Fortification Creek Planning Area Proposed Resource Management Plan Amendment/Environmental Assessment

March 2011

The BLM's multiple-use mission is to sustain the health and productivity of the public lands for the use and enjoyment of present and future generations. The Bureau accomplishes this by managing such activities as outdoor recreation, livestock grazing, mineral development, and energy production, and by conserving natural, historical, cultural, and other resources on public lands.

BLM/WY/PL-11/023+1610

WY-070-EA08-135

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Wyoming State Office
P.O. Box 1828
Cheyenne, Wyoming 82003-1828

TAKE PRIDE IN AMERICA

MAR 18 2011

Dear Reader/Interested Party:

Enclosed is the proposed Buffalo Resource Management Plan Amendment and Environmental Assessment (PRMPA/EA) for the Fortification Creek Planning Area. The Bureau of Land Management (BLM) prepared the PRMPA/EA in consultation with cooperating agencies, taking into account public comments received during this planning effort. The PRMPA provides a framework for the future management direction and appropriate use of the 100,655 acre Fortification Creek Planning Area (FCPA) located in Campbell, Johnson, and Sheridan counties, Wyoming. The document contains both land use planning decisions and implementation decisions to guide the BLM's management of the FCPA.

The attached PRMPA/EA analyzes three alternatives: (I) No Action, in which coalbed natural gas (CBNG) development and other resources would be managed under existing land use planning decisions; (II) CBNG development would be geographically phased under a prescriptive management approach to protect erodible soils, and a resident elk herd, and (III) CBNG development would be required to meet performance based standards to protect the elk herd and ensure successful reclamation. Alternative III is the preferred alternative and the proposed PRMPA.

The proposed PRMPA has been prepared in accordance with the Federal Land Policy and Management Act of 1976 (FLPMA) and the National Environmental Policy Act of 1969 (NEPA). The document has been sent to members of the public who requested a copy and to pertinent local, State, Tribal and Federal Government entities. The PRMPA/EA contains the Proposed Plan amendment, a summary of changes made between the DRMPA/EA and PRMPA/EA, impacts of the Proposed Plan, a summary of the written and verbal comments received during the public review period for the DRMP/DEIS, and responses to the comments. Additional hard copies and CD-ROM versions of the PRMPA may be obtained by contacting the Buffalo Field Office, (307) 684-1100. The document will also be available online at http://www.blm.gov/wy/st/en/info/NEPA/documents/bfo/fortification_creek.html.

The PRMPA will be circulated for a 30-day review and protest period. Any person who participated in the planning process for this PRMPA, and has an interest which is or may be adversely affected, may protest approval of this PRMPA and land use planning decisions contained within it (see 43 Code of Federal Regulations 1610.5-2) during the 30-day period starting with the date of this letter. For further information on filing a protest, please see the accompanying protest regulations in the pages that follow (labeled as Attachment No. 1). The regulations specify the required elements of your protest. Take care to document all relevant facts. As much as possible, reference or cite the planning documents or available planning records (e.g. meeting minutes or summaries, correspondence, etc.

E-mailed and faxed protests will not be accepted as valid protests unless the protesting party also provides the original letter by either regular or overnight mail postmarked by the close of the protest period. Under these conditions, the BLM will consider the e-mailed or faxed protest as an advance copy and will afford it full consideration. If you wish to provide the BLM with such advance notification, please direct faxed protests to the attention of Brenda Hudgens-Williams, BLM protest coordinator at 202-912-7212, and e-mailed protests to: Brenda_Hudgens-Williams@blm.gov.

All protests, including the follow-up letter (if e-mailing or faxing) must be in writing and mailed to the following address:

Regular Mail:	Overnight Mail:
Director (210)	Director (210)
Attention: Brenda Williams	Attention: Brenda Williams
P.O. Box 1383	20 M St. SE, Room 2134LM
Washington, D.C. 20024-1383	Washington, D.C. 20003

Before including your address, phone number, e-mail address, or other personal identifying information in your protest, be advised that your entire protest – including your personal identifying information – may be made publicly available at any time. While you can ask us in your protest to withhold from public review your personal identifying information, we cannot guarantee that we will be able to do so.

The BLM Director will make every attempt to promptly render a decision on each protest. The decision will be in writing and will be sent to the protesting party by certified mail, return receipt requested. The decision of the BLM Director shall be the final decision of the Department of the Interior. Responses to protest issues will be complied and formalized in a Director's Protest Decision Report made available following issuance of the decisions. Upon resolution of all land use plan protests, the BLM will issue an Approved RMPA and Decision Record (DR). The Approved RMP and DR will be mailed or made available electronically to all who participated in the planning process and will be available to all parties through the "Planning" page of the BLM national website (*http://www.blm.gov/planning*), or by mail upon request.

The Buffalo Field Manager has made a Finding of No Significant Impact (FONSI) for this Environmental Assessment and Resource Management Plan amendment, and recommended that I approve the Fort Creek RMPA, EA and FONSI. Pursuant to 43 CFR 1610.5-5, I do so approve.

Sincerely,

Donald A. Simpson
State Director

I *Attachment 1*

Protest Regulations

[CITE: 43CFR1610.5-2]

TITLE 43--PUBLIC LANDS: INTERIOR
CHAPTER II--BUREAU OF LAND MANAGEMENT, DEPARTMENT OF THE INTERIOR
PART 1600--PLANNING, PROGRAMMING, BUDGETING--Table of Contents
Subpart 1610--Resource Management Planning
Sec. 1610.5-2 Protest procedures.

(a) 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 a resource management plan may protest such approval or amendment. A protest may raise only those issues which were submitted for the record during the planning process.

(1) The protest shall be in writing and shall be filed with the Director. The protest shall be filed within 30 days of the date the Environmental Protection Agency published the notice of receipt of the final environmental impact statement containing the plan or amendment in the Federal Register. For an amendment not requiring the preparation of an environmental impact statement, the protest shall be filed within 30 days of the publication of the notice of its effective date.

(2) The protest shall contain:

(i) The name, mailing address, telephone number and interest of the person filing the protest;
(ii) A statement of the issue or issues being protested;
(iii) A statement of the part or parts of the plan or amendment being protested;
(iv) A copy of all documents addressing the issue or issues that were submitted during the planning process by the protesting party or an indication of the date the issue or issues were discussed for the record; and
(v) A concise statement explaining why the State Director's decision is believed to be wrong.

(3) The Director shall promptly render a decision on the protest.

(b) The decision shall be in writing and shall set forth the reasons for the decision. The decision shall be sent to the protesting party by certified mail, return receipt requested. The decision of the Director shall be the final decision of the Department of the Interior.

Fortification Creek Planning Area
Proposed Resource Management Plan Amendment/
Environmental Assessment

Proposed Action Location:

Fortification Creek Planning Area
U.S. Department of the Interior
Bureau of Land Management
Campbell, Johnson, and Sheridan Counties, Wyoming

Lead Agency:

U.S. Department of the Interior
Bureau of Land Management
Buffalo Field Office
1425 Fort Street
Buffalo, Wyoming 82834

Responsible Official:

Donald A. Simpson
State Director
Bureau of Land Management
Wyoming State Office
5353 Yellowstone
Cheyenne, Wyoming 82009

Contact:

Thomas Bills
Project Manager
Bureau of Land Management
Buffalo Field Office
1425 Fort Street
Buffalo, Wyoming 82834

Proposed Resource Management Plan Amendment
Environmental Assessment
And Finding of No Significant Impact
For the
Fortification Creek Planning Area

U.S. Department of Interior
Bureau of Land Management
Buffalo Field Office, Wyoming

March 2011

Recommended for Approval

Duane Spencer, Buffalo Field Manager

Approved

Donald A Simpson, Wyoming State Director

FINDING OF NO SIGNIFICANT IMPACT
for the
FORTIFICATON CREEK PLANNING AREA
RESOURCE MANAGEMENT PLAN AMENDMENT
ENVIRONMENTAL ASSESSMENT (WY-080-135)

FINDING OF NO SIGNIFICANT IMPACT:
On the basis of the information contained in the proposed Fortification Creek Resource Management Plan Amendment (RMPA) and Environmental Assessment (EA), and all other information available to me, it is my determination that: (1) the implementation of the proposed RMPA will not have significant environmental impacts; and (2) the proposed RMPA does not constitute a major federal action having a significant effect on the human environment. Therefore, an environmental impact statement or a supplement to the existing environmental impact statement is not necessary and will not be prepared.

