining trends of the greater sage grouse populations within the CISA, cumulative impacts for greater sage-grouse could be more pronounced than for other special status species.

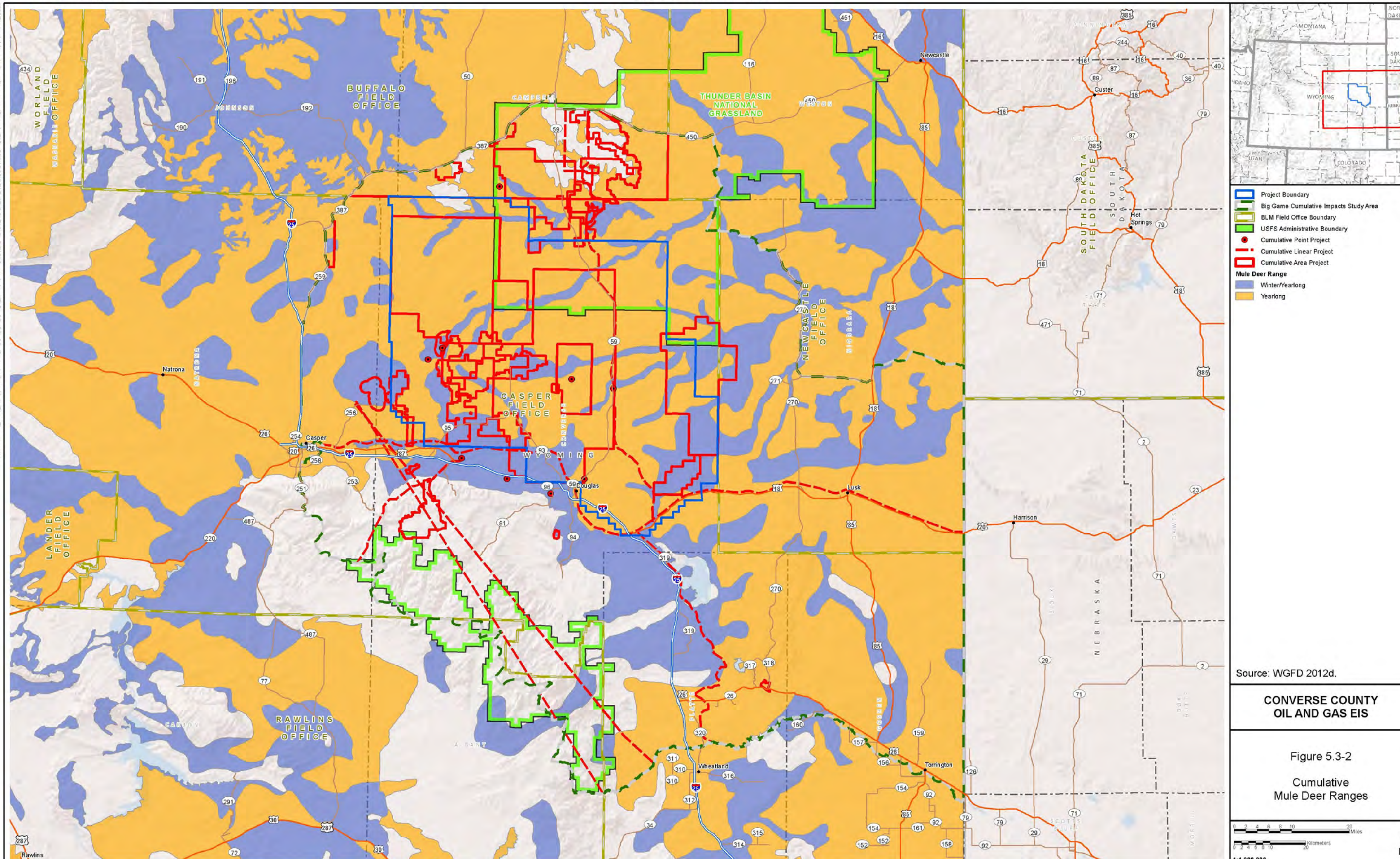

Figure 5.3-2

Cumulative
Mule Deer Ranges

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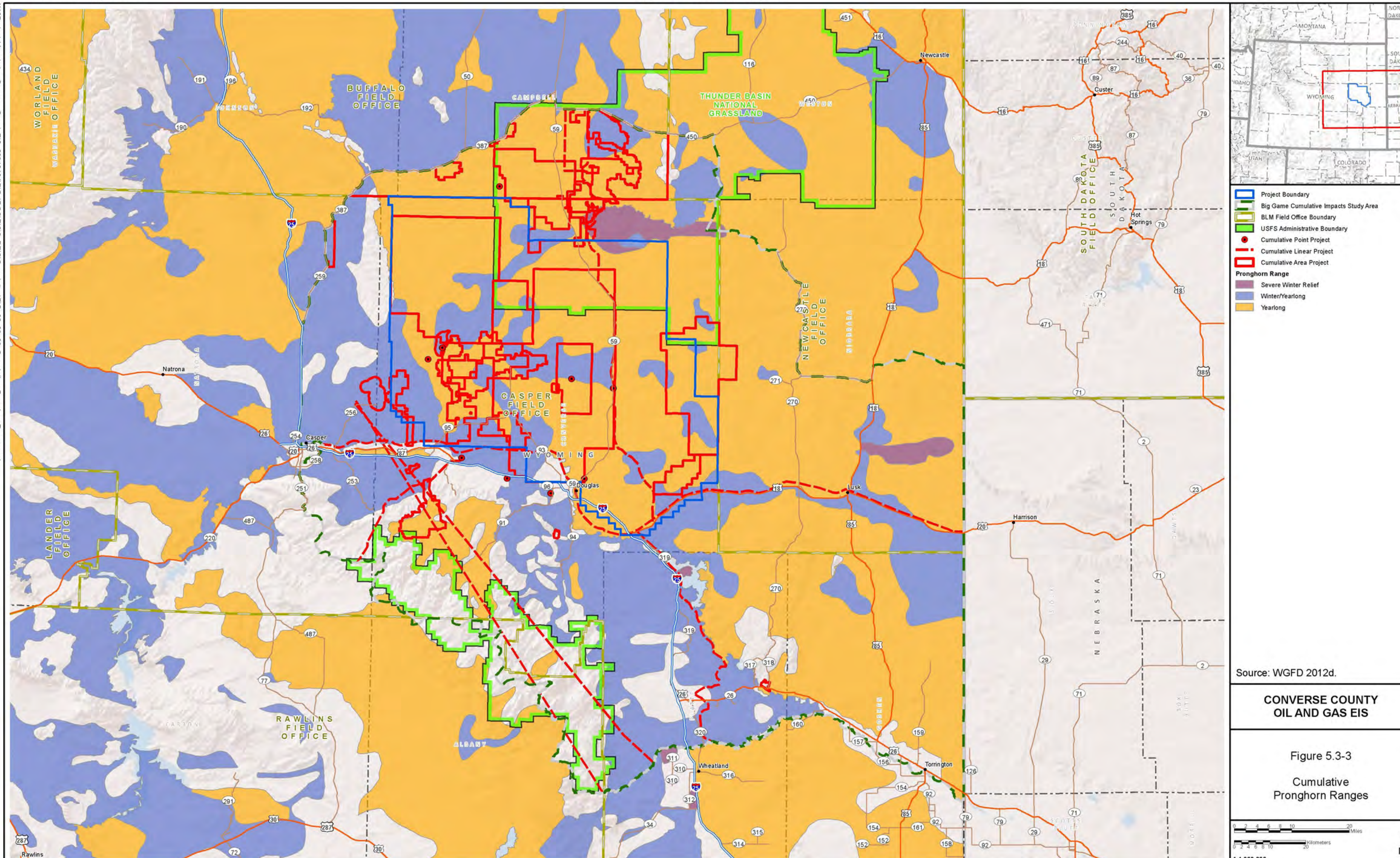

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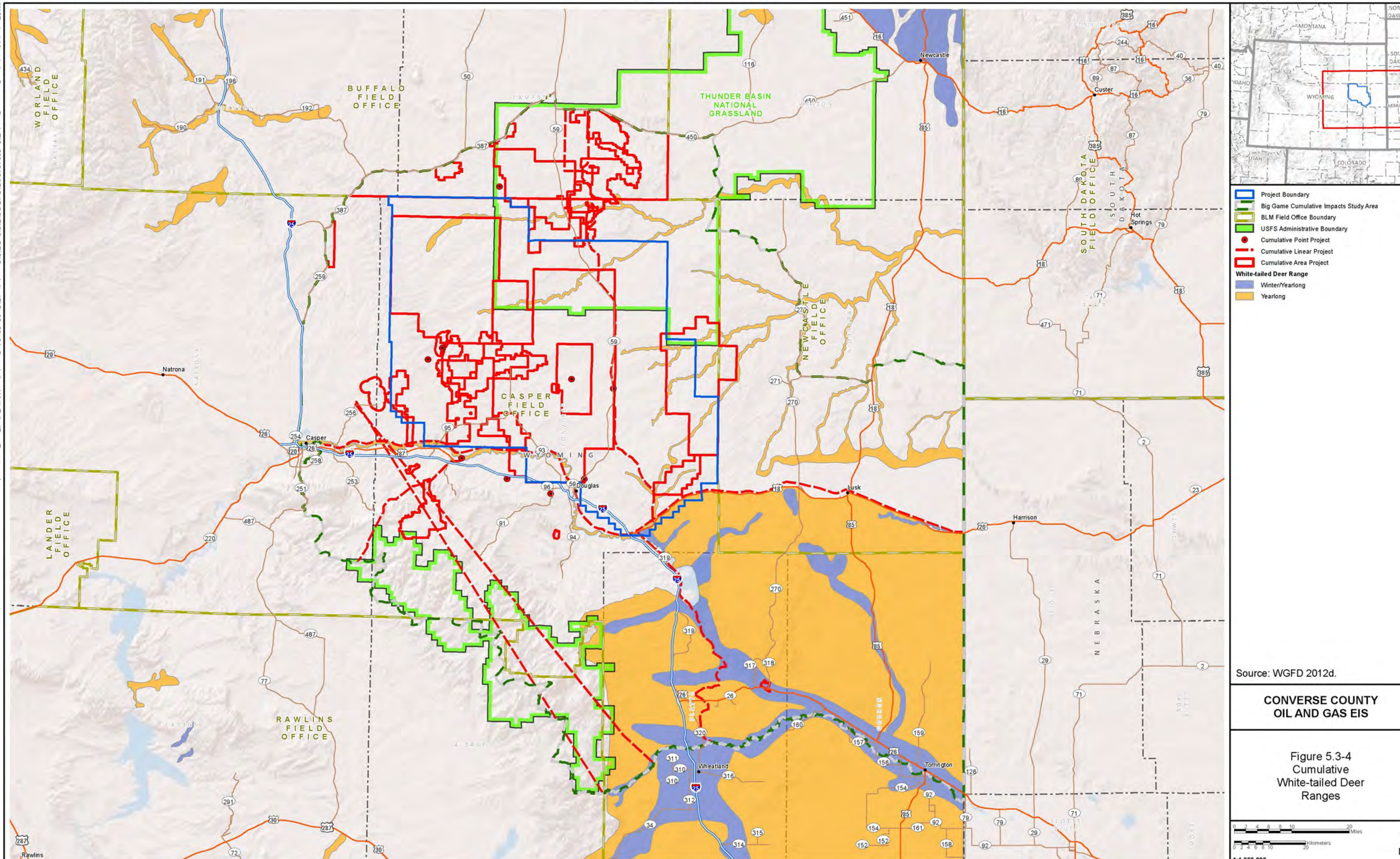

Figure 5.3-4
Cumulative
White-tailed Deer
Ranges

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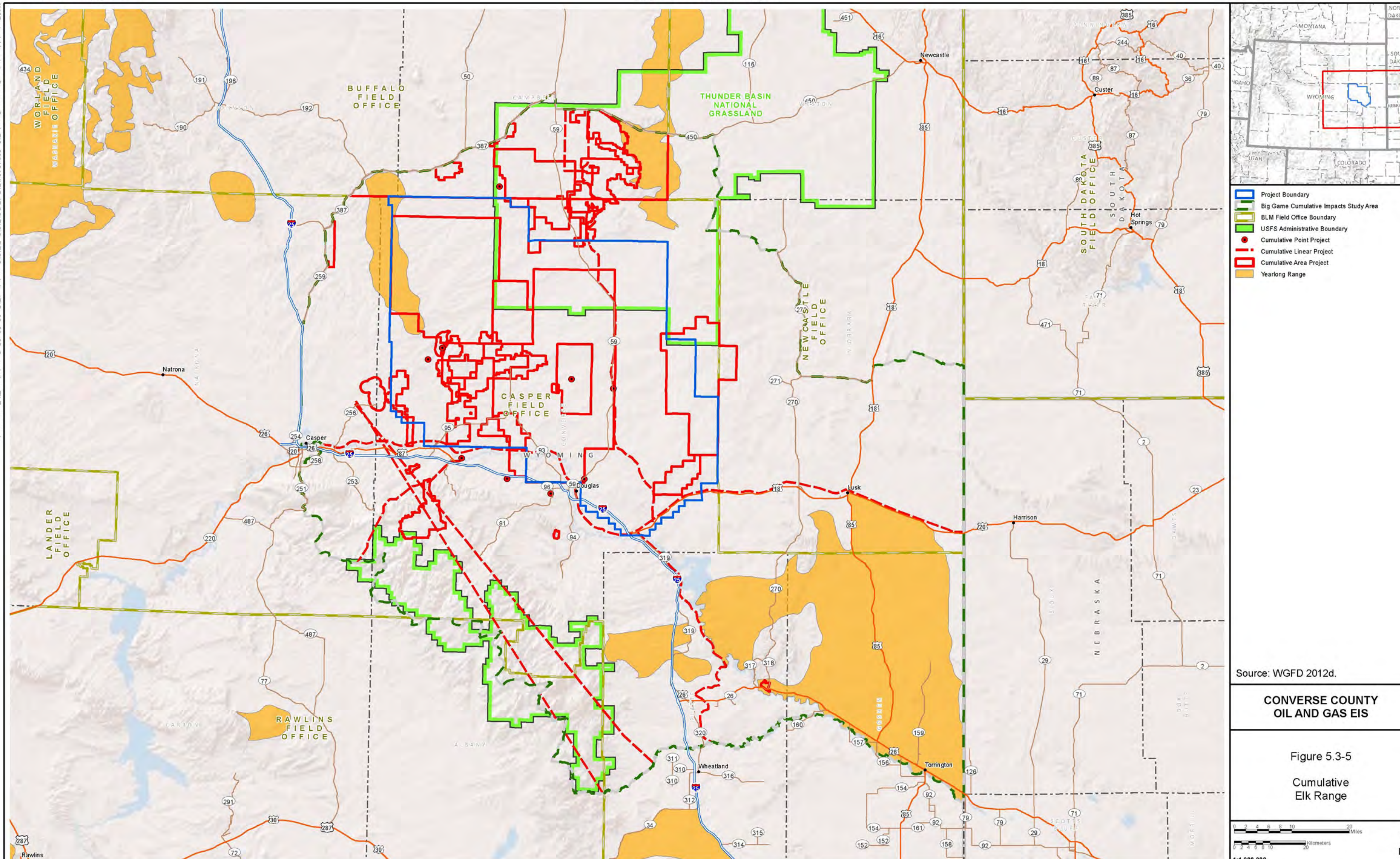

Figure 5.3-5

Cumulative Elk Range

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Greater Sage-grouse

Past, present, and reasonably foreseeable future actions, excluding the proposed Project, have resulted, or would result, in surface disturbance within the greater sage-grouse CISA, totaling approximately 87,166 acres, which is approximately 2.7 percent of the CISA (**Table 5.3-*34***).

Table 5.3-34 Cumulative Surface Disturbance within the Greater Sage-grouse Big Game CISA by Project Type

Project Type	Cumulative Projects in CISA				Total	
	Past and Present		Reasonably Foreseeable			
	acres	percent	acres	percent	acres	percent
Oil and Gas[1]	31,016	1.0	6,127	0.2	37,143	1.2
Mining	41,787	1.3	3,473	0.1	45,260	1.4
Other	4,074	0.1	689	<0.1	4,763	0.1
Total	**76,877**	**2.4**	**10,289**	**0.3**	**87,166**	**2.7**

[1] Does not include the Converse County EIS Project alternatives.

As shown in **Table 5.3-*35***, Alternative B would disturb an additional 1.6 percent of the greater sage-grouse CISA, while Alternative C would disturb an additional1.2 percent of the greater sage-grouse CISA. This additional disturbance from Alternatives B and C would account for 37.7 and 29.9 percent of the total cumulative disturbance within the greater sage-grouse CISA, respectively.

Table 5.3-35 Total Cumulative Surface Disturbance in the Greater Sage-grouse CISA

Projects	Disturbance (acres)	Percent of CISA
All Other Projects in CISA	87,166	2.7
Alternative B	52,667	1.6
Total Cumulative for Alternative B	**139,833**	**4.3**
Alternative C	37,267	1.2
Total Cumulative for Alternative C	**124,433**	**3.9**

Potential cumulative effects to greater sage-grouse as a result of cumulative activity in the CISA would closely relate to impacts discussed in Section 4.18.3 and as described for all terrestrial wildlife. Under Alternative B, exceptions to timing stipulations would be sought in the vicinity sage-grouse leks outside PHMA. However, such exceptions generally would be granted on a case-by-case basis. Where exceptions would not be granted under Alternative B (within PHMA and on the TBNG) or where adherence to timing stipulations would occur under Alternative C, drilling and completion of wells would be scheduled to occur outside of the stipulation windows. This would result in a varying cycle scheduled around variable timing stipulations designed to protect sage-grouse leks and breeding habitat. ***Exceptions to timing limit stipulations*** under Alternative B would adversely impact sage-grouse by causing nest abandonment, reduced reproductive success, a reduction in lek attendance, and displacements of animals from other sensitive seasonal ranges.

Table 5.3-*36* provides the cumulative surface disturbance acreages for greater sage-grouse PHMA and GHMA for all other cumulative actions as well as cumulative disturbance that would result under each alternative. **Figure 5.3-6** displays greater sage-grouse PHMA within the CISA and the locations of past, present, and reasonably foreseeable actions within those habitats.

Table 5.3-36 Cumulative Surface Disturbance to Greater Sage-grouse Habitat Management Areas

Habitat[1]	Total Habitat within Greater Sage-grouse CISA (acres)[2]	Estimated Cumulative Habitat Disturbed[3]					
		Other Cumulative *Projects*		Total with Alternative B		Total with Alternative C	
		Acres[4]	Percent	Acres[4]	Percent	Acres[4]	Percent
PHMA	427,830	6,045	1.4	11,671	2.7	9,092	2.1
GHMA	2,644,407	9,012	57.1	1,545,012	58.4	1,532,047	57.9

1 Habitat designated by WY EO ***2019-3***, the Approved Resource Management Plan Amendment for the Wyoming Greater Sage-grouse Sub-region (Attachment 4 to BLM 2015b), and the Land Management Plan Amendment for TBNG (Attachment B to USFS 2015b). Designated BLM PHMA correlates with the Core Area Version 3 Maps.

2 The greater sage-grouse CISA encompasses the CCPA plus and 11-mile buffer and is a total of 3,226,826 acres.

3 Values include impacts to PHMA and GHMA assuming an even distribution of disturbance that could occur anywhere throughout the CCPA (199,281 acres of PHMA and 1,287,429 acres of GHMA) for each Alternative (0.7 percent for Alternative A, 3.5 percent for Alternative B, and 2.5 percent for Alternative C); as well as other development projects in the cumulative effects area.

4 Due to the programmatic nature of this Project, actual disturbance values were not available; therefore, quantitative assessment was calculated as the sum of the acres impacted within the CISA by each project in the general cumulative effects area. The acres impacted in the CISA for each project was calculated as a percentage within the project boundary multiplied by the actual surface disturbance associated with that project.

A portion of the cumulative disturbance area has been, or would be, reclaimed or has recovered materially (i.e., wildfire areas). The reclaimed areas and areas associated with habitat conversion would be capable of supporting wildlife use (including greater sage-grouse); however, species composition and densities likely would change. Under Alternative B, the actual amount of wildlife habitat to be reclaimed on private land (approximately 83 percent of the CCPA) would be dependent on landowner agreements; however, reclamation under Alternative C would occur as recommended by the BLM and USFS on federal surface as well as on private surface underlain by federal mineral estate (i.e., approximately 65 percent of the CCPA), increasing the opportunity for habitats to return to suitable wildlife habitat.

Based on the historic, existing, and proposed level of development that would occur within habitats occupied by greater sage-grouse within the CISA and the trend data presented in Section 4.18.3, greater sage-grouse populations likely would continue to experience habitat loss and fragmentation; therefore, they may exhibit further population declines.

5.3.18.4 Aquatic Biological Resources

Potential cumulative effects to aquatic biological resources as a result of past, present, and reasonably foreseeable future actions in the CISA would closely relate to impacts to surface water resources discussed in Section 5.3.16.1. Relevance to groundwater resource impacts would depend on whether the aquatic habitat (i.e., perennial streams) has a hydraulic connection to areas of aquifers potentially affected by groundwater drawdown from mining or oil and gas development.