This finding is based on my consideration of the Council on Environmental Quality's (CEQ) criteria for significance (40 CFR 1508.27), with regard to the context and to the intensity of the impacts described in the EA.

CONTEXT:
Elk are a common species ranging throughout mountainous regions of western North America. Many eastern states have reintroduced populations. The viability of a small Wyoming elk herd is insignificant within the national and regional contexts.

The Fortification Creek elk are a small isolated herd living in a prairie environment. Such prairie herds were common prior to European expansion on the western plains. Today, elk herds occupying prairie habitats are unusual though not unique and are therefore of local interest and importance. The public, conservation groups, and the State of Wyoming have all expressed their interest in maintaining a viable elk herd within the Fortification Creek Planning Area (FCPA). The proposed RMPA includes elements such as phasing development and performance standards to maintain the elk herd at or above the Wyoming Game and Fish Department (WGFD) population objective.

INTENSITY:
Most leases were purchased with a stipulation that impacts to steep slopes, fragile watersheds and crucial elk habitat would be mitigated through a plan acceptable to the authorizing officer designed to avoid significant impacts. The proposed RMPA is a performance based approach which defines performance standards to protect these sensitive resources thus preventing significant effects while accommodating oil and gas development.

The FCPA contains unique characteristics including a Wilderness Study Area (WSA) and a proposed Area of Critical Environmental Concern (ACEC). The WSA is administratively closed to mineral leasing and is being managed in accordance with the BLM's Interim Management Policy (BLM Manual H-8550-1, 1995). The performance standards within the proposed RMPA designed to protect the steep slopes, fragile watersheds, crucial elk habitat, and other resources are sufficient to protect the important and relevant values of the proposed ACEC.
Relevant scientific literature was reviewed in preparing the RMPA/EA. The scientific community is

consistent with their conclusions related to the effects of disruptive activities, such as mineral development, upon elk and other ungulate species. The scientific community is also consistent with their conclusions related to reclamation, identifying challenging reclamation situations and techniques for successful reclamation. Therefore the anticipated effects are not highly controversial, highly uncertain, or involve unique or unknown risks. The performance standards and monitoring program provide for an adaptive management approach to counter any uncertain, unique, or unknown effect that may arise.

The RMPA is a programmatic document with management decisions and performance standards to prevent individual CBNG Plans of Development (PODs) from reaching significant impacts either cumulatively or by establishing precedence for future actions.

The proposed RMPA does not pose a risk to public health and safety. There are no scientific, cultural, or historical resources present within the FCPA that will be significantly affected by the preferred alternative. No Endangered Species Act listed species or their critical habitat are present within the FCPA. The proposed RMPA will not have any anticipated impacts that would threaten a violation of Federal, State, or local law or requirements imposed for the protection of the environment.

Recommended by:

Signature: _____ Date: MAR 18 2011
Duane W. Spencer, Buffalo Field Office Manager

Approved by:

Signature: _____ Date: MAR 18 2011
Donald A. Simpson, Wyoming State Director

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Acronyms

ACEC	Area of Critical Environmental Concern
AEM	Adaptive Environmental Management
AIRFA	American Indian Religious Freedom Act
AMP	Allotment Management Plan
AMS	Analysis of the Management Situation
AP	Approved Permit
AQRV	Air Quality Related Values
AR	Administrative Record
APD	application for permit to drill
AUM	animal unit month
bcf	billion cubic feet
BFO	Buffalo Field Office
BLM	Bureau of Land Management
BMP	Best Management Practice
BRA	Buffalo Resource Area
Btu/hp-hour	British thermal units per horsepower-hour
CAA	Clean Air Act
CBNG	coal bed natural gas
CBNGA	Coal Bed Natural Gas Alliance
CCAR	California Climate Action Registry
CDF	California Department of Forestry and Fire
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cfs	cubic feet per second
CH_4	methane
CO	carbon monoxide
COA	Condition of Approval
CREG	Consensus Revenue Estimating Group
CRMP	coordinated resource management plan
dBA	decibels (A-weighted)
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
°F	degrees Fahrenheit
FCPA	Fortification Creek Planning Area
FEIS	Final Environmental Impact Statement
FLM	Federal Land Manager
FLPMA	Federal Land Policy and Management Act
FMU	Fire Management Unit
FONSI	Finding of No Significant Impact
FOOGLRA	Federal Onshore Oil and Gas Leasing Reform Act of 1987
FR	Federal Register
gal/yr	gallons per year
hp/hr	Horsepower per hour

HUC	Hydrologic Unit Code
IBLA	Interior Board of Land Appeals
IMPROVE	Interagency Monitoring of Protected Visual Environments
JARE	Journal of Agriculture and Resource Economics
lb/hr	pounds per hours
lb/MMBtu	pounds per million British thermal units
LWC	Lands with Wilderness Characteristics
mby	million barrels per year
mcf	thousand cubic feet
mgd	million gallons per day
$mile^2$	square mile
MMBtu/hr	Million British thermal units per hour
MMCF	million cubic feet
MMS	Minerals Management Systems
N	nitrogen
NAAQS	National Ambient Air Quality Standards
NCSHPO	National Council of State Historic Preservation Officers
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NO_2	nitrogen dioxide
NO_x	oxides of nitrogen
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRCS	National Resources Conservation Service
NRDC	Natural Resources Defense Council
NRHP	National Register of Historic Places
NSO	No Surface Occupancy
NSS	Native Species Status
OGOR	Oil and Gas Operations Report
OHV	off-highway vehicles
ONRR	Office of Natural Resources Revenue
OSFM	Office of the State Fire Marshal
PFYC	Potential Fossil Yield Classification
PILT	payment in lieu of taxes
PL	Public Law
PM	particulate matter
$PM_{2.5}$	particulate matter less than or equal to 2.5 microns in size
PM_{10}	particulate matter less than or equal to 10 microns in size
POD	Plan of Development
PRB	Powder River Basin
PRB O&G FEIS	Powder River Basin Oil and Gas Final Environmental Impact Statement
PRMPA	Proposed Resource Management Plan Amendment
PSD	Prevention of Significant Deterioration
RFD	Reasonably Foreseeable Development

RMP	Resource Management Plan
RMPA	Resource Management Plan Amendment
ROD	Record of Decision
ROW	right-of-way
SAFCA	Social Assessment of the Four-County Area
SO_2	sulfur dioxide
SO_x	oxides of sulfur
SHPO	State Historic Preservation Office
SIL	Significant Impact Levels
SMA	Special Management Area
SRP	Special Recreation Permit
SSURGO	Soil Survey Geographic (data)
tcf	trillion cubic feet
TCP	traditional cultural property
TL	Timing Limitations
tpy	tons per year
$\mu g/m^3$	microgram per cubic meter
U.S.C.	United States Code
USDA	U.S. Department of Agriculture
USDOI	U.S. Department of the Interior
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UWYO	University of Wyoming
VOC	volatile organic compound
VRM	Visual Resource Management
VMT	vehicle miles traveled
WAAQS	Wyoming Ambient Air Quality Standards
WDEQ	Wyoming Department of Environmental Quality
WGFD	Wyoming Game and Fish Department
WGISC	Wyoming Geographic Information Science Center
WHMA	Wildlife Habitat Management Area
WMP	Water Management Plan
WOGCC	Wyoming Oil and Gas Conservation Commission
WSA	Wilderness Study Area
WSEO	Wyoming State Engineer's Office
WSGS	Wyoming State Geological Survey
WYCRO	Wyoming Cultural Records Office
WYCRIS	Wyoming Cultural Resources Information System
WYDOE	Wyoming Department of Employment
WYDOT	Wyoming Department of Transportation
WY EAD	Wyoming Department of Administration and Information, Economic Analysis Division
WYNDD	Wyoming Natural Diversity Database
WYPDES	Wyoming Pollutant Discharge Elimination System

Executive Summary

This Proposed Resource Management Plan Amendment (PRMPA) and Environmental Assessment (EA) presents management options and a proposed action for Bureau of Land Management (BLM)-managed minerals within the Fortification Creek Planning Area (FCPA). Total acreage within the FCPA boundaries is 100,655 acres, 42,755 acres of which are Federally owned and 93,159 acres of which are BLM managed mineral resources within Campbell, Johnson, and Sheridan counties in Northeastern Wyoming. Because some of the Federally owned minerals are within a Wilderness Study Area (WSA) or pertain to coal, only 79,362 acres of mineral estate will be evaluated. The FCPA is generally bounded on the northeast by Wild Horse Creek, on the west by the Powder River, and on the south by Fortification and Montgomery roads.