In total, approximately 324 miles of perennial stream habitat is located within the CISA for aquatic biological resources. The majority of the perennial stream miles are located in the North Platte River, which includes 91 miles or approximately 28 percent of the total perennial stream length in the CISA. Other perennial streams include Antelope Creek (7.9 percent), La Prele Creek (7.7 percent), Sand Creek (7.4 percent), and Bates Creek (6.3 percent). A higher risk of cumulative impacts would be related to these streams that have the highest number of stream miles in the CISA. The following cumulative actions overlap with perennial streams within the CISA:

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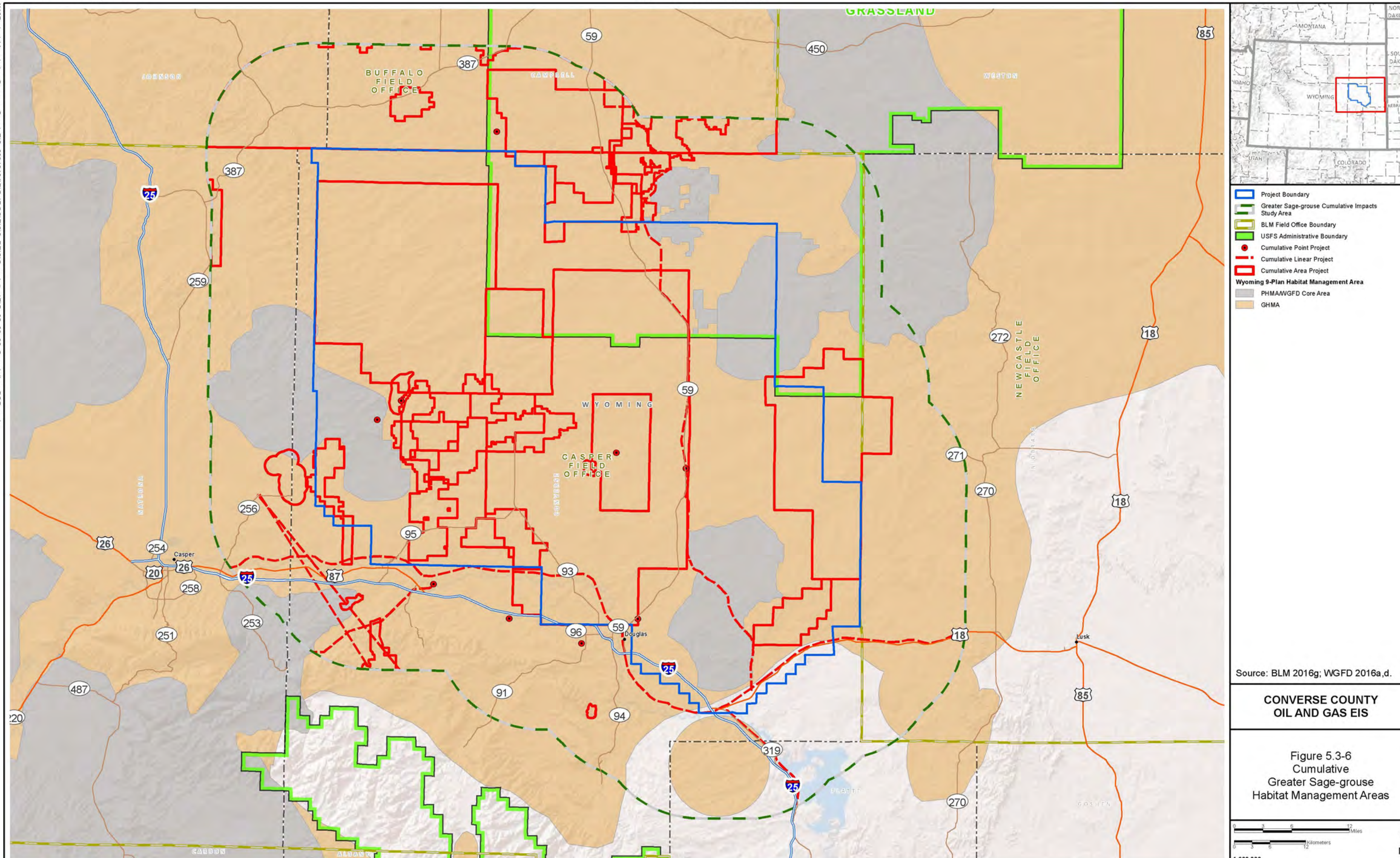

Figure 5.3-6
Cumulative
Greater Sage-grouse
Habitat Management Areas

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Oil and Gas Development

- East Converse Development – Willow Creek.
- Highland Loop Road Development – La Prele Creek, Spring Canyon Creek, and North Platte River.
- Salt Creek Development – Salt Creek.
- Spearhead Ranch Development – Antelope, Sand, South Fork Wind, and Wind creeks.
- Greater Crossbow Development, Marys Draw Development, and Buck Draw North Gas Plant – Bates Creek.
- Bucking Horse Gas Plant – Fivemile Creek.

Mining

- Ludeman Uranium Mine – North Platte River drainage.
- Antelope Coal Mine – Antelope Creek drainage.
- Knife River Stone Quarry – Deer Creek.

Other Development

- Campbell Hill Windpower Project – North Platte River.
- Pioneer Wind Park Project I and II – Dry Creek and North Platte River.
- Top of the World Wind Project – North Platte River subwatersheds.
- Dave Johnson Power Plant – North Platte River.
- Transmission Lines – Dry, Deer, East Fork Dry, and Wind creeks and North Platte River.

In general, Project-specific impacts for Alternatives B and C would combine with other cumulative actions to affect aquatic species in the following ways: 1) alteration or loss of habitat as a result of surface disturbance; 2) changes in water quality as a result of surface disturbance or introduction of contaminants into drainages; and 3) changes in available habitat as a result of water withdrawals or discharge.

Habitat Alteration or Loss. It is assumed that surface disturbance activities would not be allowed in perennial stream segments or other waterbodies on public land that contain game fish species; however, linear facilities or new access roads possibly could involve a crossing of small-sized streams. Stream crossings would result in disturbance to aquatic habitat during the construction period. Long-term loss of habitat would occur only if road crossing structures or culverts were used. In total, these disturbed areas would represent a relatively small portion of the aquatic habitat within the particular stream in the CISA. BMPs and land management requirements on BLM and USFS lands would minimize loss of perennial stream habitat.

Water Quality Effects. Construction and development activities could result in effects on water quality if surface disturbance or spills were to occur in drainage areas near perennial streams. BMPs and land management requirements on BLM and USFS lands would minimize or avoid effects on water quality and aquatic habitat. There would be a potential higher risk of sediment input to perennial streams that are located on private lands because reclamation would be done at the direction of the landowner and may not be to pre-construction conditions or suitable habitat.

Water Quantity Effects. Water use for the proposed Project would require approximately 3,250 to 8,000 acre-feet per year from existing, proposed, or new groundwater supply wells. Water use could affect stream flows and aquatic habitat if water sources are derived from or connected to surface water. If a groundwater source is hydrologically connected to surface water, flow reductions could occur and affect the amount of available habitat for aquatic species. Any potential Project-specific effect of water use on perennial stream habitat would combine with other cumulative actions involving water use. Although the total water withdrawal volumes are not known for the other cumulative actions at this time, cumulative reductions in perennial stream flow could occur, which would affect aquatic species.

5.3.18.5 Special Status Aquatic Species

Cumulative actions, including the proposed Project, could affect special status aquatic species if surface disturbance were to occur within the following drainages that support USFS Sensitive Species: Salt Creek in the Powder River Basin (plains minnow), Antelope Creek in the Cheyenne River Basin (plains topminnow and northern leopard frog), and Lightning Creek in the Cheyenne River Basin (flathead chub). Based on linear stream mile lengths, the largest amount of potential habitat for special status species within the CISA includes North Platte River (91 miles) followed by Antelope Creek (25 miles) and Salt Creek (12 miles). Less than 1 mile of perennial stream habitat occurs in Lightning Creek and the TBNG. Disturbance or water use within or near perennial streams throughout the CISA also could affect native fish species of conservation need such as bigmouth shiner, brassy minnow, central stoneroller, common shiner, Iowa darter, plains killifish, and plains topminnow.

The types of impacts discussed for aquatic biological resources (Section 5.3.18.4) also would be applicable to special status aquatic species, which include potential direct disturbance to habitat or changes in water quality or quantity in streams inhabited by special status species. Northern leopard frog could be adversely affected by traffic associated with cumulative projects if vehicles cause mortalities during frog movements to and from water sources used as breeding sites. Cumulative actions that overlap with perennial streams containing potential habitat for special status species are listed below along with the special status species associated with each streams. The occurrences of Forest Sensitive species plains minnow in the Salt Creek drainage and the flathead minnow in the North Platte River are located outside of the TBNG. Antelope Creek (plains topminnow and northern leopard frog) and Lightning Creek (flathead chub) are the two streams with Forest Sensitive species that are located within the CISA and the TBGNF.

- East Converse Oil and Gas Development – Lightning Creek (flathead chub);
- Salt Creek Oil and Gas Development – Salt Creek (plains minnow);
- Ludeman Uranium Mine – North Platte River (flathead minnow);
- Antelope Coal Mine – Antelope Creek drainage (plains topminnow and northern leopard frog);
- Top of the World and Pioneer Wind Park I and II Projects – North Platte River (flathead chub);
- Dave Johnston Power Plant – North Platte River (flathead chub); and
- Transmission Lines – North Platte River crossings (flathead chub).

Water use from cumulative projects potentially could affect federally listed species including one aquatic species (pallid sturgeon) in the Platte River in Nebraska. If new depletions would occur in the Platte River by individual cumulative projects that exceed 0.1 acre-feet and would rely on surface water or hydrologically connected groundwater, an evaluation would be required by the Wyoming State Engineer to determine whether the water use is a new or existing activity. If the activity is considered an existing water-related activity, the State Coordinator would determine whether any further action is required under the Platte River Recovery Implementation Program. If further actions are required, a Wyoming Platte River Recovery Agreement would be executed between the water user and the Wyoming State Engineer. This would mitigate the effects of individual cumulative projects.

BMPs and management requirements on BLM and USFS lands would avoid or minimize adverse effects to special status aquatic species on public lands. There would be no required protection on private lands other than protection to wetlands from the USACE 404 permitting process. Additional mitigation as recommended for the proposed Project (Section 4.18.5) would protect fish passage, spawning habitat, and water withdrawal effects on special status aquatic species.

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6.0 Mitigation

This Mitigation ***chapter*** has been developed by the BLM and the USFS ***describes the general approach to mitigation of resource impacts and to describe the overall application of compensatory mitigation in the CCPA***. ***Mitigation is an approach to reduce impacts to resources and values managed by the agencies in order to plan and provide for multiple use and sustained yield of resources on public lands.***

6.1 Introduction

Landscape-scale mitigation is an approach to mitigating impacts to resources and values managed by the agencies in order to plan and provide for multiple use and sustained yield of resources on public lands. This landscape-scale mitigation approach is being initiated for this programmatic EIS to identify potential compensatory mitigation opportunities to be selected during site-specific analysis of development proposals.

This introduction provides the background of the regulations as well as a summary of the affected resources and proposed Project. The subsequent sections discuss the federal agencies mitigation hierarchy, their management goals and ***objectives***, the OG-committed design features, the additional mitigation proposed ***review of*** through this EIS, and finally the general approach to compensatory mitigation that would occur during site-specific proposals.

The BLM's ability to require application of mitigation measures is limited by the extent of the agency's authority as it relates to the surface and fluid mineral estate ownership patterns within the CCPA (see Section 1.4.3).

6.1.1 Regulatory Background

In September 2015, the BLM issued the Record of Decision and Approved Resource Management Plan Amendment for Greater Sage-grouse and the USFS issued the Greater Sage-grouse ROD for Northwest Colorado and Wyoming that included a commitment to create a mitigation strategy to establish guidelines for the protection of resources under agency management. Additionally, the USDOI issued IM No. WY-2012-032 implementing the Wyoming Reclamation Policy. These documents are described in more detail below.

- ***Instruction Memorandum IM 2019-018, Compensatory Mitigation: an IM released on December 6, 2019, by the Deputy Director for Policy and Programs for the BLM provided updated guidance that except where the law specifically requires, the BLM will not require compensatory mitigation from public land users. While the BLM will consider voluntary proposals for mitigation, the BLM will not accept any monetary payment to mitigate the impacts of a proposed action. This policy supersedes all previous policies regarding compensatory mitigation.***
- Approved Resource Management Plan Amendment Appendix C – Required Design Features: an appendix to the BLM Approved Resource Management Plan Amendment for Greater Sage-grouse released in September 2015. This appendix establishes requirements for the design of lands and realty, range management, fluid minerals, coal exploration, wild horses, travel management, vegetation management, wildfire and fuels management, noise, and West Nile virus in sage-grouse PHMA and GHMA.
- Approved Resource Management Plan Amendment Appendix F – Mitigation Guidelines for Surface-Disturbing and Disruptive Activities on Wyoming BLM Lands: an appendix to the BLM Approved Resource Management Plan Amendment for Greater Sage-grouse released in

September 2015. This appendix provides a compilation of practices employed by the BLM to mitigate impacts from surface disturbance.

- Greater Sage-grouse ROD Appendix B – Mitigation Strategy: an appendix to the USFS Greater Sage-grouse ROD for Northwest Colorado and Wyoming including Land Management Plan Amendments for the TBNG issued on September 2015. This appendix states that the USFS will require mitigation resulting in a net conservation gain to the greater sage-grouse in authorizing third-party actions with the potential to remove or degrade greater sage-grouse habitat.
- Instruction Memorandum No. WY-2012-032: an IM dated March 27, 2012, implementing Wyoming Reclamation Policy. The Associate State Director implemented the Wyoming Reclamation Policy, which identifies ten reclamation requirements that must be addressed when developing reclamation proposals for surface disturbing activities.

6.1.2 Public Land Uses and Affected Resources

The public lands in the CFO primarily are used for livestock grazing, mineral extraction, and recreation (camping, hiking, hunting, and OHV use where allowed). The CFO provides 462 leases for the grazing of cattle, sheep, horses, bison, and goats on 1.4 million acres of public lands (BLM 2007b). Mineral leases allow for the extraction of coal, geothermal resources, oil and gas, and other solid leasable material such as bentonite, phosphates, trona, and uranium. Recreational use of public lands in the CFO includes relatively unregulated use of rural lands including four Special Recreation Management Areas, two National Back Country Byways and miles of NHTs.

Resources that likely would be impacted by the Converse County Oil and Gas Project would be biological, heritage, and visual in nature. Biological resources generally would relate to terrestrial wildlife habitat with an emphasis on sage grouse, raptors, and migratory birds. Impacts to cultural resources and resources of Native American concern would directly affect cultural resources of all types as well as the integrity of the viewshed for many of these types of resources, including in the vicinity of the NHTs and the Pine Ridge area. More information on impacts to these areas and resources can be found in Chapters 4.0 and 5.0 of the EIS.

6.1.3 Converse County Oil and Gas Project

6.1.3.1 Description of Converse County Project Area

The Project is an oil and natural gas exploration and development project proposed by an OG comprised of Anadarko ***(now Occidental Petroleum Corporation)***, Chesapeake Energy Corporation, EOG Resources, Inc., Devon Energy, and ***Northwoods*** Energy.

The CCPA comprises an area of approximately 1.5 million acres in Converse County, Wyoming. Approximately 6 percent of the CCPA is public lands administered by the BLM, 4 percent is administered by the USFS within the TBNG, seven percent is administered by the State of Wyoming, and the remaining 83 percent is privately owned. The BLM administers the minerals underlying approximately 64 percent of the land surface within the CCPA. The CCPA is dominated by rolling plains with sagebrush shrubland and grassland as the dominant vegetation communities.

Existing oil and gas infrastructure within the CCPA consists of the following (WOGCC 2015b):

- 1,520 productive wells on 1,366 well pads;
- 16 waste water disposal well pads;
- 1,822 miles of access roads;
- 5 gas plants;
- 1 central processing facility;

- 18 compression facilities;
- 1 equipment/pipe storage yard;
- 1 workforce facility;
- 6 freshwater makeup ponds;
- 1,184 miles of gas gathering and trunk pipelines;
- 538 miles of oil gathering and trunk pipelines; and
- 911 miles of overhead electrical distribution lines.

Approximately 20 pipeline operators service the various oil and gas fields within the CCPA. The greatest concentration of gathering pipelines occurs in the southeastern and northwestern portions of the CCPA. In the center of the CCPA four co-located gas trunk pipelines run north to south passing through the USFS administrative boundary for the TBNG. Rocky Mountain Power and Niobrara Electric provide power to the CCPA through 911 miles of electrical distribution lines. Of the 911 miles of electrical distribution lines, 779 are owned and operated by Rocky Mountain Power (Rocky Mountain Power 2015) and 132 are owned and operated by Niobrara Electric (Niobrara Electric 2015).

Planned federal oil and gas development in the CCPA includes those facilities described in the NEPA documents for the following previously approved development projects:

- Mowhawk EA: up to 32 wells on 6 well pads;
- Scott Field EA: up to 150 wells on 40 well pad;
- Spearhead Ranch EA: up to 224 wells on 56 well pads;
- Highland Loop Road EA: up to 148 wells on 37 well pads;
- East Converse EA: up to 72 wells on 18 well pads; and
- Samson Hornbuckle EA: up to 288 wells on 48 well pads.

Based on the foregoing documents and accounting for the mineral ownership in the area, an estimated 1,663 wells remain to be drilled on 361 new well pads in addition to the 1,520 existing wells in the CCPA (as of January 9, 2015). Infrastructure also would be constructed to support the 1,633 new wells as disclosed in the above NEPA documents.

6.1.3.2 Description of Proposed Development of the CCPA

The OG proposes to explore and develop potentially productive subsurface formations underlying the CCPA. Planned activities include the following:

- 5,000 oil and natural gas wells on 1,500 multi-well pads at a rate of 500 well per year for a period of 10 years;
- 455 additional pads for production, water source, and disposal wells;
- 1,580 miles of new well pad access roads;
- 390 miles of collector roads;
- 874 acres of construction and production facilities; and
- 17,272 acres of linear facilities (oil and gas pipelines, water pipelines, and electrical distribution lines).

6.1.3.3 Summary of Proposed Surface Disturbance within the CCPA

The existing oil and gas infrastructure occupies approximately 13,819 acres (0.9 percent) of the CCPA. Planned oil and gas infrastructure would disturb an additional 10,253 acres (0.7 percent) of the CCPA. The Proposed Action would disturb 52,667 acres in addition to the existing and planned development resulting in 5.1 percent of the CCPA disturbed by existing and future development. Impacts to resources from development are analyzed in Chapter 4.0 of the EIS.

6.2 Mitigation Hierarchy

The mitigation hierarchy involves ***five*** levels of action to limit the negative impacts of development projects that are applied in the following order: avoidance, minimization, rectification, reduction, and compensation.