There are approximately 52,576 acres of private surface land and 5,324 acres of State of Wyoming surface and subsurface land in the area. While the FCPA encompasses private and State, as well as Federal lands, BLM will make decisions only on its lands and resources. However, under the Federal Land Policy and Management Act (FLPMA) and National Environmental Policy Act (NEPA), BLM is required to consider impacts to non-BLM lands and resources that would occur as a result of its actions.

With generally rugged topography, elevations in the FCPA range from approximately 3,700 feet along the Powder River to approximately 4,800 feet on ridges. The area is covered by shrublands, with ridges covered predominantly by juniper woodlands. This diverse landscape is home to an isolated elk herd as well as a variety of other wildlife. The FCPA is used as a hunting area for resident and non-resident hunters. Human activity is visible throughout the landscape, with gas field developments and private ranches within and surrounding the FCPA.

Overview of the Plan

This PRMPA/EA is organized and formatted consistently with applicable NEPA and Council on Environmental Quality (CEQ) regulations. It has been developed in accordance with BLM's Land Use Planning Handbook and other policies and guidance relevant to the management of public lands.

The PRMPA/EA was developed with the cooperation and input of several State agencies, the three affected counties, and other interested parties. BLM also coordinated with the U.S. Fish and Wildlife Service (USFWS) and Native American tribes. The PRMPA/EA describes these contacts and coordination efforts, which have improved the analysis and enhanced the basis for decision-making.

The formal scoping period began on August 20, 2007, with the publication of the Notice of Intent (NOI) in the Federal Register (FR). Written comments on the proposal for the RMPA/EA were accepted through November 30, 2007. A Draft RMPA/EA was released for public comment on August 7, 2008 and written comments were received through October 7, 2008. Concerns regarding the ability to access gas leases in the FCPA and protection of the elk herd, prompted BLM to reconsider the alternatives. Revised alternatives were evaluated in this PRMPA/EA. The 2008 comments were incorporated into this version of the PRMPA/EA.

The purpose of this RMPA/EA is to consider changes in management of coal bed natural gas (CBNG) development within the FCPA. While virtually all of the Federal CBNG reserves have

been leased, new information regarding wildlife, notably elk, has led BLM to consider modifying certain operational standards for CBNG development. The current land use plan was prepared in 1985 and amended in 2001. In 2003, BLM prepared another RMPA/Environmental Impact Statement (EIS) for the entire Powder River Basin (PRB), which includes the FCPA (BLM 2003a). This PRMPA/EIS did not specifically address the following issues:

- Protection of the isolated elk herd found in the FCPA;
- Continuation of the prohibition against overhead power lines within the FCPA;
- Designation of portions of the FCPA as an Area of Critical Environmental Concern (ACEC); and
- Lands with Wilderness Characteristics and Wild Lands (Secretarial Order 3310).

In cooperation with the Wyoming Game and Fish Department (WGFD) and the University of Wyoming (UWYO), BLM has been monitoring elk populations and movement within the FCPA. This ongoing study and analysis has confirmed that the elk are particularly susceptible to mineral development. Because BLM has leased fluid minerals in the FCPA, but has not generally allowed development, the agency decided to reevaluate its management controls to balance additional impacts to the elk and other resources.

Management Alternatives

The development of the alternatives for the FCPA included a public scoping process that allowed interested members of the public, special interest groups, and resource and land use agencies to comment on the appropriate scope of issues to consider in the planning process. The formal scoping period began on August 20, 2007; with the publication of the NOI to prepare the RMPA/EA in the FR. Written comments on the proposal for the RMPA/EA were accepted through November 30, 2007.

A Draft RMPA/EA was released for public comment on August 7, 2008. Written comments were received through October 7, 2008. Concerns regarding the ability to access gas leases in the FCPA and protection of the elk herd, prompted BLM to reconsider the alternatives. Revised alternatives were evaluated in this PRMPA/EA. The 2008 comments were incorporated into this version of the PRMPA/EA.

Because the lands have been leased giving the leaseholders the right to develop the mineral resource, BLM discussed potential development options with the leaseholders. BLM met with leaseholders to propose phasing development to reduce impacts to the elk herd. It was agreed that the phased development would be feasible from an operational and economic standpoint. The phased development approach is built into the two action alternatives discussed below.

Three alternatives were considered in the PRMPA/EA. The first, known as the No Action Alternative – Alternative I, is required by NEPA and CEQ regulations. It considers impacts under existing management direction. As such, development on the CBNG leases could proceed without any new management direction.

Under the second alternative, Alternative II, the placement of facilities would be prescribed and the pace of CBNG development would be managed through a geographically-phased approach. Each phase of development would last three years and would be followed by one year of successful reclamation before proceeding to the next area. There would be Timing Limitations (TLs) for surface-disturbing activities within the elk crucial winter and parturition (calving)

ranges. Overhead power lines would be allowed on BLM surface land within existing road corridors and drainages. Development within crucial winter and parturition ranges would be restricted to achieve WGFD goals. Development would not be allowed on highly erosive soil or slopes greater than 25 percent. An ACEC would be established along the citizen-proposed boundaries and ACEC management prescriptions would be identified. Additionally, a Wildlife Habitat Management Area (WHMA) would be established.

The third alternative, the Proposed Action, calls for performance-based CBNG development, with standards for elk use and interim reclamation, before additional development. Overhead power lines would be allowed on BLM surface land within road corridors. Eighty percent or more security habitat would be retained within each geographic phase. Already existing stipulations for steep slopes, fragile watersheds, and elk crucial habitat would remain. Surface-disturbing activities on slopes greater than 25 percent and erosive soils would not be allowed, but there could be exceptions. Exceptions would be granted if the operator proposed an adequate disturbance and reclamation plan. The disturbance and reclamation plan would take into account the performance-based standards and the operator would be required to meet these standards. This alternative would be closely monitored by BLM. BLM may authorize additional drilling if BLM determines that the security habitat and other performance standards have been met. Neither an ACEC nor WHMA would be established.

Lands With Wilderness Characteristics

The 1979 and 1985 Wilderness Inventories for the FCPA was updated for this PRMPA/EA. BLM did not identify lands with wilderness characteristics outside of the WSA. Lands outside of the WSA have been managed for multiple uses including mineral development. The road inventory indicates that the areas determined not to possess wilderness characteristics in 1979 do not possess wilderness characteristics today. Federal mineral leases have been issued throughout the FCPA outside the WSA. CBNG companies have been in the field in recent years actively preparing their APDs. Lands and resources outside the WSA do not exhibit a high degree of naturalness and there is no opportunity for solitude or primitive unconfined recreation outside of the WSA.

Environmental Impacts

Results of the analysis in the PRMPA/EA indicated that changes to BLM's management of CBNG in the FCPA would have minor to moderate impacts to a number of resources. For some resources, the Proposed Action would reduce impacts from those expected under the No Action Alternative. For example, phased development and retaining 80 percent of the security habitat would allow the elk herd to continue to meet the WGFD's population objective of 150 individual animals.

Coordination and Consultation

BLM published a NOI to prepare the RMPA/EA in the FR on August 20, 2007, and a public scoping period was held through November 30, 2007. Three public meetings were held from October 29 through October 31, 2007, in Gillette, Buffalo, and Sheridan, Wyoming, respectively. Approximately 64 people attended these meetings.

BLM received more than 25,000 form letters and 16 unique comment letters during the scoping period. These letters suggested which issues, alternatives, and information should be used in

developing the RMPA/EA. The State of Wyoming and Sheridan and Johnson counties entered into formal agreements with BLM.

A Draft RMPA/EA was released for public comment on August 7, 2008. Written comments were received through October 7, 2008 and incorporated into this version. Concerns regarding the ability to access CBNG leases in the FCPA while protecting the elk herd, prompted BLM to reconsider the alternatives. More than 32,000 form letters and 56 unique comment letters were received.

A revised Draft RMPA/EA was released for public comment on September 17, 2010. Written comments were received through November 19, 2010 and incorporated into the PRMPA/EA. Concerns included how the phased approach would work, protection of the elk herd, and socioeconomic impacts. Restricting or eliminating hunting of the FCPA elk herd was suggested during the comment period. However, this was not analyzed in this PRMPA/EA because it is unrealistic. More than 22,197 form letters and 374 unique comment letters were received.

Impact Summary

CBNG impacts will impact nearly all resources and resource protections will impact CBNG development and other resource uses. These impacts are briefly listed in Table ES-1.

Table ES-1 Summary of Impacts

Land Use or Management Action	Alternative I (No Action)	Alternative II (Prescriptive)	Alternative III Proposed Action (Performance Based)
Air Resources Management	No exceedances of air quality standards	No exceedances of air quality standards	No exceedances of air quality standards
Soil Resources Management	Minor (-) 179 miles of new roads	Minor (-) 101 miles of new roads	Minor (-) 77 miles of new roads
Water Resources Management	Moderate (-) 179 miles of new roads and groundwater drawdown	Moderate (-) 101 miles of new roads and groundwater drawdown	Moderate (-) 77 miles of new roads and groundwater drawdown
Vegetation Resources Management	Minor (-) 3,536 acres (3.5%) disturbance to vegetation	Minor (-) 2,249-acre (2.2%) disturbance to vegetation	Minor (-) 2,092-acre (2.3%) disturbance to vegetation
Fish and Wildlife Resources Management	Major (-) 34,149 acres (84%) of yearlong security habitat is lost, 25,774 acres (80%) of crucial range security habitat is lost	Moderate (-) 9,118 acres (22%) of yearlong security habitat is lost, 4,213 acres (12%) of crucial range security habitat is lost	Moderate (-) 7,094 acres (17%) of yearlong security habitat is lost, 3,446 acres (11%) of crucial range security habitat is lost

Table ES-1 Summary of Impacts

Land Use or Management Action	Alternative I (No Action)	Alternative II (Prescriptive)	Alternative III Proposed Action (Performance Based)
Special Species Resources Management	Major (-) Loss of habitat	Moderate (-) Loss of some habitat	Moderate (-) Loss of some habitat
Cultural Resources Management	Minor (-) Sites inventoried and mitigated	Minor (-) Sites inventoried and mitigated	Minor (-) Sites inventoried and mitigated
Paleontological Resources Management	Minor (-) Fossils inventoried and mitigated	Minor (-) Fossils inventoried and mitigated	Minor (-) Fossils inventoried and mitigated
Visual Resources Management	Moderate (-) 9.3 miles of overhead power lines, 179 miles of new roads	Moderate (-) 2.5 miles of overhead power lines, 101 miles of new roads	Moderate (-) 1.6 miles of overhead power lines, 77 miles of new roads
Fuels and Fire Management	Minor (-) Increased fire risk	Minor (-) Increased fire risk	Minor (-) Increased fire risk
Rangeland Resource Management	Minor (-) 3,536-acre disturbance, water impoundments dispersed	Minor (-) 2,249-acre disturbance, water impoundments outside crucial ranges	Minor (-) 2,092-acre disturbance, water impoundments performance based
Recreation Resources Management	Minor (-) 3,536-acre disturbance	Minor (-) 2,249-acre disturbance	Minor (-) 2,092-acre disturbance
Transportation Resources Management	Major (-) Vehicle trips increase by 273%	Major (-) Vehicle trips increase by 210%	Major (-) Vehicle trips increase by 207%
Fluid Minerals Management	No Impact 726 potential new wells	Major (-) 487 potential new wells	Major (-) 483 potential new wells
Special Designations	No Impact No special designations	Major (+) 57,855 acres protected	Negligible (-) Performance-based standards protective
Social and Economics	Minor (+) 340 jobs supported in surrounding counties. Increase of federal, state, and local revenues of $307 million.	Negligible 228 jobs supported in surrounding counties. Increase of federal, state, and local revenues of $206 million.	Negligible 227 jobs supported in surrounding counties. Increase of federal, state, and local revenues of $204 million.

1.0 PURPOSE AND NEED FOR ACTION

1.1 Introduction

The Bureau of Land Management (BLM) Buffalo Field Office (BFO) has issued leases to private firms to develop coal bed natural gas (CBNG) in the Fortification Creek Planning Area (FCPA) in Northeastern Wyoming. These leases conveyed the right to develop Federal CBNG under certain stipulations and terms and conditions. Since those leases were issued, the Wyoming Game and Fish Department (WGFD), University of Wyoming (UWYO), and BLM have been studying an isolated, non-migratory herd of Rocky Mountain Elk (*Cervus elaphus nelson*) located within the planning area. In addition, BLM has deferred taking action on plans of development (PODs) filed with the BFO until it could analyze the impacts of the CBNG on the elk, visual resources, cultural resources and water quality.

This chapter will present BLM's purpose and need for the action, outline the legal authorities that will guide the analysis and decisionmaking, and provide an overview of the planning area.

1.2 Purpose and Need

The purpose of this Resource Management Plan Amendment (RMPA)/Environmental Assessment (EA) is to provide the necessary level of analysis upon which to base a decision on future CBNG development within the FCPA. Critical issues that this RMPA will address are wildlife, cultural, paleontological, and visual resources and how to best manage CBNG development in a region with erosive soils and steep slopes. Of particular importance is consideration of a proposed Area of Critical Environmental Concern (ACEC), which was deferred from the Powder River Basin (PRB) Oil and Gas RMPA/Final Environmental Impact Statement (FEIS; PRB O&G FEIS) in 2003 (BLM 2003a). In addition, given that BLM has received CBNG PODs for lands that have been leased within the FCPA, this is an opportune time to review existing management decisions in light of new information.

Under the Federal Land Policy and Management Act (FLPMA) and National Environmental Policy Act (NEPA), BLM is required to consider impacts to non-BLM lands and resources that would occur as a result of its actions. An RMPA and an EA, prepared under NEPA, are needed to consider the proposed ACEC designation and to consider possible new or changed management actions or other protective measures that are not currently authorized in the existing land use plan.

Portions of the FCPA were proposed for ACEC designation during scoping for the PRB O&G FEIS (BLM 2003a). BLM verified that the proposed area met importance and relevance criteria. The PRB O&G FEIS deferred a final decision on ACEC designation (BLM 2003a). A decision will be made with this PRMPA/EA whether to designate and ACEC.

BLM is required to allow lease holders reasonable access to the lands for which they hold leases. Therefore the need for the action is to consider all reasonable alternatives including one in which current management would continue. Under current management direction, CBNG extraction would be allowed in accordance with the existing stipulations and terms and conditions for development. BLM will use this RMPA to consider additional management controls, including timing and location stipulations, to mitigate potential impacts.

This is a programmatic RMPA/EA that includes evaluation of environmental impacts of broad BFO actions in the FCPA. The proposed action will define and implement a program that sets

the stage for site-specific actions to follow. Individual NEPA analyses will be required for individual actions—in this case based on PODs. Each POD submitted to BLM for gas development on a lease will go through a NEPA analysis before BLM approves the POD.

Initially, BLM considered a proposed land exchange with the State of Wyoming for land within a Wilderness Study Area (WSA) in the FCPA. This proposal has since been withdrawn and was not analyzed in this PRMPA/EA.

Since BLM approved the original Buffalo Resource Area (BRA) Resource Management Plan (RMP) Record of Decision (ROD; BLM 1985a) in 1985, CBNG has replaced conventional oil and gas development as the dominant play throughout the PRB. BLM estimates that CBNG development could result in more than 726 wells in the FCPA compared to approximately 100 wells for conventional gas development. CBNG development requires electricity to operate the wells, gas metering stations, compression facilities and other infrastructure, and for water treatment and disposal. Power lines are buried from central overhead power line points to individual wells, and there are approximately six wells and 2 miles of buried power lines per drop point.

The BFO RMP (BLM 2001a) designated the FCPA as Visual Resource Management (VRM) Class III, which allows changes to the landscape as long as the changes do not become the predominant element in the landscape. BLM prohibited overhead power lines on Federal surface land within the FCPA in the BRA RMP. Typically, overhead power is allowed in VRM Class III areas. The overhead power line prohibition will be revisited in this PRMPA/EA.