6.2.1 Avoidance

Avoidance of valued resources during project siting and/or execution requires early screening of biodiversity, ecological services, cultural resources, and other identified resources of value as well as analysis of alternate locations for siting or schedule adjustments. Development in areas where NSO, CSU, and timing limitation stipulations apply should be avoided per the guidance in the CFO RMP, the USFS TBNG LRMP, the BLM Approved Resource Management Plan Amendment, and the USFS Land Management Plan Amendments. Resources within the CCPA to be spatially and temporally avoided include the following:

- Class 1 and Class 2 waters – CSU within 500 feet to 0.25 mile
- Cultural resources
- Highly erosive soils
- Slopes greater than 40 percent and soils susceptible to mass failure.
- Historic trails
  - NSO on selected parcels along the Bozeman and Oregon trails as identified in Appendix W of the BLM ROD and Approved Casper RMP (BLM 2007b) and on trail traces mapped in the CFO GIS database
  - CSU within 0.25 mile or the visual horizon of trail remains, and extending to the viewshed foreground (out to a maximum of 3 miles)
- Mountain plover
  - 0.25-mile buffer around occupied mountain plover nests
  - Conditions of approval on APDs from April 10 to July 10 where populations are known to occur
- Prairie dog town complexes
  - Prohibit construction and drilling from March 1 through August 31 if black-footed ferrets are present in the TBNG
- Raptor nests
  - Bald Eagle – 1-mile NSO buffer from February 1 to July 31
  - Bald Eagle winter roosts – 1-mile NSO buffer from November 1 to March 31
  - Golden Eagle – 0.25-mile NSO buffer from February 1 to July 31
  - Merlin – 0.25-mile NSO buffer from April 1 to August 15

- Ferruginous Hawk – 0.25-mile NSO buffer from March 1 to July 31
- Swainson's Hawk – 0.25-mile NSO buffer from March 1 to July 31
- Burrowing Owls – 0.25-mile NSO buffer from April 15 to August 31
- Other raptors – 0.125-mile buffer from February 1 to July 31

- Raptor artificial nesting structures February 1 to July 31
  - Ferruginous Hawk – 0.5-mile NSO buffer plus 0.5-mile seasonal buffer
  - Golden Eagle – 0.5-mile NSO buffer
- Sage grouse, leks, core areas, nesting, early brood-rearing, wintering habitats, PHMAs, and GHMAs
  - NSO or no surface disturbing activities on or within a 0.6-mile radius of the perimeter of occupied sage-grouse leks
  - No surface disturbing and/or disruptive activities within PHMA from March 15 to June 30 to protect sage-grouse breeding, nesting, and early brood rearing habitat
  - No surface disturbing and/or disruptive activities within PHMAs (connectivity only) from March 15 to June 30 to protect breeding, nesting, and early brood-rearing habitats within 4 miles of the lek or lek perimeter of any occupied sage-grouse lek
  - No 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 PHMAs
  - NSO within 0.25 mile of occupied leks. Avoid human activity between 8 PM and 8 AM from March 1 to May 15 within GHMAs
  - Avoid surface disturbing activities in suitable nesting and early brood rearing habitats within 2 miles of occupied leks or in identified nesting and brood rearing habitats outside of the 2-mile buffer from March 15 to July 15 within GHMAs
  - Construction of new oil and gas development is prohibited within 0.25 mile of display grounds within GHMAs
  - No construction or drilling within 2 miles of active display grounds from March 1 to June 15 within GHMAs
  - Limit new noise levels to 10 dBA above ambient noise (existing activity included) measured at the perimeter of a lek from 6 PM to 8 AM from March 1 to May 15
  - Avoid surface disturbance in winter concentration areas from December 1 to March 15
- Sharp-tailed grouse
  - Construction of new development is prohibited within 0.25 mile of active display grounds in the TBNG
  - Construction and drilling is not permitted within 1 mile of active display grounds from March 1 to June 15 on the TBNG
- Special management areas
- Special status plant species – NSO on designated critical habitat
- Springs and wells
  - CSU within 500 feet
  - Swift fox dens – no construction or drilling within 0.25 mile of dens from March 1 to August 31

- Waterbodies – NSO within 500 feet; and
- Wetlands and riparian areas – NSO within 500 feet

6.2.2 Minimization

Minimization is defined as measures taken to limit the degree or magnitude of the action and its implementation. It requires making reasonable predictions of impacts that would remain after avoidance has been applied and looking for minimization opportunities throughout the life of the project. Minimization measures would best be achieved in conjunction with monitoring and adaptive management. This EIS identifies existing requirements, regulatory guidelines, OG-committed design features, and additional mitigation measures (Section 6.***5***) designed to minimize impacts.

6.2.3 Rectification

Rectification involves repairing, restoring, or rehabilitating impacts to a resource that cannot be avoided or adequately minimized. The type and amount of rectification would depend on the importance, sensitivity, and scarcity of the resource as well as existing land use plan or policy protection measures. Rectification would take place as soon as possible after the onset of the impacts.

6.2.4 Reduction

Impact reduction typically involves actions taken over time to reduce or eliminate impacts to resources that cannot be avoided or adequately minimized or rectified. Much like rectification, the type and amount of rectification would depend on the importance, sensitivity, and scarcity of the resource as well as existing land use plan or policy protection measures and would take place as soon as possible after the onset of the impacts.

6.2.5 Compensation

Compensatory mitigation is the final step in the mitigation hierarchy ***by providing replacement*** and aims to compensate for residual impacts that cannot be avoided or adequately minimized. Typically, compensatory mitigation would target the same resources or ecosystem services that are impacted, but that is not always the case. Occasionally the target resources or ecosystem services could be different from what was impacted if it is judged to be of a higher priority.

6.2.5.1 Laws, Regulations, Policies, and Land Use Plan Objectives

If residual impacts affect the ability to comply with laws, regulations, policies, and/or land use plan objectives compensatory mitigation would be warranted to offset the impact(s). The selected forms of mitigation should consider other agency, tribal, state, and local laws, regulations, and policies and the beneficial or negative effects that could occur from the selected forms of mitigation.

6.2.5.2 Types of Compensatory Mitigation

There are four types of compensatory mitigation typically used; restoration, establishment, enhancement, and preservation. All are focused on benefiting a resource value.

<u>Restoration</u>

Restoration mitigation can be used to return or re-establish an area containing a valuable resource, or resources to pre-disturbance conditions or a condition equal to baseline conditions. This could apply to important wildlife habitat, river segments, or a culturally important location. Complete restoration could take considerable time and would be subject to environmental conditions.

Establishment

Establishment mitigation is the creation of an environment that is conducive to the existence of a resource value. This is accomplished through the manipulation of physical, chemical, and/or biological characteristics in an area that did not previously support the resource value.

Enhancement

Enhancement mitigation is used to improve an area that supports a resource value. The resource value can be biological, cultural, or human use of the land (i.e., recreational or visual).

Preservation

Preservation mitigation is used to develop a plan for long-term protection of a resource value from future impacts through legal or physical mechanisms. This would often include a reduction or exclusion of an action that is incompatible with the desired condition necessary for the resource value.

6.3 Federal Agency Management Goals and Objectives

The overall goal of this mitigation section is to provide guidance for the development of mitigation measures during subsequent site-specific evaluation of development proposals for the Project. Mitigation is organized to address the following specific objectives:

- Identify the goals and objectives of the BLM CFO RMP and the 2015 Approved Resource Management Plan Amendment, and the USFS TBNG LRMP and the Greater Sage-grouse ROD;
- Identify resources that would be impacted by development; and
- Identify key conservation opportunities.

6.3.1 BLM Casper Field Office

The goals and objectives of the BLM CFO involve the management of the following eight resource topics as listed in the ROD and Approved Casper RMP as amended in 2012.

1. Physical Resources;
2. Mineral Resources;
3. Fire Management and Ecology;
4. Biological Resources;
5. Heritage and Visual Resources;
6. Land Resources;
7. Special Management Areas; and
8. Socioeconomic Resources.

Six of the eight resource topics could be affected by oil and gas development and are discussed in Sections 1.2.1.1 through 1.2.1.6

6.3.1.1 Physical Resources

Goal PR:1 Minimize the impact of management actions in the planning area on air quality by complying with all applicable air quality laws, rules, and regulations.

Objectives:

PR:1.1 Comply with applicable state and federal AAQS for criteria pollutant concentration levels associated with management actions.

PR:1.2 Maintain concentrations of PSD pollutants associated with management actions in compliance with the applicable increment.

Goal PR:2 Implement management actions within the scope of the BLM's land-management responsibilities to improve air quality as practicable.

Objectives:

PR:2.1 Reduce visibility-impairing pollutants in accordance with the reasonable progress goals and timeframes established within the State of Wyoming's Regional Haze State Implementation Plan.

PR:2.2 Reduce atmospheric deposition levels below generally accepted level of concern and level of acceptable change.

Goal PR:5 Maintain or improve surface water and groundwater resources consistent with applicable state and federal standards and regulations.

Objectives:

PR:5.1 Maintain watershed, wetland, and riparian functions to support surface-flow regimes and water quality.

PR:5.2 Minimize or control contributions of nonpoint source pollution from public lands to receiving waterbodies, with particular attention being paid to special management waters (i.e., water quality limited segment) established by the State of Wyoming.

PR:5.3 Improve control of sources of pollutants on federal lands that may threaten drinking-water sources.

Goal PR:6 Provide for physical and legal availability of water to facilitate authorized uses on public lands and to protect and provide conservation of those waters.

Objectives:

PR:6.2 Improve opportunities for water conservation. Apply water conservation measures to all developments, where practical.

PR:6.4 Develop and implement a procedure for conversion of abandoned oil and gas wells to livestock and wildlife water supply use.

Goal PR:7 Bring all watersheds to their full potential conditions.

Objectives:

PR:7.2 Improve protection for surface water and groundwater sources.

6.3.1.2 Biological Resources

Goal BR:1 Manage for the biological integrity of terrestrial and aquatic ecosystems to sustain vegetation, fish, wildlife, and special status species, while providing for multiple uses of BLM-administered lands.

Objectives:

BR:1.1 Maintain a diversity and distribution of plant species, habitats, seral stages, and types (e.g., age, structure, cover classes, density), including forests and woodlands, grasslands, mountain shrublands, sagebrush (all subspecies), riparian/wetland areas, and desert shrublands.

BR:1.6 Maintain internal (BLM) and external support for managing invasive and noxious plant species using an integrated approach for the detection, control, or eradication of new infestations.

BR:1.7 Continue coordination of invasive and noxious plant species detection and control activities across jurisdictional and political boundaries and include provisions for invasive and noxious plant species management for all BLM-funded or authorized actions.

BR:1.8 Maintain adequate baseline information regarding the extent and control of invasive and noxious plant species to make informed decisions, evaluate effectiveness of management actions, and assess progress toward goals to improve invasive and noxious plant species management.

BR:1.14 Maintain or improve the continuity and productivity of wildlife habitats to support the WGFD wildlife population objectives.

BR:1.15 Maintain and improve seasonal habitats (e.g., concentration areas, migration corridors, etc.) of fish, wildlife, and special status species on a landscape scale.

BR:1.17 Maintain special status species plant communities in natural patterns on a landscape scale and maintain special status plant species' habitats in proper functioning condition, including natural diversity (i.e., composition and mosaics) and recognizing the impacts of natural processes (i.e., fire).

Goal BR:2 Manage all BLM actions or authorized activities to sustain plant, fish, and wildlife populations and their habitats and to avoid contributing to the listing of or jeopardizing the continued existence or recovery of special status species and their habitats.

Objectives:

BR:2.1 Minimize adverse impacts and mitigate unavoidable impacts to plant, fish, wildlife, and special status species and their habitats from BLM actions and authorized activities.

Goal BR:4 Manage terrestrial and aquatic ecosystems to provide sustainable recreational and educational benefits to the public.

Objectives:

BR:4.1 Improve public awareness and support, including partnerships, for the conservation, restoration, and management of vegetation, fish, wildlife, and special status species programs.

BR:4.2 Provide wildlife and wildlife habitat outreach and educational materials to the public on an annual basis.

6.3.1.3 Heritage and Visual Resources

Goal HR:1 Preserve and protect cultural and paleontological resources and ensure that they are available for appropriate use by present and future generations.

Objectives:

HR:1.1 Develop project or site-specific treatment plans or other protective measures for special areas or cultural resources in areas of high risk for development or at high risk for adverse impacts.

HR:1.2 Consult with Native American tribal governments at the leasing stage for proposed land uses having the potential to impact cultural resources identified as having tribal interests or concerns.

Goal HR:3 Promote stewardship, conservation, and appreciation of cultural and paleontological resources.

Objectives:

HR:3.1 Maintain and enhance programs that provide opportunities for scientific research of cultural and paleontological resources.

HR:3.2 Improve educational opportunities and public outreach programs.

HR:3.3 Develop and maintain interpretation of cultural and paleontological resources in areas of high public interest and access.

Goal HR:4 Establish a working relationship with Native American tribes.

Objectives:

HR:4.1 Maintain proactive consultation with Native Americans, as appropriate, to identify resource types or places that may be impacted by BLM authorizations or actions.

Goal HR:5 Manage public lands in a manner that will maintain the overall scenic (visual) quality of these lands.

Objectives:

HR:5.1 Class II: Retain the existing character of the landscape. The level of change should be low. Management activities should be seen, but not attract attention of the casual observer. The basic elements of form, line color, and texture found in the predominant natural features of the characteristic landscape should be repeated.

HR:5.2 Class III: Partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention, but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.

HR:5.3 Class IV: Provide for management activities that require major modification of the existing character of the landscape. The level of change to the characteristic landscape can be high. These management activities may dominate the view and be the focus of the viewer's attention; however, every attempt should be made to minimize the impacts of these activities through careful location, minimizing disturbance, and repeating elements.

6.3.1.4 Land Resources

Goal LR:1 Manage the acquisition, disposal, withdrawal, and use of public lands to meet the needs of internal and external customers and to preserve important resource values.

Objectives:

LR:1.3 Maintain availability of public lands to meet the habitation, cultivation, trade, mineral development, recreation, and manufacturing needs of external customers and the general public.

Goal LR:3 Manage public lands to meet transportation and ROW needs.

<u>Objectives:</u>

LR:3.1 Make public lands available to meet the needs of major ROW customers (e.g., an intrastate pipeline).

LR:3.2 Make public lands available to meet the needs for smaller ROW (e.g., roads or pipelines for oil fields).

6.3.1.5 Special Management Areas

Goal SD:10 Manage the Sand Hills Management Area to maintain the integrity of soils and vegetation and to protect highly erosive soils and watershed values.

Goal SD:14 Manage historic trails for long-term heritage and educational values and to enhance the public experience.

<u>Objectives:</u>

SD:14.1 Sites associated with historic trails will be interpreted and developed as needed.

SD:14.2 Maintain compatible recreational use with historic trail values.

Goal SD:16 Reduce imminent threats from natural or human-caused deterioration or potential conflicts with other resource uses.

<u>Objectives:</u>

SD:16.1 Maintain an inventory and evaluate trail segments for contributing or non-contributing status and include this information in a revised trails management plan.

SD:16.3 Maintain setting for those contributing trail segments where setting is an aspect of integrity by utilizing viewshed management tools.

SD:16.4 Develop activity plans for contributing trails segments and associated sites identified as high risk for adverse impacts.

6.3.1.6 Socioeconomic

Goal SR:1 Provide opportunities to develop national energy resources on BLM-administered lands within the planning area.

Goal SR:3 Provide opportunities to sustain the cultural, social, and economic viability of local and regional communities by using decision-review processes that include considerations of various potential impacts of BLM decisions, including housing, employment, population, fiscal impacts, social services, cultural character, and municipal utilities.

Goal SR:5 Reduce potential risks associated with known hazards resulting from human activity, including, but not limited to, health and safety issues and other sensitive resource values.

6.3.2 USFS Thunder Basin National Grassland Goals and Objectives

The goals and objectives of the USFS TBNG involve the management of grassland that is consistent with the USFS mission of sustaining the health, productivity, and diversity of the land to meet the needs of present and future generations. The four goals and associated objectives are discussed in Sections 1.2.2.1 through 1.2.2.4.

6.3.2.1 Goal 1: Ensure Sustainable Ecosystems

Promote ecosystem health and conservation using a collaborative approach to sustain the Nations forests, grasslands and watersheds.

Goal 1.a: Improve and protect watershed conditions to provide the water quality and quantity and soil productivity necessary to support ecological functions and intended beneficial water uses.

Objectives:

1. Within 10 years, identify watershed conditions to provide baseline data sufficient to meet the following objectives:
    - Improve 20 percent of 6th Hydrologic Unit Code (sub-watershed) level watersheds from Class II to Class I, or from Class III to Class II. Maintenance of unimpaired watersheds and restoration of impaired watershed are high priorities.
    - Achieve a 20 percent reduction in acres of eroded or disturbed soils by Forest Service permitted or management actions.
    - Achieve a 20 percent reduction in the amount of degraded waterbodies, such as dam impoundments by Forest Service permitted or management actions.
2. Implement management practices that will move at least 80 percent of riparian areas and woody draws toward self-perpetuating tree and shrub communities within site capability.
3. At least 80 percent of the perennial streams will meet or move toward proper functioning condition.
4. Within 15 years, identify, maintain, and/or improve stream flows for at least 10 percent of stream segments having high resource values within watersheds.
5. Throughout the life of the Plan, ensure proper plugging of abandoned wells to prevent cross contamination of aquifers (e.g., seismograph holes, water wells, etc.).

Goal 1.b: Provide ecological conditions to sustain viable populations of native and desired non-native species and to achieve objectives for MIS.

Objectives:

1. As scientific information becomes available, jointly develop with the USFWS and other agencies conservation and recovery strategies for plant and animal species, listed as threatened or endangered under the ESA, and implement established conservation or recovery strategies over the life of the Plan.
2. Within 15 years, demonstrate positive trends in population viability, habitat availability, habitat quality, population distribution throughout the species range within the planning area, and other factors affecting threatened, endangered, sensitive species and MIS.
3. Develop and implement conservation strategies for Forest Service sensitive species, as technical information becomes available.
4. Within 15 years, conserve populations of species at risk and rare communities by demonstrating positive trends in habitat availability and quality, or any other applicable factors affecting species at risk.
5. Identify rare plant and animal communities, inventory them, and develop associated management strategies to conserve them. Support the development and implementation of State and Regional Conservation Plans as they apply to the grassland or forest units.

6. Within 10 years, provide sufficient habitat for MIS to reduce adverse impacts on populations during droughts.
7. Establish scientifically credible monitoring programs, develop survey methods, and initiate baseline and trend surveys for populations, habitats and/or ecological conditions to contribute to viability of threatened and endangered species, species at risk, and MIS.
8. Complete and initiate implementation of conservations strategies for globally rare plant species (G2-3 rankings) including Barr’s milkvetch and other high priority species in cooperation with other conservation agencies and organizations.
9. Conduct target surveys for globally rare plant species (Barr’s milkvetch, smooth goosefoot, Ute ladies’ tresses) and other rare plant species with viability concerns.

Goal 1.c: Increase the amount of forests and grasslands restored to or maintained in a healthy condition with reduced risk and damage from fires, insects and diseases, and invasive species.

Objectives:

1. Within 10 years, implement management practices, including prescribed fire, that will move all affected landscapes toward desired vegetation composition and structure as described in Geographic Area direction.
2. Over the next 15 years, retain only those range structures (fences and water developments) that achieve resource management (i.e., wildlife habitat, botanical, range management, visual quality, and recreation) goals and objectives.
3. Within 5 years, develop and implement cooperative noxious weeds and undesirable non-native or invasive species management plans in consultation with appropriate partners and agencies.
4. Within 3 years, develop and implement a certified noxious weed-free forage program in consultation with appropriate state agencies.
5. Within 10 years, limit further expansion of areas affected by noxious weeds.
6. Within 10 years, implement an integrated prevention and pest control management program for noxious weeds and undesirable non-native or invasive plant species.
7. Immediately initiate hazardous material cleanup on identified sites.
8. In a timely manner, review PSD permit applications, and make recommendations where needed to reduce impacts to those Congressionally designated Class I areas specified in the Federal Clean Air Act as subject to air quality related values.

6.3.2.2 Goal 2: Multiple Benefits to People

Provide a variety of uses, values, products, and services for present and future generations by managing within the capability of sustainable ecosystems.

Goal 2: Multiple Benefits to People Provide a variety of uses, values, products, and services for present and future generations by managing within the capability of sustainable ecosystems.

Goal 2.a: Improve the capability of the Nation's forests and grasslands to provide diverse, high-quality outdoor recreation opportunities.

Objectives:

1. Annually maintain or reconstruct 20 percent of National Grassland trails to regional standards.

2. Over the next 15 years, provide readily available information concerning recreation opportunities for developed, historic, and cultural sites.
3. Within 5 years, provide appropriate directional signing to key recreation sites and inform people about the public access routes to national grasslands and national forests.
4. Within 10 years, complete site and recreation plans, including rehabilitation and re-vegetation strategies. As demand warrants, increase recreational opportunities where compatible with resource objectives. These opportunities may include trails, campgrounds, and interpretation.
5. Within 5 years, draft and begin implementing a science and marketing based interpretive program strategy that uses a variety of communication media. The purpose of the strategy will be to effectively use communication principles and methods based in the field of interpretation to:
    - Communicate with target audiences regarding management concerns or issues, changes in management direction, and specific projects
    - Enhance visitor's recreation experiences by identifying and implementing interpretive projects that highlight national grassland and forest resources and management.
6. Provide non-motorized and motorized trails for a wide variety of uses and experiences.
7. Manage trail systems to minimize conflicts among users.
8. When appropriate, authorize special use permits for outfitter-guide services on National Forest System lands.
9. Through partnerships, encourage, establish, and sustain a diverse range of recreational facilities and services on National Forest System lands. Encourage outfitters and guides who support interpretive and educational awareness of grassland ecosystems or who provide services to people with disabilities.
10. When appropriate, designate, and manage outfitted camp locations.

Goal 2.b: Improve the capability of wilderness and protected areas to sustain a desired range of benefits and values.

Wilderness Objective:

1. Within 5 years of Congressional designation, revise or develop wilderness plans to emphasize recreational, aesthetic, and educational experiences consistent with values of those areas.

Heritage Sites Objectives:

1. Within 5 years, develop and implement a heritage inventory strategy and implementation schedule to survey and evaluate sites, in support of management actions and activities as agreed upon with the SHPO, Tribal Historic Preservation Offices and to include compliance with laws Sec. 106 and Sec. 110 of the NHPA.
2. Within 5 years, assess identified sites eligible for the NRHP in conjunction with SHPO and Tribal Historic Preservation Offices and provide interpretation for NRHP sites where appropriate and consistent with developed preservation plans.
3. Within 3 years, identify and protect traditional cultural properties in consultation with federally recognized American Indian tribes.
4. Within 10 years, update prehistoric, ethnographic, and historic overviews.
5. Educate, interpret, and promote partnerships to increase public awareness, protect heritage resources, and further the goals of research.