Since completing the PRB O&G FEIS (BLM 2003a) and the original BRA RMP, BLM and the WGFD have gathered additional information regarding the population levels and crucial winter and parturition (calving) ranges of an isolated elk herd within the FCPA. This information will be used to determine the impact of CBNG development on the herd and to develop protective measures to minimize future impacts to the herd based on the latest data. BLM has also recently completed an inventory of paleontological resources within the FCPA. This inventory will assist in the analysis and help minimize impacts to fossil resources from CBNG development.

Any decisions based on this PRMPA/EA will be programmatic, in that they will provide overall management guidance that will be applied to future PODs filed by lease holders or their operators. The plan will set goals and objectives to be considered in site-specific actions that will follow. Individual NEPA analyses will be required for individual PODs and individual well applications for permits to drill (APDs). The individual PODs will be evaluated against the decisions from this PRMPA/EA.

1.2.1. Split Estate Lands

Throughout this document, BLM uses the term “split estate” to describe certain lands that have a retained Federal mineral interest. The reasons for this split between surface and subsurface ownership varies, but it usually pertains to land (surface) originally passed from Federal ownership under the Homestead acts or Statehood Act that contains minerals (subsurface) held for the benefit of all Americans. The surface of split estate lands in the FCPA is privately owned. These tracts have retained Federal minerals below them, most of which have been leased for mineral development.

While BLM has the authority to lease and allow development of these split estate tracts, it works closely with surface owners to respect property rights and ensure compatibility with surface uses.

In some cases, BLM may not allow activities on private or State split estate lands in conjunction with Federal mineral development if such development would cause undue or unnecessary degradation to the environment.

1.3 Fortification Creek Planning Area

The FCPA is located within the PRB in Northeastern Wyoming. The location of the FCPA is shown on Figure 1-1. As shown on Figure 1-2, the FCPA is generally bounded on the northeast by Wild Horse Creek, on the west by the Powder River, and on the south by Fortification and Montgomery roads.

Total acreage within the boundaries of the FCPA is 100,655 acres. The plan will address the management of 79,362 acres of Federal mineral estate managed by BLM within Sheridan, Johnson, and Campbell counties. Total Federal mineral estate in the FCPA is 93,159 acres; however because the WSA will not be developed, Federal mineral estate in the WSA was not included in the analysis. Federal coal mineral estate was not included in the analysis. There are approximately 42,755 acres of BLM surface land, 52,576 acres of private surface land, and 5,324 acres of State of Wyoming surface and subsurface land in the area. While the FCPA encompasses private, state, and Federal lands, BLM will only make decisions on lands and resources under its jurisdiction. However, under the FLPMA and NEPA, BLM is required to consider impacts to non-BLM lands and resources that would occur as a result of its actions. Land ownership is shown on Figure 1-2.

A wilderness inventory was completed in 1979 and those lands with wilderness characteristics (LWC) became a WSA. A coalition of conservation groups proposed to expand the boundaries of the Fortification Creek WSA in 1994 and 2004. These proposed lands have been inventoried for LWCs as part of the Fortification Creek RMP amendment process. The inventory is available at http://www.blm.gov/wy/st/en/info/NEPA/documents/bfo/fortification_creek.html. The inventory determined that the FCPA outside of the WSA does not contain LWCs.

Oil and gas leasing in the Powder River Basin has been ongoing since before the Buffalo RMP was revised in 1985; currently the FCPA is nearly completely leased. Development of these oil and gas leases will occur because the CBNG oil and gas play is proven and several PODs have been submitted.

With generally rugged topography, elevations in the FCPA range from approximately 3,700 feet along the Powder River on the western boundary to approximately 4,800 feet on ridges. The area is covered by shrublands, with ridges supporting juniper woodlands. This diverse landscape is home to an isolated elk herd as well as a variety of other wildlife.

The FCPA is used as a hunting area for resident and non-resident hunters. Effects of human activity are visible throughout the landscape with gas field developments on the south and east, and private ranches surrounding the FCPA.

1.4 Overview of the Plan

This PRMPA/EA has been organized and formatted consistently with applicable NEPA and Council on Environmental Quality (CEQ) guidelines and the BLM Land Use Planning Handbook. The goal of this document is to provide the reader with a clear understanding of the alternatives, environmental resources that may be affected, potential environmental

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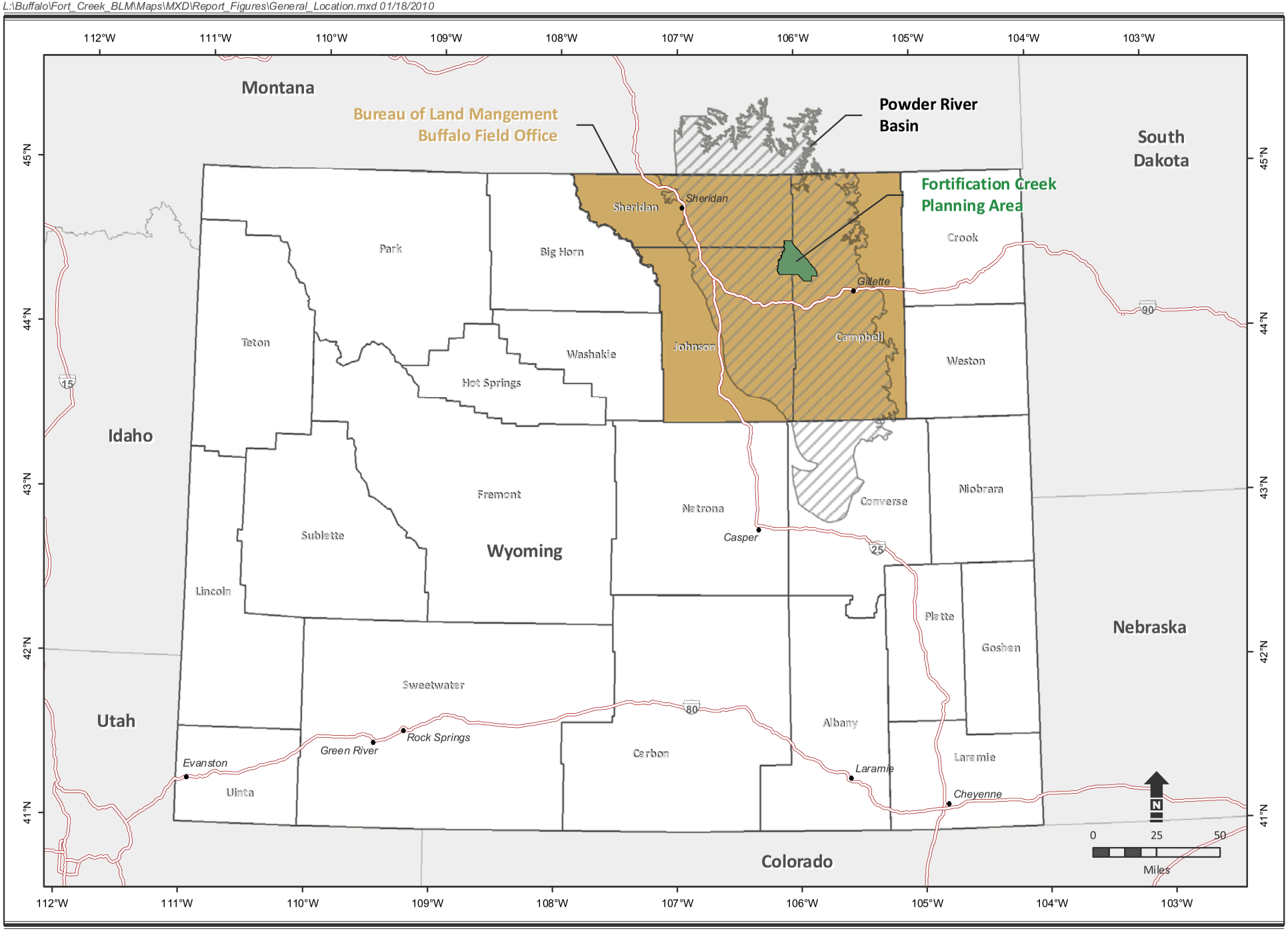

Source:
Wilderness Boundaries - Bureau of land Management 2009
Basemap - ESRI 2009

Figure 1-1

General Location Map

Fortification Creek Planning Area

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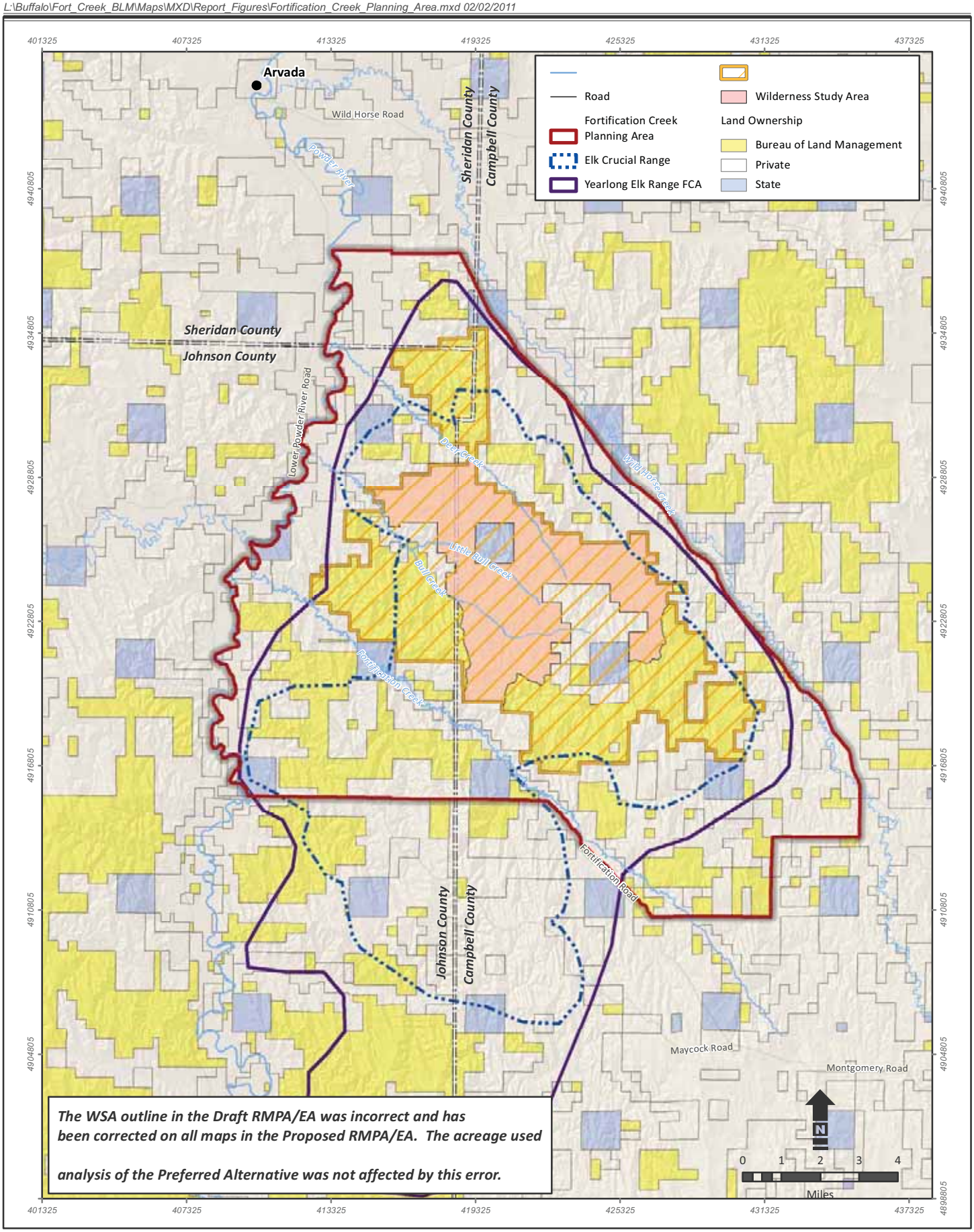

The WSA outline in the Draft RMPA/EA was incorrect and has been corrected on all maps in the Proposed RMPA/EA. The acreage used analysis of the Preferred Alternative was not affected by this error.

Source:
Mineral Estate/Boundaries - Bureau of land Management 2009
Topography - United States Geological Survey 2005
Hydrography - National Hydrography Dataset 2003

Figure 1-2

Fortification Creek Planning Area

Campbell, Johnson, and Sheridan Counties, Wyoming

consequences, and the environmental review and evaluation process. The following are the chapter titles for this document and brief descriptions of the chapter contents:

- Chapter 1 – Purpose and Need: This chapter offers a brief history and background of the FCPA and describes the purpose and need for the action, the scoping process and issues, planning criteria, the planning process, related plans, relevant policy, and the overall vision of the PRMPA/EA.
- Chapter 2 – Alternatives: This chapter describes potential management approaches, or "alternatives" and discusses the alternative development process. It describes three alternatives that are evaluated in detail in this PRMPA/EA, including the No Action Alternative and two action alternatives that provide a range of alternate management approaches to address the planning issues.
- Chapter 3 – Affected Environment: This chapter describes the current physical, biological, human, and land use environments of the FCPA. The description provides a baseline against which the impacts of the alternatives may be compared. The baseline described in this chapter represents environmental and social conditions and trends in the FCPA at the time this document was being prepared.
- Chapter 4 – Environmental Consequences: This chapter describes how, and to what extent, baseline conditions would be altered by the alternatives. These changes are measured in terms of adverse and beneficial impacts, and direct, indirect, and cumulative impacts.
- Chapter 5 – Consultation and Coordination: This chapter describes how BLM interacted with cooperators and stakeholders.
- Chapter 6 – References: This chapter provides full citation information for all references, published and unpublished, cited in this document, as well as personal contacts used in developing this PRMPA/EA.

Appendices A through H provide supporting information for the chapters described above. The appendices offer more detailed information, which some readers may find helpful when reviewing the main text of the document.

Potential decisions and/or other discussions contained in this document may refer directly to maps and figures and many potential decisions themselves are "map based." Therefore, the reader must rely on the text and maps taken together to fully understand the potential decisions described for each alternative.

1.5 Scoping and Issues

As required by NEPA, the BLM BFO completed a process to determine the relevant issues that will guide the scope of the environmental analysis and alternatives to be analyzed in the FCPA RMPA/EA. This process, called scoping, is conducted in the early phases of the planning process, and is used to determine important issues, identify possible alternatives, and gather public comments on BLM's action. The BFO used comments received during the scoping period to determine:

- Important issues to be addressed;
- Possible data needs and sources;
- Alternatives to be assessed; and

- Potential environmental and socioeconomic effects of the various alternatives.

The formal scoping period began on August 20, 2007, with the publication of the Notice of Intent (NOI) in the Federal Register (FR). Written comments on the proposal for the RMPA/EA were accepted through November 30, 2007 and BLM received more than 25,000 form letters and 16 unique comment letters during the scoping period. A Draft RMPA/EA was released for public comment on August 7, 2008. Written comments were received through October 7, 2008 and more than 32,000 form letters were received along with 56 unique comment letters. These comments were incorporated into this version.

Concerns regarding the ability to access gas leases in the FCPA and protection of the elk herd, prompted BLM to reconsider the alternatives. These new alternatives are evaluated in this PRMPA/EA.

The vast majority of the comment letters received were from members of the Natural Resources Defense Council (NRDC), who were supportive of management objectives to protect sensitive resources in the FCPA, a land exchange for the State parcel surrounded by the WSA, underground power lines, and required phased development with proven reclamation.

1.5.1. Issues Addressed

Based on BLM's management concerns, and input from cooperating agencies; other Federal, State, and local agencies; and the public, the PRMPA/EA will address the following issues:

- Wildlife and wildlife habitat (particularly the elk herd);
- Visual resource management;
- Steep slopes and sensitive soils;
- Phased development;
- CBNG produced water management; and
- Consideration of designating a portion of the FCPA as an ACEC.

1.6 Planning Criteria

Planning criteria are the constraints or ground rules that are developed to guide and direct the planning revision of the FCPA RMPA/EA. Planning criteria are based on laws and regulations; guidance provided by the BLM Wyoming State Director; results of consultation and coordination with the public, other agencies, and governmental entities, and Native American tribes; analysis of information pertinent to the FCPA; public input; and professional judgment. Additional planning criteria may be identified as the planning process progresses.