Special Areas Objective:

1. Within 5 years, develop and implement a management and monitoring plan for each Research Natural Area.

2.c. Improve the capability of the Nation's forests and grasslands to provide a desired sustainable level of uses, values, products, and services.

Livestock Grazing Objectives:

1. Annually, provide forage for livestock on suitable rangelands. Annual grazing levels will be adjusted, as needed, during periods of drought or for other conditions.
2. As needed, revise allotment management plans to meet desired vegetative conditions described in Geographic Areas and to implement all appropriate management plan direction.

Geologic and Paleontologic Resources Objectives:

1. Within 15 years, inventory and evaluate 20 percent of high potential paleontological formations.
2. Within 15 years, develop conservation plans for significant geological and paleontological sites.
3. Within 15 years, provide interpretation for at least 20 percent of important geological and paleontological sites, consistent with the conservation plans.

Mineral and Energy Resources Objectives:

1. Ensure reclamation provisions of operating plans are completed to standard.
2. Honor all valid existing legal mineral rights.

Miscellaneous Products Objective:

1. Provide appropriate opportunities to satisfy demand for miscellaneous products (special forest and grassland products, such as mushrooms, floral products and medicinal plants) through environmentally responsible harvest and collection methods on National Forest System Lands.

Scenery Objective:

1. Implement practices that will meet, or move the landscape character toward scenic integrity objectives.

Special Uses Objective:

1. Ensure all special use permits are meeting requirements for customer service and are in compliance with the terms of their permits or contracts.

Wildlife, Fish, and Plant Use Objectives:

1. Within 10 years, identify, manage, develop, and interpret appropriate watchable wildlife and plant viewing sites.
2. Within 10 years, support native and desirable non-native plant, fish, and wildlife populations by meeting or making measurable progress towards desired vegetative composition and structure, as described in Geographic Area direction.

6.3.2.3 Goal 3: Scientific and Technical Assistance

Develop and use the best scientific information available to deliver technical and community assistance and to support ecological, economic, and social sustainability.

Goal 3.a: Improve the knowledge base provided through research, inventory, and monitoring to enhance scientific understanding of ecosystems, including humans, to support decision-making and sustainable management of the Nation's forests and grasslands.

Objectives:

1. Implement inventory and monitoring systems to provide scientific information and decision support across all land ownerships.
2. Provide research results and tools through technology transfer to support effective management, protection, and restoration of ecosystems.
3. Assess potential habitat capability at the local level for management indicator species by identifying existing or establishing new reference areas and implementing long-term monitoring. Some reference areas will need to be managed for multiple-year accumulation of vegetation and litter for those management indicator species of high structure grasslands and sagebrush habitats.
4. Assess the potential impacts of the construction of impoundments in upper watersheds on hydrologic flows and patterns on downstream habitat on the sturgeon chub and other sensitive native fish species.
5. Assess the condition of watersheds containing aquatic habitats of sensitive fish species that are found primarily in clear-water streams and rivers.

6.3.2.4 Goal 4: Effective Public Service

Ensure the acquisition and use of an appropriate corporate infrastructure to enable the efficient delivery of a variety of uses.

Goal 4.a: Improve the safety and economy of the Forest Service roads, trails, facilities, and operations and provide greater security for the public and employees.

Objectives:

1. Within 5 years, identify travel opportunities and restrictions, including designating motorized travel-ways and areas, to meet land management objectives. Provide reasonable access for use of the national grasslands and national forests.
2. Within 5 years, provide site-specific maps and information showing closures, restrictions, and opportunities for motorized and non-motorized use using a science-based Roads Analysis process.
3. Within 5 years, identify the minimum Forest Service road system for administration, utilization, and protection of National Forest system lands and resources, while providing safe and efficient travel and minimizing adverse environmental effects.
4. Where appropriate, encourage and authorize recreation opportunities for people with disabilities.

4.b. Provide appropriate access to National Forest System lands and Forest Service programs.

Land Ownership and Access Objectives:

1. Within 3 years, develop and implement approved land ownership adjustment plan in response to resource management and public needs. The plan shall be coordinated, reviewed, and updated annually.
2. Within 3 years, develop and implement a 5-year ROWs Acquisition Program in response to resource management programs and access needs. This 5-year plan will be coordinated, reviewed, and updated annually.

Unauthorized Uses Objective:

1. Take appropriate law enforcement or administrative actions on all unauthorized uses.

Public and Organizational Relations Objectives:

1. Provide opportunities for federally recognized American Indian tribes to participate in planning and management of the national grasslands and national forests, especially where tribes have claimed special geographic, historical, or cultural interest.
2. Work in cooperation with federal, state, and county agencies, individuals, and nongovernment organizations for control of noxious weeds and invasive species and animal damage.
3. Create and foster partnerships with other agencies, accredited educational and research institutions, and other appropriate public and private sector organizations to further the goals of research, education, protection, and interpretation.
4. Cooperate with the appropriate state and federal agencies in balancing desired wildlife and fish population objectives with desired habitat conditions.
5. Identify opportunities for partnerships to provide new recreational fisheries and/or waterfowl and wetlands habitat.

6.3.3 Combined Goals and Objectives from the BLM Record of Decision and Approved Resource Management Plan Amendment and the USFS Greater Sage-grouse Record of Decision and Land Management Plan Amendment

Goal: Conserve, recover, and enhance sage-grouse habitat on a landscape scale consistent with local, state, and federal management plans and policies, as practical, while providing for multiple use of BLM administered lands and National Forest System lands.

<u>Objectives:</u>

1. In cooperation with State of Wyoming and its agencies, local governments, private landowners, local sage-grouse working groups, partners and stakeholders, develop site-specific conservation strategies to maintain or enhance sage-grouse habitats and habitat connectivity.
2. Enhance quality/suitable habitat to support the expansion of sage-grouse populations on federally administered lands within the planning areas.
3. Manage sage-grouse seasonal habitats and maintain habitat connectivity to support population objectives set by the State of Wyoming in cooperation with the agencies.
4. Identify and prioritize opportunities for habitat enhancement and conservation within sage-grouse core habitat areas based on threats and the ability to manage sage-grouse habitat.
5. Restore native (or desirable) plants and create landscape patterns which most benefit sage-grouse.

6. Develop specific objectives to conserve, enhance or restore sage-grouse priority habitat based on Ecological Site Descriptions (Forest Service may use other methods) and BLM land health evaluations (including within wetland and riparian areas) taking into account site history (historic treatments or habitat manipulations) that have changed the soil chemistry possibly altering the Ecological Site Description. If an effective grazing system that meets sage-grouse habitat requirements is not already in place, analyze at least one alternative that conserves, restores, or enhances sage-grouse habitat in the NEPA document prepared for grazing management (Doherty et al. 2010; Williams et al. 2011).
7. Establish measurable objectives related to sage-grouse habitat from baseline monitoring data, Ecological Site Descriptions (Forest Service may use other methods), or land health assessments/evaluations.
8. Manage for vegetation composition and structure consistent with ecological site potential (Forest Service may use other methods) to achieve sage-grouse seasonal habitat objectives.
9. Incorporate available site information collected using the Sage-grouse Habitat Assessment Framework or similar methods to evaluate existing resource conditions and to develop any necessary resource solutions in cooperation with State of Wyoming and its agencies, the local governments, private landowners, project proponents, partners, and stakeholders.
10. Incorporate management practices that will provide for maintenance and/or enhancement of sage grouse habitats, including specific attention to maintenance of desired understories of sagebrush plant communities. When developing objectives for residual cover and species diversity, identify the ecological site types within the planning area and refer to the appropriate Ecological Site Descriptions (Forest Service may use other methods).
11. In determining appropriate management actions that will be considered, refer to the document, “Grazing Influence, Management, and Objective Development in Wyoming's Greater Sage-grouse Habitat” (Cagney et al. 2010) for guidance.
12. Identify PHMAs and GHMAs for each Western Association of Fish and Wildlife Agencies (WAFWA) management zones (MZ) across the current geographic range of greater sage-grouse that are large enough to stabilize populations in the short term and enhance populations over the long term. Greater sage-grouse habitat in this planning area overlaps 2 WAFWA MZs: (1) MZ I-Great Plains and (2) MZ II-Wyoming Basin.
13. Protect PHMAs and GHMAs from anthropogenic disturbance that will reduce distribution or abundance of greater sage-grouse.
14. Priority will be given to leasing and development of fluid mineral resources, including geothermal, outside of PHMA and GHMA. When analyzing leasing and authorizing development of fluid mineral resources, including geothermal, in PHMA and GHMA, and subject to applicable stipulations for the conservation of greater sage-grouse, priority will be given to development in non-habitat areas first and then in the least suitable habitat for greater sage-grouse. The implementation of these priorities will be subject to valid existing rights and any applicable law or regulation, including, but not limited to, 30.S.C. 226(p) and 43 CFR 3162.3-1(h). Where a proposed fluid mineral development project on an existing lease could adversely affect greater sage-grouse populations or habitat, the BLM will work with the lessees, operators, or other project proponents to avoid, reduce and mitigate adverse impacts to the extent compatible with lessees' rights to drill and produce fluid mineral resources. The BLM will work with the lessee, operator, or project proponent in developing an APD for the lease to avoid and minimize impacts to sage-grouse or its habitat and will ensure that the best information about the greater sage-grouse and its habitat informs and helps to guide development of such federal leases.
15. In all sagebrush focal areas and PHMAs, the desired condition is to maintain a minimum of 70 percent of lands capable of producing sagebrush with 10 to 30 percent sagebrush canopy

cover. The attributes necessary to sustain these habitats are described in Interpreting Indicators of Rangeland Health (BLM Tech Ref 1734-6).

16. The habitat objectives will be part of the sage-grouse habitat assessment to be used during land health evaluations (see Monitoring Framework). These habitat objectives are not obtainable on every acre within the designated greater sage-grouse habitat management areas. Therefore, the determination on whether the objectives have been met will be based on the specific site's ecological ability to meet the desired condition identified in the table.

6.4 OG-Committed Design Features

In addition to federal and state regulatory requirements and guidance the OG has committed to adhering to the following additional design features.

6.4.1 Air Quality

- During dry periods, all appropriate measures shall be taken to control fugitive dust. These measures may include, but are not limited to, the application of water or chemical dust suppressants. Dust control measures would be subject to surface landowner approval.
- Speed limits (e.g., 25 miles per hour 40 km per hour) would be posted along all access roads and enforced during construction and maintenance activities to reduce airborne fugitive dust.
- Operators would use Tier 2 drill rigs when drilling wells for the Converse County Project. This does not apply to water rigs, workover rigs, or casing rigs.
- ***Where needed, operators would use Tier 4 diesel generators to power wells.***
- ***To address concerns with PM and dust impacts, increase the use of dust suppressant during construction and project activities near residences and schools when dust is visible.***
- ***To address concerns with PM and dust impacts, reduce speed limits on lease roads to 25 miles per hour.***
- ***To address concerns with near-field 1-hour NO_2 impacts, follow the Wyoming Oil and Gas Conservation Commission 500 feet setback guidance for well sites.***
- ***To address concerns with nitrogen deposition impacts, use a lower compressor engine NO_x factor of 0.5 g/hp-hr.***

6.4.2 Cultural Resources, Historic Trails, and Resources of Native American Concern

There are no OG-committed design features for this resource.

6.4.3 Geology and Mineral Resources

There are no OG-committed design features for this resource.

6.4.4 Hazardous Materials, Solid Waste, and Public Health and Safety

- The Operators would place dumpsters at each construction site to collect and store garbage and refuse, and they would ensure that all refuse and garbage is transported to a State-approved sanitary landfill for disposal.
- SPCC plans would be implemented and adhered to in a manner such that spills or accidental releases of oil would be remediated. An orientation would be conducted by the Operators to make project personnel aware of the potential impacts that can result from accidental spills, and to ensure they know the appropriate response when a spill occurs.

6.4.5 Land Use

There are no OG-committed design features for this resource.

6.4.6 Lands and Realty

There are no OG-committed design features for this resource.

6.4.7 Noise

There are no OG-committed design features for this resource.

6.4.8 Paleontological Resources

There are no OG-committed design features for this resource.

6.4.9 Range Resources

- The operators may install temporary fencing around the outer disturbed perimeter of the well site, in accordance with committed surface use agreements.
- Operators would inform employees and contractors regarding land ownership boundaries and any restrictions for on and off-road vehicle activity by employees and contract workers to the immediate area of authorized activity or existing roads and trails.

6.4.10 Recreation

- Operators would inform employees and contractors regarding land ownership boundaries and any restrictions for on and off-road vehicle activity by employees and contract workers to the immediate area of authorized activity or existing roads and trails.

6.4.11 Socioeconomics and Environmental Justice

Following public review of the SDEIS the OG submitted the following commitment to hold annual meetings with Converse County commissioners:

> ***Members of the Operator Group commit to meet individually with a delegation of Converse County commissioners every year they are developing in the Project area for up to 10 years after issuance of the ROD for the Project. This meeting will occur between October and December of a given year, which will generally coincide with the finalization of individual operator's budgets for the upcoming year. At this meeting, the operator will describe to the county commissioners its anticipated level of activity, such as the number of drill rigs and/or completions activities that the operator will operate within the Project Area during the upcoming year, and construction of large planned facilities (such as compressor stations, major pipelines, and communication towers). The operator and county commissioners will discuss potential impacts of this anticipated development on roads and other infrastructure. As condition of this meeting, the county commissioners commit to keep sensitive information (such as rig and completions activities) received from an individual operator confidential and should recognize that information provided about anticipated activities is always subject to change.***

6.4.12 Soils

- Final roadway alignments may include but not be limited to erosion control measures to stabilize steeper slopes and to prevent loss of soil. These measures could include as conditions dictate hay bales, shallow swales and ditches, rock/rip rap embankments, and culvert outlet protection.

Potential soil erosion would be controlled at culvert outlets with appropriate structures. Catch basins, roadway ditches, and culverts would be cleaned and maintained regularly.

- Operators would identify unstable slopes and local factors that can induce slope instability. Special construction techniques would be used where applicable in areas of steep slopes, erodible soil, and stream channel crossings.
- Where appropriate, operators would consult with private surface owners within the project area and coordinate reclamation efforts to meet committed surface use agreements.
- ***Prior to re-seeding, compacted areas would be scarified by ripping or chiseling to loosen compacted soils where underlying material would not degrade topsoil.***

6.4.13 Transportation and Access

There are no OG-committed design features for this resource.

6.4.14 Vegetation

- State- or county-listed noxious weeds resulting from disturbance associated with the proposed project would be controlled in accordance with guidelines established by the USEPA, BLM, USFS, or appropriate authorities. Prior to the use of any herbicide on federal surface, the applicator would have a commercial applicators license and a current approved Pesticide Use Proposal for the chemical being applied, submitted to and approved by BLM or USFS. When project activities occur on private surface estate, operators would adhere to committed surface use agreements.
- Seeding would occur in the next appropriate seeding season following the completion of surface disturbing activities, generally within 180 days of the last well being completed on the pad. In the fall, seeding would take place after September 15 and prior to ground frost, and in the spring after the frost has left the ground and prior to June 1. Seed mixes would be prescribed either by the surface owner or the BLM. Where appropriate, operators would adhere to committed surface use agreements on private lands.
- Any required monitoring for reclamation success would be conducted in coordination with the BLM or USFS. When project activities occur on private surface estate, operators would adhere to committed surface use agreements.
- On all areas to be reclaimed on federally administered surface estate, seed mixtures would be required to be site-specific, composed of native or other appropriate BLM- or USFS-approved species, and would be required to include species promoting soil stability. Livestock palatability and wildlife habitat needs would be given consideration in seed mix formulation. BLM or USFS guidance for native seed use is BLM Manual 1745 (Introduction, Transplant, Augmentation, and Reestablishment of Fish, Wildlife, and Plants), and EO No. 11987 (Exotic Organisms). Seed mixtures on privately owned surface estate would be determined through coordination with the landowner. When project activities occur on private surface estate, operators would adhere to committed surface use agreements.
- Interseeding, secondary seeding, or staggered seeding may be required to accomplish revegetation objectives. During rehabilitation or areas in important wildlife habitat, provision would be made for the establishment of native species, if determined to be beneficial for the habitat affected. Follow-up seeding or corrective erosion control measures may be required on areas of surface disturbance which experience reclamation failure. When project activities occur on private surface estate, operators would adhere to committed surface use agreements.
- Any mulch used would be certified weed free and free from mold or fungi. Mulch may include native hay, small grain straw, wood fiber, live mulch, cotton, jute, synthetic netting, and rock. Straw mulch should contain fibers long enough to facilitate crimping and provide the greatest

cover. When project activities occur on private surface estate, operators would adhere to committed surface use agreements.

- Operators would monitor noxious weed occurrence on the project area and implement a noxious weed control program in cooperation with the BLM or USFS, and Converse County. Weed-free certification would be required for grain or straw used for mulching re- vegetated areas. When project activities occur on private surface estate, operators would adhere to committed surface use agreements.

6.4.15 Visual Resources

- New roads and pipeline corridors, to the extent safe and practicable, would follow contours and use topography as screening. New pipelines would be combined with existing or proposed roads, where safe, practical and feasible. Where appropriate, operators would consult with private surface owners to locate facilities to accommodate and meet committed surface use agreements.

6.4.16 Water Resources

- The location of new water wells on privately owned surface estate would be coordinated with the landowner.
- Streams, wetlands, and riparian areas disturbed during project construction would be restored to as near pre-project conditions as practical, and if impermeable soils contributed to wetland formation, soils would be compacted to reestablish impermeability.
- Reclamation activities would begin on disturbed wetland areas after completion of project activities. Disturbed channel beds would be reshaped to their approximate original configuration.

6.4.17 Wetland and Riparian Areas

There are no OG-committed design features for this resource.

6.4.18 Wildlife and Aquatic Biological Resources

- Unless otherwise agreed to by the AO in writing, power lines would be constructed in accordance with the APLIC Suggested Practices for Avian Protection on Power Lines—The State of the Art in 2006 (APLIC 2006) or equivalent based on third-party power providers' Avian Protection Plans.
- Well locations and associated road and pipeline routes would be selected and designed to avoid disturbances to areas of high wildlife value (e.g., raptor nest sites, wetland areas) where safe and practical.
- If existing information is not current, field evaluations for greater sage-grouse leks and/or nests may be conducted by a qualified biologist prior to the start of activities in potential greater sage-grouse habitat. These field evaluations for leks and/or nests would be conducted if project activities are planned in potential greater sage-grouse habitat between March 15 and June 30. The Operators would coordinate with agency biologists to ensure that such surveys are conducted using proper survey methods.
- Subject to third-party power providers' Avian Protection Plans, raptor perching deterrents would be used on power lines structures within 0.5 mile of active sage-grouse leks to minimize raptors perching in the immediate area of the lek and reduce the potential for increased raptor predation during the sage-grouse breeding season.

6.5 Proposed Mitigation for the Converse County Oil and Gas EIS Project

The Converse County Oil and Gas EIS establishes mitigation measures in addition to the regulations, goals and objectives, BMPs, and OG-committed design features to reduce or eliminate impacts to the resources analyzed in Chapter 4.0. The following is a summary of proposed mitigation measures by resource. For more information regarding the impacts these measures address, or the overall effectiveness see the Chapter 4.0 resource sections.

6.5.1 Air Quality

AQ-1 If located on BLM surface estate, gas plants and compressor stations will be located at least 2,000 meters from residences or other occupied dwellings.

AQ-2 USEPA, NPS, and Powder River Basin Resource Council (PRBRC) recommended the use of Tier 4 diesel drill rig engines to reduce NO_x emissions. NO_x emission reductions can mitigate nitrogen deposition and visibility impacts and near-field short-term NO_2 impacts.

AQ-3 USEPA, NPS, and PRBRC recommended the use of Tier 4 diesel engines for all engines used during well completion to reduce NO_x emissions. NO_x emission reductions can mitigate nitrogen deposition and visibility impacts and near-field short-term NO_2 impacts.

AQ-4 NPS, PRBRC, and Wyoming Outdoor Council (WOC) recommended a lower NO_x limit on compressor engines at the compressor stations to reduce NO_x emissions. NO_x emission reductions can mitigate nitrogen deposition and visibility impacts.

AQ-5 USEPA and WOC recommended the electrification of compressor engines at the compressor stations to reduce NO_x emissions. NO_x emission reductions can mitigate nitrogen deposition and visibility impacts.

AQ-6 USEPA and NPS recommended the electrification of drill rig engines to reduce NO_x emissions. NO_x emission reductions can mitigate nitrogen deposition and visibility impacts and near-field short-term NO_2 impacts.

AQ-7 USEPA and NPS recommended the electrification of frac pumping operations during completion operation to reduce NO_x emissions. NO_x emission reductions can mitigate nitrogen deposition and visibility impacts and near-field short-term NO_2 impacts.

AQ-8 NPS recommended the use of natural gas-only or bi-fuel drill rig and completion engine to reduce NO_x emissions. NO_x emission reductions can mitigate nitrogen deposition and visibility impacts and near-field short-term NO_2 impacts.