Planning criteria proposed for the PRMPA/EA include the following:

- The PRMPA/EA will comply with FLPMA and all other applicable laws, regulations, and policies. The land use plan amendment process will be governed by the planning regulations in 43 Code of Federal Regulations (CFR) 1610 and the BLM Land Use Planning Handbook H-1601-1.
- The proposed action and alternatives will be analyzed in accordance with NEPA.
- Lands affected by the PRMPA/EA will be public lands and mineral estate managed by BLM. No decisions will be made relative to non-BLM administered lands or non-Federal minerals.

- Broad-based public participation will be an integral part of the planning process.
- The PRMPA/EA will recognize all valid existing rights.
- The planning team will work cooperatively and collaboratively with cooperating agencies and all other interested groups, agencies, and individuals. The PRMPA/EA will be consistent with existing non-Federal plans and policies, provided the decisions in the existing plans are consistent with the purposes, policies, and programs of Federal law, and regulations applicable to public lands.
- The WSA will continue to be managed under the Interim Management Policy for Lands under Wilderness Review until Congress either designates all or portions of the WSA as wilderness or releases the lands from further wilderness consideration.
- The wilderness inventory was updated and no lands with wilderness characteristics outside the WSA are present.
- The planning process will involve American Indian tribal governments and will provide strategies for the protection of recognized traditional uses.
- The PRMPA/EA shall include adaptive environmental management (AEM) principles and protocols to deal with unknown future issues and outcomes.

1.7 Planning Process

In general, BLM follows a nine-step land use planning process, as outlined below. Steps 1 through 7 have been completed for the current process. The results of these steps have been incorporated throughout this PRMPA/EA, and are as follows:

- Step 1 – Identify Planning Issues: Issues and concerns are identified through a scoping process that includes the public, Native American tribes, other Federal agencies, and State and local governments.
- Step 2 – Develop Planning Criteria: Planning criteria are created to ensure that decisions are made to address the issues pertinent to the planning effort. Planning criteria are derived from a variety of sources, including applicable laws and regulations, existing management plans, coordination with other agencies' programs, and the results of public and agency scoping. As planning proceeds, planning criteria may be updated or changed.
- Step 3 – Collect Data and Information: Based on the planning criteria, data and information for the resources in the FCPA are collected.
- Step 4 – Analyze the Management Situation: The collected data and information are assembled into the Analysis of the Management Situation (AMS) (BLM 2008a).
- Step 5 – Formulate Alternatives: A range of reasonable management alternatives that address issues identified during scoping are developed.
- Step 6 – Assess Alternatives: The environmental effects of each alternative are estimated and analyzed.
- Step 7 – Select Preferred Alternative: The alternative that best resolves planning issues is identified as the Preferred Alternative. The Preferred Alternative may be a combination of the analyzed alternatives or an entirely new alternative.

- Step 8 – Select Resource Management Plan: A Draft RMPA/EA is issued and made available to the public for a review period of 60 calendar days. This document represents this step in the process. During the public review period, BLM will hold additional public meetings to further explain the Draft RMPA/EA, address public questions, and accept comments in writing. After comments on the draft document have been received and analyzed, the Draft RMPA/EA will be revised and modified, as necessary, and the PRMPA/Final EA will be published and made available for public review for 30 calendar days. A Finding of No Significant Impact (FONSI) will be signed to approve the RMPA/EA.
- Step 9 – Implement and Monitor: Upon approval of the FONSI, land use decisions outlined in the approved RMPA would be effective immediately and would require no additional planning or NEPA analysis.

Consistent with BLM Land Use Planning Handbook H-1601-1, BLM will monitor plan implementation and effectiveness, and will report annually, or as BLM determines is appropriate, on:

- The management actions undertaken;
- The management actions remaining to be undertaken; and
- The effectiveness of those actions toward meeting goals and objectives.

Monitoring strategies have been developed that identify indicators of change, acceptable thresholds, methodologies, protocols, and timeframes that would be used to evaluate and determine whether desired outcomes are being achieved. The BLM with assistance from the State of Wyoming will review and evaluate all monitoring data. The public will be invited to observe at least one monitoring team meeting annually. Elk and reclamation monitoring plans have been included as Appendix A.

The RMPA will be evaluated, at least every five years as documented in an evaluation schedule. Special or unscheduled evaluations may also be required to review unexpected management actions or significant changes that have the potential to trigger an amendment or revision.

1.7.1. Relationship to BLM Policies, Plans, and Programs

BLM has three principal levels of land use planning decisions: (1) the RMP or RMPA level; (2) the activity level; and (3) the site-specific level. This PRMPA/EA focuses on establishing resource objectives and direction while providing some activity-level guidance and site-specific decisions. It builds on the history of natural resource management planning in the vicinity of the FCPA.

Table 1-1 highlights the major BLM plans, policies, and resource-specific regulations. These plans and regulations are incorporated into this PRMPA/EA by reference, but are not included herein. In addition, some of these plans, as well as other related plans, are currently being updated. All of the new and revised plans and regulations will be included in the Administrative Record (AR) for this project and made available upon request.

Table 1-1 Plans, Policies, and Regulations
General Plans, Policies, and Regulations
National Environmental Policy Act
Federal Land Policy and Management Act
BLM Planning Regulations 40 CFR 1600
BLM Land Use Planning Handbook, H-1601-1, updated March 11, 2005 (BLM 2005a)
BLM National Environmental Policy Act Handbook H-1790-1 (BLM 2008b)
Air Resources
Clean Air Act
Water Resources
Clean Water Act of 1977, as amended
Soil Resources
Wyoming Standards for Healthy Public Rangelands (BLM 1995a)
Vegetation Resources
Taylor Grazing Act of 1934 (43 United States Code [U.S.C.] 315)
Healthy Forests Act of 2003
Clean Water Act of 1977, as amended
Executive Order 11990: Protection of Wetlands
Executive Order 13112: Control of Invasive Species
Federal Noxious Weed Act of 1974 (Public Law [PL] 93-629)
Final EIS: Vegetation Treatment on BLM Lands in the 13 Western States (BLM 1991)
BLM Manual 4180 – Rangeland Health Standards (BLM 2001b)
Wyoming Standards for Healthy Public Rangelands (BLM 1995a)
Fish, Wildlife, and Special Status Species
Endangered Species Act
The Bald and Golden Eagle Protection Act
The Migratory Bird Treaty Act
Sikes Act of 1960 (as amended)
Fish and Wildlife Management Act of 1956
Neotropical Migratory Bird Conservation Act (PL 106-247)
Cave Resources Protection Act (16 USC 4301 et seq.)

Table 1-1 Plans, Policies, and Regulations
Interagency Cooperation: Endangered Species Act, CFR 50 402
BLM Manual 6840, Special Status Species Management (BLM 2001c)
BLM Manual 4180 Rangeland Health Standards (BLM 2001b)
BLM regulations contained in 43 CFR 8200
Executive Order 12962: Recreational Fisheries (June 7, 1995)
Executive Order 13186: Conservation of Migratory Birds (January 10, 2001)
Instruction Memorandum No. WY-2010- 012: Greater Sage-Grouse Habitat Management Policy on Wyoming Bureau of Land Management (BLM) Administered Public Lands including the Federal Mineral Estate (BLM 2009a)
Cultural Resources
National Historic Preservation Act
Protecting Cultural Resources, BLM Handbook 8140 (BLM 2004a)
Visual Resources Management
43 CFR 8400 – Visual Resource Management
BLM Information Bulletins 98-135, 98-164, and 2000-096
BLM Handbook 8410-1, Visual Resource Inventory (BLM 1986)
Fuels and Fire
Healthy Forest Restoration Act of 2003
BLM Prescribed Fire Handbook (H-9214-1) (BLM 1998a), supported by the Office of Fire and Aviation Instruction Memorandum 2002-027 (BLM 2002a)
Federal Wildland Fire Management Policy and Program Review (U.S. Department of the Interior [USDOI] 1995 and 2001)
National Fire Management Analysis System (U.S. Department of Agriculture [USDA] Forest Service, et al 2006)
U.S. Department of the Interior/U.S. Department of Agriculture Western Governors' Association, 2001; A Collaborative Approach for Reducing Wildland Fire Risks to Communities and the Environment: 10-Year Comprehensive Strategy and Implementation Plan (USDOI and USDA 2001)
Interagency Standards for Fire and Aviation Operations (published annually) (USDOI 2006a)
Strategic Plan and National Fire Plan Actions (USDOI 1999)
Interagency Fire Plan Template (USDOI 2006b)
Restoring Fire-Adapted Ecosystems on Federal Lands – A Cohesive Strategy (USDOI/USDA 2000a)
National Fire Plan (USDOI and USDA 2000b)
Instruction Memorandum 2003-38, Interim Guidance for Completion of Fire Management Plan Revisions (BLM 2003b)