AQ-9 NPS, PRBC, and WOC recommended the reduce the amount of flaring during operation to reduce NO_x emissions. NO_x emission reductions can mitigate nitrogen deposition and visibility impacts.

AQ-10 NPS recommended the use of Tier 4 diesel engines during workovers to reduce NO_x emissions. NO_x emission reductions can mitigate nitrogen deposition and visibility impacts.

AQ-11 For heater treaters, NPS recommended lowering the heater treater temperature and/or installing insolation on the separator to reduce NO_x emissions. NO_x emission reductions can mitigate nitrogen deposition and visibility impacts.

AQ-12 USEPA and WOC recommended the centralizing production and operation facilities to reduce NO_x emissions. NO_x emission reductions can mitigate nitrogen deposition and visibility impacts.

AQ-13 ***USEPA and WOC recommended increasing the dust abatement effectiveness during construction activities and/or for all project activities to reduce the amount of particulate matter (PM) emissions. PM emission reductions can mitigate dust impacts.***

AQ-14 ***WOC recommended reducing the number of tanker truck trips to reduce the amount of PM emissions. PM emission reductions can mitigate dust impacts.***

AQ-15 ***WOC recommended paving or adding low silt content surface material to unpaved roads to reduce the amount of PM emissions. PM emission reductions can mitigate dust impacts.***

6.5.2 Cultural Resources, Historic Trails, and Resources of Native American Concern

CR-1 A qualified professional archaeologist will monitor surface disturbing activities during construction in areas that ***have been determined, through the NHPA process, to be likely to*** contain buried cultural ***resources***. A monitoring and discovery plan may be developed for large or complex undertakings or areas known to contain buried cultural sites.

CR-2 Avoidance areas will be fenced or otherwise marked prior to construction activities. Flagging or other marking will be removed once construction is completed in an area.

CR-3 Mandatory training will be provided to all construction personnel and contractors regarding cultural resources and the federal regulations that protect them.

CR-4 ***A qualified tribal monitor will monitor sediment-disturbing activities during construction in areas that have been determined, through tribal consultation and the NHPA process, to contain or be likely to contain Indian sacred sites and/or TCPs. A monitoring and discovery plan may be developed for large or complex undertakings or areas known to contain such resources*****.**

6.5.3 Geology and Mineral Resources

There are no proposed mitigation measures for this resource.

6.5.4 Hazardous Materials, Solid Waste, and Public Health and Safety

There are no proposed mitigation measures for this resource.

6.5.5 Land Use

There are no proposed mitigation measures for this resource.

6.5.6 Lands and Realty

There are no proposed mitigation measures for this resource.

6.5.7 Noise

There are no proposed mitigation measures for this resource.

6.5.8 Paleontological Resources

PALEO-1: ***Require an on-the-ground survey prior to approval of surface-disturbing activities or land-disposal actions for Class 4 and 5 formations (Probable Fossil Yield Classification). Monitor during surface-disturbing activities only as appropriate. Apply, as deemed necessary, for Class 3 formations.***

PALEO-***2***: The operator will suspend all activities in the vicinity of such discovery until notified to proceed by the BLM AO and will protect the discovery from damage or looting. However, the operator may not be required to suspend all operations if activities can be adjusted to be continued elsewhere or otherwise avoid further impacts to a discovered locality.

PALEO-***3***: The BLM AO will evaluate, or will have evaluated, such discoveries as soon as possible, but not later than 10 working days after being notified. Appropriate measures to mitigate effects to significant paleontological resources will be determined by the BLM AO after consulting with the operator.

PALEO-***4***: Within 10 days, the operator will be allowed to continue construction through the site or will be given the choice of either (1) following the BLM AO's instructions for stabilizing the fossil resource in place and avoiding further disturbance to the paleontological resources, or (2) following the BLM AO's instructions for mitigating impacts to the fossil resource prior to continuing construction. Stabilization will be conducted by a BLM-qualified and permitted paleontologist.

6.5.9 Range Resources

RANGE-1: All range improvements in the vicinity of construction activities will be documented prior to initiating construction activities. Any improvements moved or damaged will be returned to their original location or pre-damaged or better condition according to the BLM, USFS, or landowner standards.

RANGE-2: All incidents resulting in livestock injury or fatality will be reported to the livestock operator, and the affected livestock operator will be compensated at fair market value, as determined by the USDA using the U.S. Standards for grades of feeder cattle.

RANGE-3: The oil and gas operator will communicate and coordinate construction schedules with livestock operators to allow adequate time and opportunity for livestock operators to make adjustments to pasture rotation, particularly during calving/lambing seasons.

RANGE-4: Site-specific Reclamation Plans (including seed mix composition and timing of reclamation planting) that are created to minimize impacts on privately owned rangeland within the CCPA will be developed with full coordination and consultation with the landowner.

6.5.10 Recreation

There are no proposed mitigation measures for this resource.

6.5.11 Socioeconomics and Environmental Justice

SOC-1 The OG will meet at least annually with the BLM and representatives of the state and local governments to discuss near-term and mid-term development plans. Additional coordination meetings also will be conducted if situations/conditions arise that will substantially accelerate or retard development in the CCPA.

Converse County, a cooperating Agency for this EIS, has proposed a Prospective Petroleum Industry Development and Response Reporting Program. The program is foreseen as a cooperative program between the OG, local governments, and the BLM and USFS.

Although details of the program would be determined by the program's participants, topics to be monitored could include the following:

- ***Current and rolling 5-year estimates of the number of producing wells and well pads, wells to be drilled, and off-pad facilities (pipelines processing plants, etc.);***

- ***Current and estimated numbers and residency patterns of Project-related employment in affected counties and communities;***
- ***Demographic characteristics of the workforce (e.g., percent single-status employees and those accompanied by households);***
- ***Community housing conditions (i.e., occupancy and vacancy rates by housing type and housing costs);***
- ***Comparison of estimated housing supply and Project-related demand;***
- ***Forecasts of housing construction by community;***
- ***Effects on county roads;***
- ***Identification of current and estimated community/local government infrastructure and service constraints and issues; and***
- ***Identification of community/local government infrastructure and service development plans by jurisdiction.***

As proposed, the OG and affected local governments would each provide relevant information that would be aggregated and reported by a third party. The resulting information could be used by the OG and the affected local governments to develop coordinated responses to housing, community infrastructure and service, and social impacts generated by the proposed development.

6.5.12 Soils

SOIL-1: Soils ***on federal surface estate*** will be analyzed prior to disturbance ***in coordination with BLM or USFS*** to determine soil characteristics, vegetation composition and ground cover, proposed seed mixtures and application rates, and the need for potential soil amendments.

SOIL-2: To the maximum extent possible, disturbance to soils with limiting characteristics will be avoided.

SOIL-3: ***All suitable topsoil, not to exceed 12 inches in depth, will be*** separated, salvaged, and used when revegetating disturbed areas. ***Operators should use care not to mix soils with limiting characteristics (subsoil) with topsoil.***

SOIL-***4***: If ***a reasonable amount of time*** will pass between the end of construction and initiation of reclamation, erosion controls will be applied to disturbed areas.

SOIL-***5***: During reclamation, areas that have been compacted will be decompacted to the full depth of compaction by subsoiling, paraplowing, or parabolic ripping. Where soils are shallow, scarification will be the chosen method. Compaction depth will be determined on a case-by-case basis by an environmental inspector or soil scientist. Each operator will be responsible for decompacting soils on their developed leases.

SOIL-***6***: Fertilizers and/or other amendments will be used as needed to improve revegetation and reclamation success.

6.5.13 Transportation and Access

TRANS-1 Cooperative road management plans will be developed among the operators, Converse County, the state of Wyoming, and private landowners that will address maintenance requirements and responsibilities, as well as highlight potential areas of enhanced safety concern.

TRANS-2 Pipelines will be buried at road crossings. The operator will bury all ***permanent*** pipelines crossing county roads to a minimum depth of 5 feet.

TRANS-3 Passing areas will be constructed as directed by the AO.

TRANS-4 Heavy and/or slow-moving equipment will be used only at night or during non-peak driving times. Flaggers and/or flag cars will be used to alert non-Project traffic of upcoming Project equipment.

TRANS-5 Additional permanent and temporary signage will be placed along roadsides to alert motorists of upcoming construction vehicles.

TRANS-6 Signage will be installed in areas of heavy equipment and heavy truck traffic.

6.5.14 Vegetation

VEG-1 The OG will ***participate in existing statewide*** native seed collection efforts to increase native local seed stock. ***Local native seed sources will be considered when deemed practical and feasible to meet reclamation goals.***

VEG-2 Prior to surface disturbance ***on federal lands***, the oil and gas operator will arrange for infestations of noxious weeds and invasive plant species to be mapped and submitted to the land manager to develop a treatment plan.

Special Status Plant Species

SSPS-1 Known individuals and populations of Ute ladies'-tresses orchid and areas identified as suitable habitat through consultation with the USFWS will be avoided ***within suitable*** habitat, 2 years of surveys in suitable habitat ***in late July through mid-August*** will be required and consultation with USFWS may be necessary.

SSPS-2 The following protective measures will be followed in areas of Ute ladies'-tresses suitable habitat:

- ***a) Use directional drilling at pipeline crossings of known or suitable habitat.***
- ***b) Route roads around known or suitable habitat.***
- ***c) Implement dust abatement within 0.25 mile of known or suitable habitat.***

SSPS-***3*** Species requiring surveys will be identified by the BLM and USFS during the APD process. For species identified as requiring surveys, site- and species-specific surveys will be conducted. The timing and methodology of the surveys will be determined by the BLM or USFS in consultation with the appropriate agency. Surveys will be conducted in areas identified as suitable habitat. If individuals or populations are identified during surveys, species-specific avoidance through design modifications will be developed and implemented in consultation with the appropriate agency. For species that cannot be avoided, species-specific mitigation will be developed in consultation with the appropriate agency. If species or habitat avoidance remains infeasible, impact minimization and further mitigation measures could be developed in consultation with the operator, BLM, USFS, and USFWS prior to construction.

6.5.15 Visual Resources

VIS-1: Pinyon-juniper and conifer woodlands will be removed only when necessary for construction and operation. If removal is necessary, edges of any clearings will be feathered to mimic the natural characteristic of the landscape.

VIS-2: BLM environmental colors (Standard Environmental Color Chart CC-001; BLM 2014e) will be used for surface coatings of permanent structures. Color selection will be based on site-specific assessment.

VIS-3: Topography and vegetation will be utilized to the greatest extent possible to screen views from trails and other KOPs.

VIS-4: During reclamation, disturbed areas will be recontoured to pre-disturbance contours.

VIS-5: Crossings of trails by linear Project components will be at right angles with structures set as far back from the crossing as possible. ROWs and structures should be appropriately screened.

VIS-6: Lighting at facilities will be minimized to the greatest extent permitted by OSHA regulations, and lights will be down-shielded to reduce night glare and light pollution.

6.5.16 Water Resources

WR-1 Existing stream crossings will be utilized wherever practicable and use of the crossings will be incorporated during site-specific design. All stream crossings utilized for Project development or production will be maintained by the applicable operator.

WR-2 The OG will develop and utilize an Unanticipated Pipeline Release Standard Operating Procedure coupled with a pipeline volume and flow monitoring system for the underground water supply and disposal pipelines.

6.5.17 Wetland and Riparian Areas

There are no proposed mitigation measures for this resource.

6.5.18 Wildlife and Aquatic Biological Resources

Terrestrial

WLF-1: Surface disturbance will be avoided at wildlife water ***(excluding freshwater pits)*** developments during final siting and development. If avoidance is not possible, the loss of any permanently impacted wildlife water developments will be offset by installing new developments of equal capacity, in coordination with the appropriate state wildlife agency and federal land management agencies.

WLF-2: ***In accordance with BLM, USFS, and USFWS BMPs for preventing wildlife mortality as a result of fluid mineral practices, a***ll stacks, trenches, and other open structures (including water tanks) will be covered with wildlife enclosure covers and/or wildlife escape ramps will be installed in pits, trenches, and tanks to prevent entrapment and/or drowning. Any existing or proposed open poles or fence posts will be covered or filled with sand, soil, or gravel to prevent entrapment. “Bird cones” will be installed on open-vent stacks.

WLF-3: If reserve pits or other open pits for storage of water or other fluids are used, they will be fenced and covered with netting (properly installed, monitored, and maintained).

WLF-4: New power lines, roads, pipelines, and other structures will be collocated with other existing disturbance (e.g., roads, pipelines, railroads), where possible. Additionally, new power lines will be buried where feasible.

WLF-5: Noise reduction mufflers will be used on construction equipment, drilling equipment, and other motors/compressor used during drilling and production. Also, temporary walls and distance will be considered for use to reduce sound levels in important habitats.

WLF-6: New structures, including fences, will be designed and built to reduce hazards to big game and to allow big game ***seasonal*** movement throughout the year. This will not include fences designed to specifically exclude wildlife.

Migratory Birds

MIG-1 When surface-disturbing activities must occur during the avian breeding season (February 1 to July 31), a qualified biologist will conduct nest searches no more than 7 days prior to these activities. Active nests will be identified and protected in accordance with the applicable BLM, USFS, USFWS, and/or the WGFD guidance.

MIG-2 Disturbance within portions of the CCPA that are identified by federal or state wildlife management agency biologists as located in forest and woodland habitat areas will be avoided. ***At the time of development, the retention of snags, dead-topped trees, and live trees with cavities will be left in place if a safety concern is not present.***

Special Status Wildlife Species

SSWS-1: A vehicle speed limit of ***25*** mph will be implemented on roads without posted speed limits in areas of occupied sage-grouse habitat.

SSWS-2: A Raven Management Plan will be developed that outlines active adaptive management strategies for controlling raven predation and nesting within the CCPA, including the post-construction monitoring for ravens and removal of raven nests.

SSWS-3: Bird diverters/markers will be installed on ***all*** fencing in PHMA ***to the extent set forth in applicable fencing agreements with private surface owners within the CCPA***.

SSWS-***4***: A 0.25-mile no surface use buffer will be maintained in any areas identified as occupied special status bat roosts. ***As described in Section 3.18.3.5, suitable roosting habitat found within the CCPA includes rock crevices, buildings, bridges, trees, and mines. Bat surveys will be required on any bridges that are modified.***

SSWS-***5***: Any areas where herbicides would be used for vegetation treatment will be searched for bat roosts prior to spraying, and a 0.5-mile no-spray buffer will be established around roost sites.

SSWS-***6***: Surveys will be conducted for Preble's meadow jumping mouse prior to surface disturbance based on the ***USFWS*** protocol ***(2004c)***. Surveys will take place in suitable habitats in areas where surface disturbance is to occur. If the species is located, additional coordination with the BLM, USFS, and USFWS will be required prior to surface disturbing activities.

Aquatic Biology

ABR-1: When avoidance of perennial streams with game and special status fish populations will not be feasible and a culvert will be required during construction, flow will be maintained in a portion of the stream to allow unrestricted fish passage. Any plan for dewatering the stream at the culvert site must be approved by the appropriate federal and state agencies. Culvert size and type will be selected to facilitate the continued and long-term connectivity and movement of target aquatic species. If the culvert is to be in place during Project construction and operation, approval must be obtained from the federal or state agency management authority. An alternative crossing method may be required.

ABR-2: If spawning areas for game and special status fish species are known to occur at streams proposed for vehicle crossing or culvert construction, instream disturbance will be scheduled to avoid the spawning period. The exact dates for avoidance will be determined through discussions with WGFD and the appropriate federal land management agency (i.e., BLM, or USFS). All disturbed areas will be restored to pre-construction conditions prior to the next spawning season.

ABR-3: Pipeline crossings of blue ribbon (North Platte River) and red ribbon (LaPrele Creek) streams, if required, will be accomplished by boring underneath the stream. Pipeline crossings for other perennial streams proposed for trenching will be considered on a case-by-case basis through discussions with WGFD. If trenching is approved, WGFD will determine if a construction avoidance period will be required for fish spawning. All disturbed areas will be restored to pre-construction conditions.

ABR-***4***: ***To prevent the spread of aquatic invasive species, surface water will not be moved between 4th level HUC-8 watersheds.*** If vehicles and equipment are moved between multiple HUC8 watersheds, all equipment will be decontaminated, which would occur before arrival at a Project site. Decontamination will consist of either of these actions: 1) Drain all water from equipment and compartments; clean equipment of all mud, plants, debris, and aquatic organisms; and dry equipment for specified time by season (5 days in June through August, 18 days in March through May, and 3 days in December through February when temperatures are at or below freezing). A field monitor will be present to ensure that the cleaning was completed prior to vehicle and equipment moving to other streams and drainages.

Special Status Aquatic Species

SSAS-1: Where habitat for special status aquatic species cannot be avoided as a surface water source for well development activities, approval will be required from the federal agency responsible for managing the lands and WGFD responsible for managing special status species in Wyoming. Agency approval will ensure that water withdrawal methods will avoid or minimize entrainment or impingement effects to early life stages of special status fish species.

6.6 General Approach to Mitigation

As stated in Section 6.1, the overall goal of this ***chapter*** is to ***describe the general approach to mitigation of resource impacts in the CCPA. This section provides a summary of the approach to the Operator Group's proposed mitigation for the proposed oil and gas activities in the CCPA with a focus on addressing the residual impacts identified for two resources (Cultural Resources and Wildlife). Note that per recently updated guidance (IM 2019-018) the BLM will not require compensatory mitigation for the use of public lands.***

The Operator Group has proposed voluntary mitigation ***measures*** to be developed with a focus on a landscape-scale approach. This approach is to consider resource values associated with the relevant geographic area of those affected resources. The approach is to identify current and future mitigation needs, types of specific sites, and measures that will help the agencies meet their management objectives. It also is to focus on identifying measures that will achieve the greatest benefit and, when possible, provide mitigation to multiple resource values. Each proposed ***voluntary*** mitigation action must provide durability, offsetting the expected impact in both time and space. Actions must be focused on the outcome, incorporate implementation and effectiveness monitoring tied to performance standards that reflect the agency management guidance, and include provisions for adaptive management by the agencies.

6.6.1 Cultural Resources, Historic Trails, and Resources of Native American Interest

For historic trails, mitigation can be completed along trail segments and at trail-related sites that are experiencing residual impacts, or along adjacent segments and sites, or non-adjacent segments and sites. Mitigation ***measures for such impacts would be voluntary and*** provide a public benefit, such as through increased access, information collection, or education, and it must be appropriate to the scale and scope of the ***adverse*** effect that is being mitigated. BLM Manual 6280 emphasizes that mitigation for impacts to NHTs, specifically, must benefit the NHT and be conducted within the NHT Management Corridor (BLM 2012e).

Potential mitigation strategies for historic trails could include the following:

- Complete NRHP nomination forms for previously undocumented sections of historic trails
- Complete Historic American Buildings Survey documentation for NRHP-eligible buildings that are directly associated with historic trails
- Complete Historic American Engineering Record documentation for NRHP-eligible structures (e.g., bridges at water crossings) that are directly associated with historic trails
- Complete Historic American Landscapes Survey documentation for NRHP-eligible segments of historic trails and surrounding ***settings***
- Work with willing private landowners to establish conservation easements along NRHP-eligible segments of historic trails
- Work with willing landowners to purchase lands that contain NRHP-eligible trail segments and are accessible by the public, and establish measures to protect and interpret those segments
- If available, restore a historic trail segment (by removing modern intrusions and/or overgrown vegetation, rock slides, and other natural impacts) under the guidance of a trained historic trail specialist
- Conduct an archaeological inventory of a previously unrecorded segment of historic trail that is at least as long as the segment that is experiencing residual effects, and/or an inventory of a previously undocumented or inadequately documented site that is directly associated with a historic trail
- Conduct archaeological testing or excavation at a site that is directly associated with a historic trail and is experiencing residual effects from a CC EIS-related project
- Create interpretive signage for a historic trail segment or trail-related site where it can be viewed by the public
- Create a brochure or book about the historic trail and ensure distribution to schools, libraries, and historical museums and groups in Converse County
- Create a website, podcast, or video about the historic trail and impacts to and preservation and stewardship of it, to be hosted on the BLM's website, with an electronic link shared with chambers of commerce, museums, trails advocacy groups, and other organizations that conduct historical outreach and interpretation in Converse County

Mitigation used to ***resolve adverse effects to any historic property of significance to Tribes (including eligible cultural resources in*** the Pine Ridge area***)*** would be ***voluntary and*** developed through Section 106 consultation.

6.6.2 Wildlife

When authorizing third-party actions that would result in residual impacts, the BLM would work with the Wyoming Game and Fish Department to determine what voluntary compensatory mitigation may be required to offset any residual impacts.

Additional measures that would benefit greater sage-grouse and PHMAs include the following:

- Re-establish sagebrush and the appropriate grass component through seeding, transplant, and fertilization in areas that have experienced either human or natural disturbance;
- Remove pinon and juniper growth that is encroaching into sagebrush habitat;
- Enhance GHMAs known to contain leks to PHMA quality;

- Enhance sagebrush bunchgrass communities in nesting and brood-rearing habitats; and
- Establish conservation easements adjacent to PHMAs and enhance the habitat to PHMA quality.

The system for calculating debits and credits will comply with the State of Wyoming EO ***2019-3***. The 2017 MOU among the USDOI BLM, the USFS, the USFWS, the USDA, NRCS, and the State of Wyoming to Promote a Cohesive and Consistent Conservation Strategy for the Greater Sage-grouse and its Habitat in Wyoming establishes the relationship between the Wyoming greater sage-grouse compensatory mitigation framework and federal plans, and provides the basis for cooperation between the agencies that will be used when applying compensatory mitigation.

Appropriate ***voluntary*** compensatory mitigation mechanisms include mitigation banks and exchanges and approved operator-responsible compensatory mitigation measures. The approval of operator-responsible compensatory mitigation measures would require a plan to be submitted to the BLM that would define/include the following:

- Targeted resource and location;
- Baseline conditions (to support the need for selection of the resource and location);
- Mitigation action(s) to be taken (including a schedule and an adaptive management component with triggers);
- Measurable successful outcomes;
- Assessment of the durability of the successful outcome;
- Monitoring plan that would be active for the life of the disturbance being mitigated; and
- Proof of financial assurances.

The BLM would be responsible for reviewing the mitigation plan and working with the operator to assure a successful approach through the mitigation plan.

7.0 Consultation and Coordination

The CEQ regulations (40 CFR Parts 1500–1508) require an early scoping process to determine the issues related to the proposed action and alternatives that the EIS should address. The purpose of the scoping process is to actively acquire input from all interested parties to identify important issues, concerns, and potential impacts that require analysis in the EIS as well as to eliminate issues of no concern and alternatives from detailed analysis. The scoping process provides opportunities for the BLM, USFS, cooperating agencies, other interested parties, and the public to have meaningful involvement early in the decision-making process.

The BLM, with input from the USFS and cooperating agencies, developed a Draft EIS and sent it to all interested parties for public review and comment. Following a 45-day public comment period, all comments received ***were*** compiled and responses prepared for incorporation as an appendix to the Final EIS. ***The BLM also developed a SDEIS with input from the USFS and cooperating agencies to further address concerns regarding timing limit stipulations for non-eagle raptor nests within the CCPA. As with the Draft EIS, following a 90-day public comment period for the SDEIS, comments received were compiled and responses prepared for incorporation as an appendix to the Final EIS.*** The Draft EIS ***wa***s then modified, clarified, and/or corrected as appropriate in coordination with the BLM, USFS, and cooperating agencies. Once complete, the Final EIS ***wa***s distributed to all interested parties for a 30-day public protest period. Following this 30-day public protest period, the BLM and USFS will both develop separate RODs and issue the applicable ROW grants.

7.1 Agency Participation and Coordination

The BLM is the Lead Federal Agency for this EIS, which has been prepared by the BLM CFO in Casper, Wyoming. The USFS is a key cooperating agency and the USFS Douglas Ranger District of the Medicine Bow-Routt National Forests and Thunder Basin National Grassland has assisted in the development of the EIS. A third-party contractor, AECOM Technical Services, Inc. (AECOM), was retained to conduct studies, gather data, and prepare documents to support EIS preparation at the direction of the BLM. Specific regulations require the BLM to consult with federal, state, and local agencies***, and Native American Tribes*** about the potential of the Project and alternatives to affect sensitive environmental and human resources. The BLM initiated these consultation activities through the scoping process and has maintained them through regular meetings regarding key topics (e.g., alternatives and impact analyses) with cooperating agencies throughout the NEPA process. The BLM, USFS, and cooperating agencies have been actively involved in preparing, reviewing, and creating the Draft EIS, as well as in developing mitigations to reduce impacts from the proposed project. Other federal, state, and local agencies have been consulted throughout the process to address specific issues as needed.

The BLM conducted internal inter-disciplinary meetings as well as a public scoping meeting to solicit input and identification of environmental issues and concerns associated with the proposed project. A project kick-off meeting was held May 4, 2014, at the BLM facilities in Casper, Wyoming. The kick-off meeting included the key BLM and USFS resource specialists, representatives from the OG, and the third-party contractor (AECOM) project management team and key resource specialists. The purpose of the kick-off meeting was to establish the communication protocol, discuss scheduling, identify preliminary sources of existing information, and review the status of the Project Description and other project information.

The BLM invited interested federal, state, and local agencies as well as tribes to serve as cooperating agencies for preparation of the EIS; based on agency responses, the following agencies ***and organizations*** are serving in this role:

- USFS Medicine Bow-Routt National Forests and Thunder Basin National Grassland Douglas Ranger District
- U.S. Environmental Protection Agency (USEPA)
- U.S. Fish and Wildlife Service (USFWS)
- ***National Park Service (NPS)***
- State of Wyoming
- ***Wyoming State Engineer's Office***
- Campbell Board of County Commissioners
- Converse Board of County Commissioners
- Converse County Conservation District
- Johnson Board of County Commissioners
- Natrona Board of County Commissioners
- Niobrara Board of County Commissioners
- Platte Board of County Commissioners
- City of Casper
- City of Douglas
- Town of Evansville
- Town of Lost Springs
- Town of Rolling Hills

The BLM held a meeting on November 1, 2018 with the cooperating agencies to discuss the SDEIS. The revised schedule was discussed as well as options to amend the 2007 Casper RMP Decision No. 4047 regarding timing limit stipulations for non-eagle raptor nests within the CCPA. The amendment options are described in Section 1.4.2 of this SDEIS. The cooperating agencies provided input on the wording of the amendment options and/or suggested additional options and were provided an opportunity to comment on a preliminary version of the SDEIS. In addition, the BLM held a final meeting with cooperating agencies in Douglas, Wyoming, on January 17, 2020, to present the agency's final preferred alternative and to answer questions.

Refer to Section 1.5 for further discussion regarding participation and coordination with other agencies during development of the ***Draft*** EIS*,* ***SDEIS****,* and the permitting process. A summary of the consultations to date for Section 106 of the NHPA and Section 7 of the ESA are included in Section 7.2***, Consultation***.

7.2 Consultation

Federal laws require the lead federal agency (i.e., BLM) to consult with certain other federal and state agencies and entities and Native American tribes during the NEPA decision-making process (40 CFR 1502.25). The following section discusses activities conducted during the NEPA process to meet these requirements.

7.2.1 Tribal Consultation

Federal agencies are directed by the NHPA to consult with any Indian tribe that attaches religious and cultural importance to historic properties that may be affected by an undertaking. Tribal consultation is a government-to-government relationship and is the active, affirmative process of: 1) identifying and seeking input from appropriate Native American governing bodies, community groups, and individuals; and 2) considering their interests as a necessary and integral part of the BLM's decision-making process. According to 36 CFR 800.2 (c) (2)(ii)(A), "The agency official shall ensure that consultation in the section 106 process provides the Indian tribe or Native Hawaiian organization a reasonable opportunity to identify its concerns about historic properties, advise on the identification and evaluation of historic properties, including those of traditional religious and cultural importance, articulate its views on the undertaking's effects on such properties, and participate in the resolution of adverse effects." Additional guidance can be found in MS-1780, Tribal Relations (BLM 2016e) and H-1780-1, Improving and Sustaining BLM-Tribal Relations (BLM 2016f).

Under the auspices of the AIRFA, EO 13007, the NAGPRA of 1990, the NHPA, NEPA, and FLPMA, the BLM and USFS must take into account the effects of land use decisions on places (i.e., physical locations) of cultural value to American Indian groups. The BLM and USFS work in cooperation with American Indian tribes to coordinate and consult before making decisions or approving actions that could result in changes in land use, physical changes to lands or resources, changes in access, or alienation of lands. Federal programs are required to be carried out in a manner sensitive to American Indian concerns and tribal government planning and resource management programs.

Formal consultation was initiated on July 28, 2014, when the BLM mailed hard copy letters to the leadership of the following 13 tribes:

- Cheyenne River Sioux Tribe
- Crow Tribe
- Crow Creek Sioux Tribe
- Eastern Shoshone Tribe of the Wind River Reservation
- Fort Peck Assiniboine and Sioux Tribes
- Lower Brule Sioux Tribe
- Northern Arapaho Tribe
- Northern Cheyenne Tribe
- Oglala Sioux Tribe
- Rosebud Sioux Tribe
- Sisseton-Wahpeton Oyate Tribe
- Standing Rock Sioux Tribe
- Yankton Sioux Tribe

The BLM distributed these initial hard-copy letters to notify the tribes of the proposed undertaking and development of an EIS. The letter invited the tribes to participate as cooperating agencies in the EIS analysis and to consult on the Project. Following distribution of the hard copy letters, the BLM shared the same information with the cultural resource contacts for each tribe via email. The BLM continued to conduct follow-up phone calls to verify receipt of the July 28 letter. The Cheyenne River Sioux Tribe responded to this letter and expressed interest in government-to-government consultation on the Project.

A second set of hard copy letters was sent to the leadership of the same 13 tribes on February 4, 2016, to invite them to continue the government-to-government consultation under various authorities in order to identify resources and issues that need to be addressed in the EIS. Enclosures included a response form and a set of maps showing the regional location, federal mineral estate and surface ownership, and historic and culturally sensitive areas. Follow-up phone calls and emails occurred into the summer of 2016 to confirm receipt of the letter and confirm interest in continued consultation on the Project, including interest in future meetings and field visits. Seven of the 13 tribes expressed interest in continued consultation. One of the 13 tribes indicated that they wanted to be kept informed (i.e., continue to send planning information) but was not interested in meetings or field visits at this time.

On August 1, 2016, hard copy letters were sent to the leadership of two additional tribes to invite them to participate in the government-to-government consultation on the Project. The two additional tribes included:

- Cheyenne and Arapahoe Tribes
- Spirit Lake Tribe

This letter was very similar to the February 4 letter sent to the other 13 tribes and included the same enclosures.

On October 7, 2016, emails were sent to the 14 tribes that expressed interest in consultation or have not yet responded. This email offered to set up meetings at locations that would be convenient to each tribe and asked for feedback on dates when they might be available.

On April 19, 2017, a larger coordination meeting addressing multiple projects was held in Buffalo, Wyoming. A summary of the Project was presented to those tribes that were in attendance.

From July 25 to July 27, 2017, meetings addressing multiple projects were held in Casper, Wyoming. These meetings included a full day of meetings/discussions regarding each of the projects; a full day of field visits that included the Pine Ridge Area; and a half day wrap-up session. Discussions focused on the best method for the BLM to communicate with the tribes in a timely manner during the APD process, the importance of tribes having access to assess project impacts, and adherence to the Section 106 process.

Any and all specific information provided by tribal members concerning resources of Native American concern in the CCPA or the larger analysis area will remain confidential.

Input from the tribes will be requested throughout the development of this document, the additional project-specific NEPA analysis, and will continue up to and during Project construction to identify resources, impacts, and design avoidance, minimization, and mitigation measures that address impacts, pursuant to NHPA and other relevant historic preservation laws and regulations, along with the American Indian Religious Freedom Act and EO 13007, "Indian Sacred Sites".

7.2.2 Fish and Wildlife Consultation

As the lead federal agency for the EIS, the BLM was signatory to a MOU with the USFWS Wyoming Ecological Services Field Office as a cooperating agency. The Agreement, which was signed in March 2016, described the responsibilities of both agencies regarding NEPA, ESA, MBTA, and Bald Eagle Protection Act regulations.

Numerous informal activities were completed to meet the ESA Section 7 consultation requirements for the Project. These activities involved meetings, phone calls, and e-mails among the BLM, USFWS, and AECOM regarding issues related to federally listed, proposed, and candidate species, contents of the BA, and conservation measures.

The following list highlights the key informal consultation activities for the Project:

- Wildlife resource coordination telephone discussions were held on January 19 and February 16 between the BLM, USFWS, and AECOM for planning purposes regarding the BA.
- Initial species list was obtained from the USFWS Ecological Conservation Online System website and Information, Planning, and Conservation (IPaC) System on March 10, 2014.
- Species list was obtained from the USFWS Wyoming Ecological Services Field Office on March 14, 2014.
- BLM prepared a draft Biological Assessment outline
- BLM compiled occurrence information for the federally listed, proposed, and candidate species and incorporated these data with the areas associated with the proposed project facilities.
- ***BLM held a Draft EIS Review meeting with the USFWS on June 6, 2018.***
- ***BLM submitted a Draft Biological Assessment to USFWS on July 13, 2018.***
- ***USFWS provided comments on the Draft Biological Assessment on August 10, 2018.***
- ***BLM provided a Final Biological Assessment to USFWS on June 3, 2019. Completion from draft to final was delayed due to development of the SDEIS,***
- ***USFWS provided additional comments on the Final Biological Assessment on July 8, 2019.***

- ***BLM submitted a Revised Final Biological Assessment to USFWS on November 18, 2019.***
- ***BLM received a Biological Opinion from USFWS on February 10, 2020.***

7.3 Public Involvement

NEPA requires full disclosure and open public participation in the federal decision-making process, including those projects proposed by non-federal proponents that require federal approval. There are two key points during the development of an EIS when the general public is invited to participate in the process: 1) during the scoping period, and 2) during the review period of the Draft EIS.

7.3.1 *Public Scoping*

Refer to Section 1.6.1, Public Scoping, for information on the NOI publication, public scoping meetings (including one public alternatives development meeting), and a summary of scoping issues. The BLM continued to accept written comments throughout all stages of Project development. Summaries of both written comments and those received at scoping meetings are included in the Scoping Report and are available online at the BLM webpage.

7.3.2 Public Comments on the Draft EIS and SDEIS

The Notice of Availability (NOA) for the Draft EIS was published in the Federal Register on January 26, 2018. The BLM mailed postcards notifying the public of the availability of the Draft EIS on the BLM website or at the BLM Casper Field Office to 227 interested parties, including federal, state, and local officials and agencies; special interest groups; parties to the proceeding; area libraries and newspapers; and individuals. Three open house style public meetings were held in Douglas, Casper, and Glenrock, Wyoming on February 20, 21, and 22, 2018, respectively. The 45-day comment period following the notice in the Federal Register ended on March 12, 2018. The BLM received comments on the Draft EIS from a total of 106 parties.

In response to comments on the Draft EIS, the BLM developed a SDEIS to address comments specific to a Land Use Plan amendment for the Casper RMP regarding timing limit stipulations for non-eagle raptor nests. The NOA for the SDEIS was published in the Federal Register on April 26, 2019. The BLM mailed postcards notifying the public of the availability of the SDEIS on the BLM website or at the BLM Casper Field Office as well as to the same distribution list used for the Draft EIS, attendees to the public meetings on the Draft EIS, and those who submitted comments on the Draft EIS. A 90-day comment period following the notice in the Federal Register ended on July 25, 2019. The BLM received comments on the SDEIS from a total of 18 parties.

As required by NEPA, the BLM identified all substantive public comments from the Draft EIS and SDEIS and developed formal responses to each. In accordance with CEQ regulations, substantive comments include those that question one or more of the following:

- ***Purpose and need statement;***
- ***Adequacy of the range of alternatives;***
- ***Baseline information;***
- ***Adequacy or accuracy of the analysis;***
- ***Methodologies used to determine impacts; and/or***
- ***Compliance with legal and administrative procedures.***

To identify and evaluate substantive comments, a systematic process was used to ensure all comments were tracked and the content seriously considered.

1. ***Each submission (letter, email, etc.) was carefully reviewed to capture all substantive comments.***
2. ***Each submission that contained one or more substantive comment(s) was given a unique letter identifier for tracking purposes.***
3. ***Each comment within a unique submission was assigned a number.***
4. ***Each substantive comment was reviewed by the appropriate resource specialist(s), formal responses were developed, and revisions to the EIS were made as warranted.***

Submissions that were determined to be non-substantive have been included as part of the administrative record. Non-substantive comments generally include statements of opinions, feelings, and/or preferences for one element or one alternative over another. Submissions that included comments of a personal and/or philosophical nature were analyzed and considered, but not responded to because such comments are not substantive in nature.

As noted previously, substantive document changes made between the Draft EIS and the Final EIS are shown in bold italics and are indicated by vertical bars that appear in the left margin. These changes were made in response to comments received on the Draft EIS and as a result of updated information that became available after issuance of the Draft EIS.

7.3.2.1 Summary of Comments on the Draft EIS

A complete list of all 106 letters received in response to the Draft EIS, along with letter identifiers, is provided in Table 7.3-1. The letter identifiers were listed in one of seven categories: F-federal government entities (4 letters), S-state government entities (8 letters), L-local (county or municipal) governments and entities (17 letters), N-non-governmental organizations (24 letters), B-businesses (15 letters), and P-private individuals (38 letters).

A table of individual comments, as well as the BLM's responses to those comments, can be found in Appendix H. Copies of all letters received have been included in the administrative record and can be obtained from the BLM Casper Field Office upon request.

Table 7.3-1 Public Comments on the Draft EIS

Category	Letter ID	Affiliation	Author	Number of Individual Comments
Federal Government Entities	F01	U.S. Congress, Wyoming Delegation	Michael B. Enzi, John Barrasso, and Liz Cheney	3
	F02	U.S. Environmental Protection Agency	Philip S. Strobel - Director, NEPA Compliance and Review, Region 8	33
	F03	U.S. Fish and Wildlife Service	Field Supervisor, Wyoming Field Office	17
	F04	National Park Service	Adam Yarina - Midwest Regional Energy Specialist	22
State Government Entities	S01	Wyoming Department of Agriculture	Doug Miyamoto, Director	24
	S02	Wyoming Department of Environmental Quality	Brian R. Hall, Outreach Program Manager	22

Table 7.3-1 Public Comments on the Draft EIS

Category	Letter ID	Affiliation	Author	Number of Individual Comments
	S03	Wyoming Game and Fish Department	Scott G. Smith, Deputy Director	41
	S04	Wyoming Office of the Governor	Matthew Mead, Governor	8
	S05	Wyoming Office of State Lands and Investments	Bridget Hill, Director	2
	S06	Wyoming State Engineer's Office	Patrick T. Tyrrell, State Engineer	7
	S07	Wyoming State Historic Preservation Office	Mary Hopkins, Officer	1
	S08	Wyoming Office of the Governor #2	Matthew Mead, Governor	1
Local Governments and Entities	L01	Campbell County Board of Commissioners	Mark Christensen, Chairman	34
	L02	Campbell County Chamber of Commerce	Board of Directors	3
	L03	Casper Area Economic Development Alliance, Inc.	Charles T. Walsh, CEO – economic development organization for Casper and Natrona County	3
	L04	Converse County Conservation District	Michelle Huntington for Stan Mitchem, Board of Supervisors Chairman	7
	L05	Converse County Board of Commissioners	Jim Willox, Commissioner	125
	L06	Economic Development Joint Powers Board	Mark Pepper, Chairman	2
	L07	Natrona County Commissioners	John Lawson, Chairman	7
	L08	Town of Glenrock	Chad Beer, Councilman	6
	L09	Town of Glenrock	W.D. Frank, Mayor (letter #1)	5
	L10	Town of Glenrock	W.D. (Doug) Frank, Mayor (letter #2)	1
	L11	Town of Wright	Glenn Holt, Councilman	9
	L12	Town of Wright	Ralph Kingan, Mayor	4
	L13	Town of Wright	Michael Lewis	5
	L14	Town of Wright	Nelson Litaba, Councilman	3
	L15	Town of Wright	J.R. Punis???	5
	L16	Town of Wright	Doug Schrader, Councilman	5
	L17	Wyoming County Commissioners Association	Robert Hendry, President/Natrona County Commissioner	8

Table 7.3-1 Public Comments on the Draft EIS

Category	*Letter ID*	*Affiliation*	*Author*	*Number of Individual Comments*
Non-governmental Organizations	***N01***	***Cheyenne Area Landowner's Coalition***	***Alex Bowler***	***8***
	N02	***Converse County Landowners***	***Heather A. Jacobson, Jacobson Law Office, LLC***	***11***
	N03	***Environmental Defense Fund, Rocky Mountain Region***	***Dan Grossman, Director***	***60***
	N04	***Great Plains Tribal Water Alliance, Inc.***	***Peter Capossela, Attorney***	***24***
	N05	***Independent Petroleum Association of America***	***Daniel T. Naatz, Senior Vice President, Government Relations***	***5***
	N06	***Multiple Non-governmental Organizations:*** ***-Environmental Defense Fund*** ***-Institute for Policy Integrity at NYU School of Law*** ***-Montana Environmental Information Center*** ***-Sierra Club*** ***-Union of Concerned Scientists*** ***-WildEarth Guardians***	***Environmental Defense Fund:*** ***-Susanne Brooks, Director of U.S. Climate Policy and Analysis*** ***-Tomas Carbonell, Senior Attorney and Director of Regulatory Policy*** ***-Martha Roberts, Senior Attorney*** ***-Peter Zalzal, Director of Special Projects and Senior Attorney*** ***Institute for Policy Integrity at NYU School of Law:*** ***-Denise Grab, Western Regional Director*** ***-Jayni Hein, Policy Director*** ***-Peter H. Howard, Ph.D., Economic Director*** ***-Iliana Paul, Policy Associate*** ***-Richard L. Revesz, Director*** ***-Jason A. Schwartz, Legal Director*** ***-Jeffrey Shrader, Economics Fellow***	***22***

Table 7.3-1 Public Comments on the Draft EIS

Category	Letter ID	Affiliation	Author	Number of Individual Comments
			Montana Environmental Information Center: ***-Anne Hedges, Deputy Director*** ***Sierra Club:*** ***-Athan Manuel, Director, Lands Protection Program*** ***Union of Concerned Scientists:*** ***-Rachel Cleetus, Ph.D., Lead Economist and Climate Policy Manager*** ***WildEarth Guardians:*** ***-Shannon Hughes, Climate Guardian***	
	N07	***National Park Conservation Association***	***-Stephanie Kodish, Senior Director and Counsel*** ***-Reed Zars, Attorney***	***21***
	N08	***The Nature Conservancy – Cheyenne, Wyoming***	***Richard Garrett, External Affairs Director***	***18***
	N09	***Petroleum Association of Wyoming***	***Esther Wagner, Vice President, Public Lands***	***28***
	N10	***Powder River Basin Resource Council (email)***	***Shannon Anderson, Staff Attorney***	***1***
	N11	***Powder River Basin Resource Council (letter)***	***Shannon Anderson***	***52***
	N12	***Thunder Basin Grasslands Prairie Ecosystem Association***	***Frank G. Eathorne Jr., Chairman***	***11***
	N13	***Western Energy Alliance***	***Tripp Parks, Manager of Government Affairs***	***10***
	N14	***Western Watershed Project (email)***	***Kelly Fuller, Energy Campaign Coordinator***	***1***
	N15	***Western Watershed Project (letter)***	***Kelly Fuller, Energy Campaign Coordinator***	***48***
	N16	***Wild Earth Guardians***	***Rebecca Fischer, Climate Guardian***	***18***
	N17	***Wyoming Association of Municipalities***	***Richard L. Kaysen, Executive Director***	***1***
	N18	***Wyoming Association of Professional Archaeologists***	***Naomi Ollie, President***	***6***
	N19	***Wyoming Business Alliance***	***Cindy DeLancey, President***	***2***

Table 7.3-1 Public Comments on the Draft EIS

Category	***Letter ID***	***Affiliation***	***Author***	***Number of Individual Comments***
	N20	***Wyoming Outdoor Council; also on behalf of National Audubon Society and The Wilderness Society***	***Dan Heilig and John Rader, Lander, Wyoming***	***105***
	N21	***Wyoming Stock Growers Association***	***Jim Magagna, Executive Vice President***	***2***
	N22	***Wyoming Taxpayers Association***	***Buck McVeigh, Executive Director***	
	N23	***Wyoming Wildlife Federation***	***Joy Bannon, Field Director***	***14***
	N24	***Wyoming Wool Growers Association***	***Amy Hendrickson, Executive Director***	***1***
Businesses	***B01***	***Anadarko Petroleum Corporation***	***-David Applegate, Regulatory Advisor*** ***-Susan Aldridge, Regulatory Director WY/UT***	***71***
	B02	***ARC Consultants, Inc.***	***Hillary Jones, Geoarcheologist/Project Director***	***6***
	B03	***Big Sky Limited of Wyoming***	***Mike Sikorski***	***7***
	B04	***Cole Creek Sheep Company***	***-Peter C. Nicolaysen, Vice President and Shareholder*** ***- Jon C. Nicolaysen II, President and Shareholder*** ***- Maren E. Nicolaysen, Shareholder***	***2***
	B05	***Energy Capital Economic Development Corporation***	***Phil Christopherson, CEO***	***2***
	B06	***Hampton Inn and Suites Douglas***	***Lori Carr***	***2***
	B07	***Hampton Inn and Suites Douglas***	***Zach Martinez***	
	B08	***KCOE Conservation***	***Robert Veldman, Sr. Mitigation Advisor***	***1***
	B09	***W.I. Moore Ranch, Co. Inc.***	***Frankie Addington, Vice Persident***	***11***
	B10	***Northwoods Energy LLC***	***Thomas B. Tyree, Jr., CEO***	***2***
	B11	***Operator Group: Anadarko Petroleum Corporation, Chesapeake Energy Corporation, Devon Energy Corporation, EOG Resources, Inc., and SM Energy***	***Katie Schroeder, Attorney, Davis, Graham, and Stubbs, LLP***	***235***

Table 7.3-1 Public Comments on the Draft EIS

Category	Letter ID	Affiliation	Author	Number of Individual Comments
	B12	Pathfinder Ranches	Ryan M. Lance, Senior Vice President and General Counsel	7
	B13	Rasmussen Electric, Inc.	Roger Rasmussen	8
	B14	SM Energy Company	James B. Lebeck, Deputy General Counsel	12
	B15	Wave Petroleum Operating, LLC	Joseph C. Icenogle, CPL, Land Manager	15
Private Individuals	P01	Dan Brecht - Wheatland, Wyoming		1
	P02	Barbara Craig - Wright, Wyoming		5
	P03	Carin Derbonne - Wright, Wyoming		7
	P04	Frank Earthorne - Douglas, Wyoming		2
	P05	Frank Earthorne - email		1
	P06	Maribel C. Frank - Glenrock, Wyoming		5
	P07	Owen A. Frank - Glenrock, Wyoming		6
	P08	Jennifer Goodrich – Douglas, Wyoming		5
	P09	Evelyn Griffin - Pavillion, Wyoming		1
	P10	Kevin and Nena Grilley -Glenrock, Wyoming		4
	P11	Taylor Harper - Casper, Wyoming		6
	P12	Dainis Hazners - Story, Wyoming		1
	P13	Randy Jan??? - Douglas, Wyoming		4
	P14	Brian and Brandi Jensen - Glenrock, Wyoming		7
	P15	Nicholas Ladd - Glenrock, Wyoming		5
	P16	Chris Lamb - Glenrock, Wyoming		6
	P17	Lucky G. Lambdin - Sheridan, Wyoming		4
	P18	Adrianne Martinez -Douglas, Wyoming		7
	P19	Johnathan McDonald - Douglas, Wyoming		6
	P20	Chris Mochulsky - email		1
	P21	Chris Mochulsky – email #2		2
	P22	Joel A. Norberg - Gillette, Wyoming		6
	P23	Jaime Pinkerton - Glenrock, Wyoming		6
	P24	Colton D. Rodeman - Douglas, Wyoming		5
	P25	Jessica Saliga -Douglas, Wyoming		5
	P26	Janet Schneider - Wright, Wyoming		6
	P27	Sally Ann Shurmur - Glenrock, Wyoming		7
	P28	Sandra Sikorski - Upton, Wyoming		6
	P29	Twila Stafford - Douglas, Wyoming		7
	P30	Matthew Steinmetz - email		1
	P31	Summers??? - Douglas, Wyoming		4

Table 7.3-1 Public Comments on the Draft EIS

Category	*Letter ID*	*Affiliation*	*Author*	*Number of Individual Comments*
	P32	***Joanna Taylor - Buffalo, Wyoming***		***1***
	P33	***George and Joan Tellez - email***		***7***
	P34	***Clifford J. Thompson - Wright, Wyoming***		***6***
	P35	***Shannon Lee Thompson - Wright, Wyoming***		***8***
	P36	***Mary Julia Wilson - Douglas, Wyoming***		***4***
	P37	***BK1493***		***1***
	P38	***Chris Mochulsky - letter***		

In general, substantive comments pertained to the following topics:

Introduction and Background:

- ***Regulatory authority within the project area and on private surface***

Proposed Action and Alternatives:

- ***Proposed surface disturbance of well pads, utilization of recycled water, disposal of produced water, and spill prevention***
- ***Selection and analysis of alternatives***

Air Quality:

- ***Existing levels of and estimated incremental additions to the GHG emissions, nitrogen deposition, and ozone concentrations (particularly wintertime ozone) in the Uinta Basin***
- ***Analysis of impacts to climate change and social cost of carbon***

Socioeconomics and Environmental Justice:

- ***Potential impacts on minority populations, low-income populations, or Indian tribes, particularly with regard to air quality and water quality***
- ***Economic value and jobs derived from the oil and gas industry***
- ***Impact to resident and communities in terms of traffic, employment, housing, and public services***
- ***Royalties and economic impact on communities***

Range Resources:

- ***Protection of rangelands and loss of AUMs***

Soils:

- ***Surface disturbance to and reclamation potential of sensitive soils***

Vegetation:

- ***Potential impacts to and protection measures for special status plant species***
- ***Weed control***

Visual Resources:

- ***Potential impacts to the viewshed from historic trails***

Water Resources:

- ***Water consumption, valid water rights, and produced water disposal***
- ***Implementation of a comprehensive water monitoring plan***
- ***Groundwater, surface water, and wetlands protection***

Wildlife and Fisheries Resources:

- ***Potential impacts to and protection of populations and habitat of special status species and migratory birds***
- ***Impacts to greater sage-grouse***

Cumulative Impacts:

- ***Cumulative impacts on wildlife and secondary impacts associated with livestock grazing***
- ***Extent of other cumulative projects included in analysis***

7.3.2.2 Summary of Comments on the SDEIS

A complete list of all 18 letters received in response to the SDEIS, along with letter identifiers, is presented in Table 7.3-2. The letter identifiers were listed in one of seven categories: F-federal government entities (2 letters), S-state government entities (2 letters), L-local (county or municipal) governments and entities (3 letters), N-non-governmental organizations (7 letters), B-businesses (2 letters), and P-private individuals (2 letters).

A table of individual comments, as well as the BLM's responses to those comments, can be found in Appendix I. Copies of all letters received have been included in the administrative record and can be obtained from the BLM Casper Field Office upon request.

Table 7.3-2 Public Comments on the SDEIS

Category	Letter ID	Affiliation	Author	Number of Individual Comments
Federal Government Entities	F05S	U.S. Environmental Protection Agency	Philip S. Strobel - Director, NEPA Compliance and Review, Region 8	3
	F06S	U. S. Fish and Wildlife Service	Field Supervisor, Wyoming Field Office - Cheyenne	7
State Government Entities	S09S	Wyoming Game and Fish Department	Amanda Withroder, Habitat Protection Specialist	9

Table 7.3-2 Public Comments on the SDEIS

Category	*Letter ID*	*Affiliation*	*Author*	*Number of Individual Comments*
	S10S	*Wyoming Office of the Governor*	*Mark Gordon, Governor*	*2*
Local Governments and Entities	*L18S*	*Campbell County Board of Commissioners*	*Rusty R. Bell, Chairman*	*16*
	L19S	*Converse County Board of Commissioners*	*Robert G. Short, Chairman*	*2*
	L20S	*City of Douglas*	*Jonathan Teichert, City Administrator*	*2*
Non-governmental Organizations	*N25S*	*National Parks Conservation Association and Powder River Basin Resource Council*	*Sharon Mader, Senior Grand Teton Program Manager, National Parks Conservation Association* *Shannon Anderson, Staff Attorney, Powder River Basin Resource Council*	*5*
	N26S	*Petroleum Association of Wyoming*	*Esther Wagner, Vice President, Public Lands*	*7*
	N27S	*Powder River Basin Resource Council*	*Shannon Anderson, Staff Attorney*	*10*
	N28S	*Thunder Basin Grasslands Prairie Ecosystem Association*	*David W. Pellatz, Executive Director, Conservation Coordinator*	*2*
	N29S	*Western Energy Alliance*	*Tripp Parks, Manager of Government Affairs*	*2*
	N30S	*Western Watersheds Project; also on behalf of Center for Biological Diversity and American Bird Conservancy*	*Kelly Fuller, Energy and Mining Campaign Coordinator*	*25*
	N31S	*Wyoming Outdoor Council and National Audubon Society*	*John Rader, Wyoming Outdoor Council* *Nada Culver, National Audubon Society*	*8*
Businesses	*B16S*	*Anadarko Petroleum Corporation*	*-David Applegate, Regulatory Advisor* *-Susan Aldridge, Regulatory Director WY/UT*	*42*
	B17S	*Operator Group: Anadarko Petroleum Corporation, Chesapeake Energy Corporation, Devon Energy Corporation, EOG Resources, Inc., and Nothwoods Energy*	*Katie Schroeder, Attorney, Davis, Graham, and Stubbs, LLP*	*81*
Private Individuals	*P01*	*Mike Gardner – Wyoming resident*		*-*
	P38	*Eileen Hennessy – Melrose, Massachusetts*		*1*

In general, substantive comments pertained to the following topics:

- ***Verification and citation of data used to develop figures and tables;***
- ***Lack of adequate recognition by the BLM to describe limitations on its authority over mineral development within the Project Area;***
- ***Beneficial environmental effects from year-round drilling;***
- ***Specific details of LUP Amendment Option 5 and the recommendation to remove it entirely;***
- ***Requirements for TLS Relief;***
- ***Air pollution impacts of the non-eagle raptor amendment options;***
- ***Compliance with Clean Air Act, potential violations of the National Ambient Air Quality Standards and adverse impacts to air quality related values;***
- ***Tribal consultation and Section 106 consultation with regard to timing and impacts on private surface;***
- ***Impacts from Options 1 through 5 and citation of scientific literature;***
- ***Cumulative impacts to migratory birds under all alternatives and citation of scientific literature.***
- ***Analysis of impacts of new options of Alternative B on other birds protected by Migratory Bird Act, bald/golden eagles, greater sage grouse, ungulate species and special status species;***
- ***Application of the 2019 Wyoming Sage-Grouse ARMPA;***
- ***Consideration of MBTA and MGEPA;***
- ***Specific concerns with LUP Amendment Option 4, e.g., eliminating requirement that development activities begin before February 15, protection of raptors, conditions to waive TLS, etc. and the recommendation to remove Option 4 entirely;***
- ***Assumptions related to raptor nest activity and USFWS definition of active nests; and,***
- ***Clarification of the term "nest impact" and the assumptions underlying the impacts for each Option. Concerns with biased negative language regarding nest impacts.***

7.4 List of Agencies, Organizations, and Persons to Whom the EIS was Sent

In addition to the cooperating agencies listed in Section 7.1, the following Tribes, agencies, and organizations/individuals received a copy of the Draft EIS or were notified that the public Draft EIS was available for review and comment.

Federal Agencies:

- Bureau of Land Management
  - Wyoming State Office – Cheyenne, Wyoming
  - Casper Field Office – Casper, Wyoming
  - Buffalo Field Office – Buffalo, Wyoming
- Federal Depository Library System – Washington, D.C.
- U.S. Forest Service

- MBRTB Douglas Ranger District – Douglas, Wyoming
- U.S. Environmental Protection Agency (USEPA), Region 8 – Denver, Colorado
- U.S. Fish and Wildlife Service (USFWS) – Cheyenne, Wyoming

State Agencies:

- University of Wyoming – Laramie, Wyoming
- Wyoming Department of Agriculture – Cheyenne, Wyoming
- Wyoming Department of Environmental Quality
  - Water Quality Division – Cheyenne, Wyoming
- Wyoming Game and Fish Department
  - Cheyenne, Wyoming
  - Casper, Wyoming

- ***Wyoming State Engineer's Office – Cheyenne, Wyoming***

Counties:

- Campbell Board of County Commissioners – Gillette, Wyoming
- Converse Board of County Commissioners
  - Douglas, Wyoming
  - Glenrock, Wyoming
- Converse County Conservation District – Douglas, Wyoming
- Converse County Sheriff's Office – Douglas, Wyoming
- Johnson Board of County Commissioners – Buffalo, Wyoming
- Natrona Board of County Commissioners
  - Casper, Wyoming
  - Lysite, Wyoming
- Niobrara Board of County Commissioners – Lusk, Wyoming
- Platte Board of County Commissioners – Wheatland, Wyoming

Municipalities:

- City of Casper
- City of Douglas
- Glenrock Fire Department
- Town of Evansville
  - Town Clerk
  - Police Department
  - Fire Department

- Town of Lost Springs
- Town of Rolling Hills

Media:

- Casper Star Tribune – Casper, Wyoming
- Douglas Budget – Douglas, Wyoming
- KCWY TV – Mills, Wyoming
- KTWO TV – Casper, Wyoming
- The Casper Journal – Casper, Wyoming
- Wyoming Business Report – Douglas, Wyoming

Libraries:

- Converse County Library
  - Douglas, Wyoming
  - Glenrock, Wyoming
- Natrona County Public Library – Casper, Wyoming
- Campbell County Public Library – Gillette, Wyoming

Elected Officials:

- U.S. Senator John Barrasso
  - Washington, D.C.
  - Cheyenne, Wyoming
  - Casper, Wyoming
- U.S. Senator Michael Enzi
  - Washington, D.C.
  - Cheyenne, Wyoming
  - Casper, Wyoming
- U.S. Representative Liz Cheney
  - Washington, D.C.
  - Cheyenne, Wyoming
  - Casper, Wyoming
- Governor Matt Mead – Cheyenne, Wyoming
- Wyoming State Representative Dan Kirkbride – Chugwater, Wyoming

Tribal Organizations:

- Cheyenne and Arapahoe Tribes
- Cheyenne River Sioux Tribe

- Crow Tribe
- Crow Creek Sioux Tribe
- Eastern Shoshone Tribe of the Wind River Reservation
- Fort Peck Assiniboine and Sioux Tribes
- Lower Brule Sioux Tribe
- Northern Arapaho Tribe
- Northern Cheyenne Tribe
- Oglala Sioux Tribe
- Rosebud Sioux Tribe
- Sisseton-Wahpeton Oyate Tribe
- Spirit Lake Tribe
- Standing Rock Sioux Tribe
- Yankton Sioux Tribe

Organizations:

- Alliance for Historic Wyoming – Laramie, Wyoming
- Center for Biological Diversity – San Francisco, California
- Converse Area New Development Organization – Douglas, Wyoming
- Environmental Defense Fund
  - Washington, D.C.
  - Santa Fe, New Mexico
  - Boulder, Colorado
- Petroleum Associates of Wyoming – Casper, Wyoming
- Powder River Basin Resource Council – Sheridan, Wyoming
- Rocky Mountain Elk Foundation – Missoula, Montana
- Santarella and Eckert, LLC – Littleton, Colorado
- Western Ranchers Alliance – Littleton, Colorado
- Western Watersheds Project – Thatcher, Arizona
- WildEarth Guardians – Laramie, Wyoming
- Wildlands Defense – Boise, Idaho
- Wyoming Outdoor Council
  - Lander, Wyoming
  - Logan, Utah

Industry/Business:

- 3 Bear Energy, LLC
- Anadarko Petroleum Corporation ***(now Occidental Petroleum Corporation)***

  - Casper, Wyoming
  - Cheyenne, Wyoming
- ATCO Structures and Logistics – Littleton, Colorado
- Black Bison Water – Casper, Wyoming
- Boner Brothers Partnership – Douglas, Wyoming
- Cameron Surf – Casper, Wyoming
- Chesapeake Energy – Casper, Wyoming
- Cole Creek Sheep Company – Casper, Wyoming
- Devon Energy Corporation – Oklahoma City, Oklahoma
- DRU Consulting, LLC – Gillette, Wyoming
- EOG Resources - Denver
- E.R.S. – Wright, Wyoming
- Garrett Group International – Cheyenne, Wyoming
- Gene R. George and Associates, Inc. – Casper, Wyoming
- Goldspur – Nacona, Texas
- Greer Services Archeology – Casper, Wyoming
- Hayden-Wing Associates – Laramie, Wyoming
- Hell and Back Ranch – Douglas, Wyoming
- HB Rentals – Riverton, Wyoming
- Impact Natural Resources, LLC – Houston, Texas
- Jerry's Welding Service – Douglas, Wyoming
- Jona, Inc. – Casper, Wyoming
- Key Energy – Casper, Wyoming
- KCOE ISOM – Loveland, Colorado
- KLJ Engineering – Casper, Wyoming
- Leber Ranch - Douglas, Wyoming
- Lewis, Bess, Williams, and Weese P.C. – Denver, Colorado
- Manning Ranch – Lost Springs, Wyoming
- Melgaard Construction Company, Inc. – Gillette, Wyoming
- Midwest Industrial Supply, Inc. – Canton, Ohio
- Nachtman Land and Livestock – Douglas, Wyoming
- Nerd Gas Company, Ltd. – Casper, Wyoming
- Nicolaysen and Associates, P.C. – Casper, Wyoming
- Parkerton Ranch Inc. and Canyon Isle Holding – Casper, Wyoming
- Pathfinder Directional Driller
- Samson Resources – Denver, Colorado

- Shorteared Livestock and Water – Glenrock, Wyoming
- SM Energy – Denver
- Thunder Basin Grazing Association – Douglas, Wyoming
- Transworld System Petroleum – Denver, Colorado
- True Oil – Casper, Wyoming
- Upstream Petroleum Management/RKI – Englewood, Colorado
- Uranium One – Casper, Wyoming
- Walsh Environmental – Boulder, Colorado
- Warrior Energy Services Corporation – Casper, Wyoming
- Water System Drilling, Inc. – Gillette, Wyoming
- Western Ecosystems Technology, Inc. – Cheyenne, Wyoming
- Wild West Consulting – Glenrock, Wyoming
- WWC Engineering
  - Casper, Wyoming
  - Sheridan, Wyoming

Individuals:

- Ellis Adams – Rock Springs, Wyoming
- Ronnie Ades – Casper, Wyoming
- Matthew Allen – Gillette, Wyoming
- Gloria Ambrose – Glenrock, Wyoming
- Jim Anderson – Glenrock, Wyoming
- Pam Anderson – Glenrock, Wyoming
- Mr. Arnold – Glenrock, Wyoming
- Ronnie Azles – Casper, Wyoming
- Ed Bartow – Gillette, Wyoming
- Liz Batton – Douglas, Wyoming
- Rusty Baxter – Douglas, Wyoming
- Mark Berry – Douglas, Wyoming
- Karl Bischoff – Douglas, Wyoming
- Robert Brug – Sheridan, Wyoming
- Jeanette Buelt – Casper, Wyoming
- Sherman Callender – Gillette, Wyoming
- Kelly Carpenter – Casper, Wyoming
- Richard Carraz – Glenrock, Wyoming
- Jason Carter – Douglas, Wyoming

- Jan Cath – Gillette, Wyoming
- John Clark – Douglas, Wyoming
- Edith Cook
- Doug Cooper – Casper, Wyoming
- Frank and Leslie Eathan – Douglas, Wyoming
- Stuart Elclinth – Casper, Wyoming
- Dustin Erickson – Douglas, Wyoming
- Doug Farmer – Douglas, Wyoming
- Brian Fox
- Jon Garcia – Douglas, Wyoming
- Kevin and Nena Grilley – Glenrock, Wyoming
- Patty Grose – Glenrock, Wyoming
- Terry Henderson – Shawnee, Wyoming
- Kathleen Kilsdock – Douglas, Wyoming
- Jason Lillegraven – Laramie, Wyoming
- Tyler Miller – Gillette, Wyoming
- Petter and Kristi Mogen – Douglas, Wyoming
- Kristi Mogen – Sheridan, Wyoming
- Frank Moose – Douglas, Wyoming
- Kathy Moriarty
- Donita Munn – Gillette, Wyoming
- Sarah Oaberg – Douglas, Wyoming
- Kylin Petterson – Gillette, Wyoming
- Mark Rabenberg – Gillette, Wyoming
- Matt Redden – Douglas, Wyoming
- Lana Richardson – Glenrock, Wyoming
- Quentein Richardson
- Mark and Katherine Roberts – Douglas, Wyoming
- Jacob Roland – Casper, Wyoming
- Justin Rolison – Casper, Wyoming
- Kaleb Simpson – Douglas, Wyoming
- Ray Smith – Casper, Wyoming
- Todd Smith – Casper, Wyoming
- Dave St. John
- Orvie Stoneking – Glenrock, Wyoming
- Janice Switzer – Douglas, Wyoming

- Josh Taylor – Douglas, Wyoming
- Renee Taylor – Evansville, Wyoming
- David Walker and Sam Wahilomi – Douglas, Wyoming
- William Williamson – Gillette, Wyoming
- Timothy Wittenhaue – Douglas, Wyoming

7.5 List of Preparers and Reviewers

Table 7.5-1 identifies BLM and USFS staff members on the EIS interdisciplinary team for the Project.

Table 7.5-1 BLM and USFS Interdisciplinary Team

Resource	BLM Staff	USFS Staff
NEPA Coordinator/Project Manager	Mike Robinson	Misty Hays/***John Madden***
Air Quality and Climate Change	Charis Tuers/***Ryan McCammon***	Misty Hays
Cultural Resources and Native American Concerns	Patrick Walker/Melissa Benner	Amanda Sanchez
Cultural and Historic Trails	Patrick Walker/Melissa Benner	Amanda Sanchez/Tani Randollff
Geology and Minerals	Matt Clark	Jim McKay
Hazardous Materials / Public Health and Safety	Art Terry	Jim McKay
Land Use	Jen Weber	Misty Hays
Lands and Realty	Jen Weber	Misty Hays
Noise	Shane Gray	Tim Byer
Paleontological Resources	Angela Bulla	Jim McKay
Range Resources	Dustin Burger	Geri Proctor / Moriah Shadwick
Recreation	Tammy Owens	Travis Rixford/Misty Hays
Socioeconomics and Environmental Justice	Jessica Montag	John Madden
Soils	Dustin Burger	Randy Tepler
Transportation and Access	Jen Weber	Ryan Nupen
Vegetation	Dustin Burger	Katie Haynes
Visual Resources	Tammy Owens	Jeff Tupala
Water Resources	Shane Evans	David Gloss
Wildlife - Terrestrial	Shane Gray	Tim Byer
Wildlife – Aquatic	Shane Gray	Bill Baer

AECOM is the third-party environmental contractor responsible for preparing the EIS under the direction of the BLM. The responsibilities and education of the individual team members are summarized in **Table 7.5-2**.

Table 7.5-2 Preparers/Reviewers for AECOM and Subcontractors

Name / Affiliation	Education	Responsibility
Scott Ellis AECOM	B.A. Biology and English, 1971, Cornell University	Senior Project Advisor, NEPA Process Advisor, Review
Dan Gregory AECOM	M.S. Geology, 1982, Colorado State University B.A. Geology, 1974, Colorado College	Project Manager, Project Description, Alternatives, Mitigation, Review
Molly Giere AECOM	M.B.A. Business Administration, 2002, University of Dayton B.S. Biology, 1988, The Ohio State University	Assistant Project Manager, Project Description, Alternatives, Cumulative, Review
Chris Dunne AECOM	B.S., Natural Resource Management, 2007, Colorado State University	Project Coordinator, Project Description, Alternatives, Range Resources, Mitigation
Matt Petersen AECOM	M.S. Aquatic Ecology, 1996 Utah State University B.S. Fisheries, 1990 Texas A&M University	Alternatives Development, NEPA Advisor
Courtney Taylor AECOM	M.S. Atmospheric Science, 2006, Colorado State University B.A. Environment, Economics, and Politics, 2000, Claremont McKenna College	Senior Air Quality, Climate, and Regional Photochemical Modeling Lead
Marco Rodriguez AECOM	PhD Mechanical and Aerospace Engineering, 2004, University of California Irvine M.S. Mechanical and Aerospace Engineering, 2001, University of California Irvine B.S. Physics, 1997, Universidad Autonoma Metropolitana-Iztapalapa	Regional Photochemical Modeling
Caitlin Shaw AECOM	M.S. Atmospheric Science, 2009, University of Nebraska B.S. Meteorology, 2006, Valparaiso University	Regional Photochemical Modeling*, **GHG analysis***
Dustin Rapp AECOM	M.S. Atmospheric Science, 2007, Colorado State University B.S. Physics, 2004, Union University, Jackson, TN	Air Quality and Climate
Rebecca Schwendler PaleoWest Archeology	Ph.D. Anthropology, 2004, University of New Mexico M.A. Anthropology, 1997, University of New Mexico B.A. Sociocultural Anthropology, 1993, Tufts University	Cultural Resources, Historic Trails, and Native American Concerns
Bill Berg AECOM	M.S., Geology, 1980, University of Wyoming B.S., Geology, 1976, Colorado State University	Geology and Minerals, Hazardous Materials/Solid Waste, Public Health and Safety, Paleontological Resources, Groundwater
Steve Graber AECOM	B.S., Natural Resource Management, 2002, Colorado State University B.A., Economics, 2002, Colorado State University	Public Health and Safety, Land Use, Lands and Realty, Noise, Recreation, Transportation and Access
Ron Dutton Sammons/Dutton, LLC	M.S. Economics, 1976, University of Wyoming B.S. Economics, 1974, University of Wyoming	Socioeconomics and Environmental Justice
George Blankenship Blankenship Consulting	Master of Urban & Regional Planning, 1980, University of Colorado B.A. Social Work, 1978, Colorado State University B.A. Anthropology, 1970, University of Nebraska	Socioeconomics and Environmental Justice

Table 7.5-2 Preparers/Reviewers for AECOM and Subcontractors

Name / Affiliation	Education	Responsibility
Terra Mascarenas AECOM	B.S., Soil and Crop Science, 1997, Concentration in Environmental Science, Colorado State University	Soils
Meagan Jones AECOM	***B.S. Environmental Biology, 2005. Bethel College***	***Soils***
Amy Gilboy AECOM	M.S. Resource Ecology and Management, 2003, University of Michigan B.S. Biology, 1997, Florida State University	Vegetation, Special Status Plants, Wetlands/Riparian Areas
Merlyn Paulson AECOM	M.L.A. II Landscape Architecture and Geographic Information Systems, 1975, Harvard University B.L.A. Landscape Architecture and Environmental Planning, 1972, Utah State University	Visual Resources
David Fetter AECOM	B.S., Watershed Science, 2004, Colorado State University	Surface Water, Water of the U.S.
Ken Fantone AECOM	M.S. Geology, 1983, South Dakota School of Mines & Technology B.S. Geological Sciences, 1977, Pennsylvania State University	Groundwater Modeling
Patti Lorenz AECOM	B.S., Wildlife, 2002, Colorado State University	Terrestrial Wildlife. Special Status Wildlife
Rollin Daggett AECOM	M.S. Freshwater and Marine Biology, 1973, Memorial University of Newfoundland B.S. Zoology, 1971, College of Environmental Sciences at Syracuse University	Aquatic Biological Resources, Special Status Aquatic Biological Resources
Janet Guinn AECOM	B.S. Psychology/Anthropology, 1984, University of Pittsburgh	Public Participation
Ben Tracy AECOM	B.A. Humanities, 2002, Arizona State University B.S. Natural Resources, Minor in GIS, 2013, Colorado State University	GIS, Qualitative Analysis
Steve Ensley AECOM	B.S. Environmental Conservation, 2004, Northern Michigan University	GIS
Sue Coughenour AECOM	General Education, Western Illinois University	Document Production

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9.0 Glossary

Access road	A road used specifically by an operator to access a Project well pad or other project component.
Acre-foot	Volume of water required to cover 1 acre to a depth of 1 foot; equivalent to a volume of 43,560 cubic feet, approximately 325,829 gallons, or approximately 7,758 barrels of water.
Alluvial	Pertaining to material or processes associated with transportation or deposition of soil and rock by flowing water (e.g., streams and rivers).
Alluvium	Unconsolidated or poorly consolidated gravel, sands, and clays deposited bystreams
Ambient noise	Total, all-encompassing noise associated with a given environment and time.
Aquifer	A body of rock that is sufficiently permeable to conduct groundwater and to yield economically significant quantities of water to wells and springs.
Archaeology	The scientific study of material remains (as fossil relics, artifacts, and monuments) of past human life and activities.
Barrel	Volume of water equivalent to 42 gallons of water; approximately 7,758 barrels are equivalent to 1 acre-foot of water.
Botany	A branch of biology dealing with plant life.
Completion	A generic term used to describe the assembly of downhole tubulars and equipment required to enable safe and efficient production from an oil or gas well.
Condensate	A low-density, high-API gravity liquid hydrocarbon phase that generally occurs in association with natural gas. Its presence as a liquid phase depends on temperature and pressure conditions in the reservoir allowing condensation of liquid from vapor.
Core Areas	Greater sage-grouse core population areas designed to identify habitats necessary to promote greater sage-grouse population viability and ensure stable populations persist in the face of human development.
Critical habitat	Habitat that is present in minimum amounts and is the determining factor in the potential for population maintenance and growth.
Crude oil	A general term for unrefined petroleum or liquid petroleum.
Cumulative effects	The combined environmental impacts that accrue over time and space from a series of similar or related individual actions, contaminants, or projects. Although each action may seem to have a negligible impact, the combined effect can be significant. Included are activities of the past, present, and reasonably foreseeable future; synonymous with cumulative impacts.
Cuttings	Small pieces of rock that break away due to the action of the bit teeth.

dBA	A-weighting. The most commonly used frequency weighting measure; simulates human sound perception and correlates well with human perception of the annoying aspects of noise.
Depletion	The drop in reservoir pressure or hydrocarbon reserves resulting from production ofreservoir fluids.
Direct impacts	Impacts that are caused by the action and occur at the same time and place (40 Code of Federal Regulations 1508.7); synonymous with directeffects.
Directional drill	A means of subterranean drilling that can be carried out and controlled in terms of depth and direction.
Disturbed area	An area where natural vegetation and soils have been removed.
Endangered species	Any species in danger of extinction throughout all or a significant portion of its range. Plant or animal species identified by the Secretary of the Interior as endangered in accordance with the 1973 Endangered Species Act.
Floodplain	That portion of a river valley, adjacent to the channel, that is built of sediments deposited during the present regimen of the stream and that is covered with water when the river overflows its banks at flood stages. The 100-year floodplain is that portion of the river valley adjacent to the channel, which has a 1 in 100 chance of being inundated in a given year.
Formation	A body of rock that is sufficiently distinctive and continuous that it can be mapped. In stratigraphy, a formation is a body of strata of predominantly one type or combination of types; multiple formations form groups, and subdivisions of formations are members.
Fugitive dust	Dust particles suspended randomly in the air from road travel, excavation, and rock loading operations.
Drilling mud	A term that is generally synonymous with drilling fluid and that encompasses most fluids used in hydrocarbon drilling operations, especially fluids that contain significant amounts of suspended solids, emulsified water, or oil.
Gathering pipeline	Typically smaller diameter pipelines connecting production wells to central gathering locations, such as tank batteries for hydrocarbon liquids or compressor stations for natural gas. For natural gas, gathering pipelines are upstream of transmission pipelines, which are upstream of distribution pipelines.
General Habitat Management Area (GHMA)	BLM-managed and National Forest System lands where some special management would apply to sustain greater sage-grouse populations. GHMAs are areas of occupied seasonal or year-round habitat outside of PHMAs.
Hydrocarbon resources	Naturally occurring organic compounds comprising hydrogen and carbon. The most common hydrocarbons are natural gas, oil, and coal.
Impact	A modification in the status of the environment brought about by the Proposed Action or an alternative.

Incremental impacts	***The impact (e.g., disturbance) that the specific project or project alternative would contribute to the overall total impact (or disturbance) the analysis area.***
Indirect impacts	Impacts that are caused by the action and are later in time or farther removed in distance but are still reasonably foreseeable (40 Code of Federal Regulations 1508.8); synonymous with indirect effects.
Injection well	A well in which fluids are injected rather than produced, the primary objective typically being to maintain reservoir pressure. Two main types of injection are gas and water.
Intermittent stream	A stream that flows only part of the time or during part of the year.
Irretrievable	Applies primarily to the lost production of renewable natural resources during the life of the project.
Irreversible	Applies primarily to the use of nonrenewable resources, such as minerals, cultural resources, wetlands, or to those factors that are renewable only over long time spans, such as soil productivity. Irreversible also includes loss of future options.
Lek	An assembly area where grouse conduct display and courtship behavior.
Migration	The long-distance movement of wildlife, usually between breeding and non-breeding areas.
Mitigate, Mitigation	To cause to become less severe or harmful; actions to avoid, minimize, rectify, reduce or eliminate, and compensate for impacts to environmental resources.
National Environmental Policy Act	The National Environmental Policy Act (NEPA) of 1969; the national charter for protecting the environment. NEPA establishes policy, sets goals, and provides means for carrying out the policy. Regulations from 40 Code of Federal Regulations 1500-1508 implement the act.
National Pollutant Discharge Elimination System (NPDES)	A part of the Clean Water Act that requires point source dischargers to obtain Elimination System permits. These permits are referred to as NPDES permits and are administered by the U.S. Environmental Protection Agency.
National Register of Historic Places (NRHP)	A list, maintained by the National Park Service, of areas that have been designated as being of historical significance.
Native species	Plants or animals that originated in the area in which they are found (i.e., they naturally occur in that area).
Noise	Unwanted sound; one that interferes with one's hearing of something; a sound that lacks agreeable musical quality or is noticeably unpleasant.
Paleontology	A science dealing with the life of past geological periods as known from fossil remains.
Perforation	The communication tunnel created from the casing or liner into the reservoir formation, through which oil or gas is produced.
Perennial stream	A stream or reach of a stream that flows throughout the year.
Plug and abandon	To prepare a well to be closed permanently, usually after either logs determine there is insufficient hydrocarbon potential to complete the well, or after production operations have drained the reservoir.

Primary production or recovery	The means by which the initial reservoir production is achieved, such as natural production from a gas-drive reservoir. In many cases, a secondary recovery method, such as waterflood, is required to maintain a viable reservoir production rate.
Priority Habitat Management Area (PHMA)	BLM-managed and National Forest System lands identified as having the highest value to maintaining sustainable greater sage-grouse populations. Areas of PHMA largely coincide with areas identified as Priority Areas for Conservation in the USFWS Conservation Objectives Team report (USFWS 2013) and contain designated core population areas (Core Areas) and connectivity areas designated under EO 2015-4.
Produced water	Groundwater pumped to the surface during reservoir production.
Production tubing	A wellbore tubular used to produce reservoir fluids. Production tubing is assembled with other completion components to make up the production string.
Raptor	Birds of prey, such as hawks, eagles, and owls.
Reclamation	Rehabilitation of a disturbed area to make it acceptable for designated uses. This process consists of two stages, interim and final: Interim Reclamation – Involves shaping, stabilizing, re-vegetating, or otherwise treating disturbed areas in order to provide a self-sustaining and productive use of the land during production operations. Final Reclamation – Involves returning the land to a condition after production and operations cease that approximates the condition prior to disturbance and maintains a stable and productive condition compatible with the land use.
Reserve pit	An earthen-bermed storage area for discarded drilling mud.
Reservoir	A subsurface body of rock having sufficient porosity and permeability to store and transmit fluids.
Residual Impact	Unavoidable adverse impact to a resource that remain after implementation of mitigation has been applied.
Rig	The machine used to drill a wellbore. The rig includes virtually everything except living quarters. Major components of the rig include the mud tanks, the mud pumps, the derrick or mast, the drawworks, the rotary table or topdrive, the drillstring, the power generation equipment and auxiliary equipment.
Right-of-Way (ROW)	Strip of land or corridor designated via an administrative grant through which a pipeline, power line, access road, or maintenance road would pass.
Riparian	Situated on or pertaining to the bank of a river, stream, or other body of water. Riparian is normally used to refer to plants of all types that grow along streams, rivers, or at spring and seep sites.
Roost	A place where birds customarily rest.
Runoff	That part of precipitation that appears in surface streams; precipitation that is not retained on the site where it falls and is not absorbed by the soil.

Scoping	Discussion with and disclosure to agencies and the public with regard to a project or undertaking wherein areas of concern or issues to be addressed in a NEPA document are determined.
Sediment	Material suspended in or settling to the bottom of a liquid. Sediment input comes from natural sources, such as soil erosion and rock weathering, as well as construction activities or anthropogenic sources, such as forest or agricultural practices.
Sediment yield	Quantification of the amount of sediment transported.
Shale	A fine-grained, fissile, detrital sedimentary rock formed by consolidation of clay- and silt-sized particles into thin, relatively impermeable layers. It is the most abundant sedimentary rock.
Split estate land	Lands with separate surface and mineral ownership.
Stratigraphy	Form, arrangement, geographic distribution, chronological succession, classification, and relationships of rock strata.
Suitable wildlife habitat	A specific set of physical conditions that surround a species, group of species, or a large community. In wildlife management, the major constituents of habitat are considered to be food, water, cover, and living space.
Tertiary	The geologic span of time between 65 and 3 to 2 million years ago.
Threatened species	Any species of plant or animal that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range.
Visual resource	The composite of basic terrain, geologic features, water features, vegetation patterns, and land use effects that typify a land unit and influence the visual appeal the unit may have for viewers.
Water disposal well	A well used for disposal or injection of produced water or other fluids.
Watershed	A region or area bounded peripherally by a water parting and draining ultimately to a particular watercourse or body of water.
Well casing	Large-diameter pipe lowered into an openhole and cemented in place. The well designer must design casing to withstand a variety of forces, such as collapse, burst, and tensile failure, as well as chemically aggressive brines. Casing is run to protect fresh-water formations, isolate a zone of lost returns or isolate formations with significantly different pressure gradients.
Well pad	A temporary drilling site, usually constructed of local materials such as gravel, shell or even wood. After the drilling operation is over, most of the pad is usually removed or contoured.
Wellbore	Includes the openhole or uncased portion of the well. Borehole may refer to the inside diameter of the wellbore wall, the rock face that bounds the drilled hole. Synonym: borehole.
Wellhead	The surface termination of a wellbore that incorporates facilities for installing casing hangers during the well construction phase.

Wetlands	Areas that are inundated by surface or groundwater with a frequency sufficient to support (and under normal circumstances do or would support) a prevalence of vegetation or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction.
Workover	The process of performing major maintenance or remedial treatments on an oil or gas well. In many cases, workover implies the removal and replacement of the production tubing string after the well has been killed and a workover rig has been placed on location.
Zone	A slab of reservoir rock bounded above and below by impermeable rock.