Table 1-1 Plans, Policies, and Regulations
Washington Office Instruction Memorandum 2004-007, Land Use Plan and Implementation Plan Guidance for Wildland Fire Management Guidance (BLM 2004b)
Rangeland Resources
Taylor Grazing Act of 1934
Public Rangelands Improvement Act of 1978 (PL 95-514)
Executive Order 12548 (1986): Establishment of Annual Fees for Domestic Livestock Grazing on Public Rangelands
FLPMA, Sections 102, 201, 202, 302, 304, 307, 309, 310, 401, 402, and 403
BLM regulations contained in 43 CFR 4100 et seq.
BLM Manual 4180 – Rangeland Health Standards (BLM 2001b)
BLM Wyoming Standards for Healthy Public Rangelands (BLM 1995a)
Recreation
43 CFR 2930, Permits for Recreation on Public Lands
Transportation
Transportation Safety Act of 1974
Hazardous Materials Transportation Act and Amendments
40 CFR 2740, 2912, 2911, and 2920, Land Use Authorizations
BM Manual 9113, Roads
BLM Manual 9112, Culverts and Bridges
Lands and Realty
43 CFR 2091, 2300, 2400, and 2710
Taylor Grazing Act of 1934
Federal Land Transfer Facilitation Act
Fluid Minerals
Federal Onshore Oil and Gas Leasing and Reform Act of 1987
Federal Oil and Gas Royalty Management Act of 1982
Federal Oil and Gas Royalty Simplification and Fairness Act of 1996
43 CFR Parts 3100 and 3200
BLM Onshore Oil and Gas Orders
BLM National Notice-to-Lessees
Unitization Manual 3180 (Exploratory)

Table 1-1 Plans, Policies, and Regulations
Unitization Handbook H-3180-1 (Exploratory)
2006 Oil and Gas Surface Operating Standards and Guidelines (Goldbook, 4th edition) (BLM 2006)
Integration of Best Management Practices (BMPs) into Applications for Permit to Drill Approvals and Associated Rights-of-Way (ROWs; WO IM 2007-021)
Special Designations
BLM Manual 1613, Areas of Critical Environmental Concern (BLM 1988a)
Secretarial Order 3310, Protecting Wilderness Characteristics on Lands Managed by the Bureau of Land Management.
BLM Manual 6301, Wilderness Characteristics Inventory
BLM Manual 6302, Consideration of Lands with Wilderness Characteristics in the Land Use Planning Process
BLM Manual 6303, Consideration of LWCs for Project-Level Decision in Areas Not Analyzed in Accordance with BLM Manual 6302

1.7.1.1. Related Plans

The 1985 BRA RMP (BLM 1985a) was amended in 2001 with the BFO RMP (BLM 2001a). Management direction for land and mineral resources administered by the BFO are described in these two documents. Along with the two RMPs for the BFO, there are additional oil and gas and wildlife plans including the 2003 PRB O&G FEIS (BLM 2003a). The BRA Resource Area Oil and Gas Surface Protection Plan for the Fortification Creek Area (BLM 1982) provides guidance for oil and gas exploration and development within the FCPA.

1.7.2. Collaboration

BLM Land Use Planning Handbook H-1601-1 (BLM 2005a) encourages BLM to use a "Collaborative Planning Process," whereby interested parties, often with widely varied interests, can work together to seek solutions with broad support for managing public lands. This section describes specific actions undertaken to consult and coordinate with government agencies, special interest groups, Native American tribes, and the public in the development of this PRMPA/EA. Additional information on public involvement and scoping is addressed in Section 1.5.

2.0 ALTERNATIVES

One of the goals of the Proposed Resource Management Plan Amendment/Environmental Assessment (PRMPA/EA) process is to ensure a consistent, coordinated approach to land management in accordance with all regulatory guidance and standards. Management goals and objectives are described for each resource, resource use, and special designation area. Major themes and management actions for the most important issues addressed by the three alternatives are presented in the following sections. All management actions that comprise the alternatives are summarized in Table 2-1 and listed in detail in Table 2-2.

In contrast to Alternative I, the No Action Alternative, Alternatives II and III are referred to as the action alternatives. Some management actions would be the same under all alternatives.

2.1 Alternative Development

The development of the alternatives for the Fortification Creek Planning Area (FCPA) included a public scoping process that allowed interested members of the public, special interest groups, and resource and land use agencies to comment on the appropriate scope of issues to consider in the planning process. The formal scoping period began on August 20, 2007 with the publication of the Notice of Intent (NOI) to Prepare a Resource Management Plan Amendment/ Environmental Assessment in the Federal Register (FR). Written comments on the proposal for the RMPA/EA were accepted through November 30, 2007. Bureau of Land Management (BLM) staff and cooperators reviewed the issues identified during scoping and collected pertinent resource information for the FCPA. This resource information is summarized in the Analysis of the Management Situation (AMS) (BLM 2008a).

Scoping issues described in Chapter 1, along with all appropriate laws, guidance, and standards, were used to establish management goals and objectives. A reasonable range of management actions (alternatives) were created to address these goals and objectives. In developing and refining alternatives, BLM sought to accomplish two objectives: (1) create a reasonable range of implementable alternatives, in accordance with National Environmental Policy Act (NEPA) and Federal Land Policy and Management Act (FLPMA) guidance; and (2) comply with applicable Federal, State, and local laws and regulations.

2.2 General Description of Each Alternative

Under NEPA, for an alternative to be considered reasonable, it should meet the purpose and need statement (as outlined in Chapter 1). For this PRMPA/EA, two action alternatives were identified in addition to the No Action Alternative. Given the purpose and need of the RMPA, both action alternatives would change BLM's management of coal bed natural gas (CBNG) development within the overall goal of protecting the elk herd, preserving visual resources, and minimizing soil erosion and impacts to water quality.

Under the No Action Alternative, BLM would manage the FCPA according to existing planning decisions. Alternatives II and III provide modest changes to existing management.

Table 2-1 Summary of Alternatives			
Resource/Issue	**Alternative I No Action**	**Alternative II Prescriptive**	**Alternative III Proposed Action Performance Based**
Soils	Surface-disturbing activities may be controlled or excluded on areas of highly erosive soils and/or slopes greater than or equal to 25 percent.	Surface disturbance will not be allowed on areas of highly erosive soils and/or slopes of 25 percent or more.	Surface-disturbing activities may be authorized on areas of highly erosive soils and/or slopes greater than or equal to 25 percent with an acceptable disturbance and reclamation plan.
Water Management Facilities	Not restricted by elk range.	Reservoirs and water management facilities would be located outside crucial winter and parturition ranges.	Reservoirs and water management facilities would be located to meet performance-based objectives.
Water Discharge	Discharge to drainages permissible, no subsequent monitoring and mitigation of downstream effects.	Surface disturbing activities to support surface water discharge would not be authorized.	Activities permitted by the State of Wyoming would be authorized.
Water Sources (stock tanks)	Replacement of impacted domestic wells.	Summer water sources provided with CBNG projects if current sources become unavailable because of CBNG development.	Summer water sources provided with CBNG projects if current sources become unavailable because of CBNG development.
CBNG Development	Pace not restricted.	Tri-phased development by geographical area. One year of successful interim reclamation before proceeding to next area.	Performance-based development by geographical area with a “bolt-on” approach. In compliance with performance standards before proceeding to the next area.
Crucial Winter Range	Timing Limitations (TLs) for surface-disturbing and disruptive activities from November 15 through April 30.	TLs for surface-disturbing and disruptive activities from November 15 through April 30.	TLs for surface-disturbing and disruptive activities from November 15 through April 30.
Parturition Range	TLs for surface-disturbing and disruptive activities from May 1 through June 30.	TLs for surface-disturbing and disruptive activities from May 1 through June 30.	TLs for surface-disturbing and disruptive activities from May 1 through June 30.
Well Metering and	Metering and visitation not restricted.	A work activity management plan, including operations and maintenance,	Well metering and all POD visitations would meet performance-based elk

Table 2-1 Summary of Alternatives			
Resource/Issue	**Alternative I No Action**	**Alternative II Prescriptive**	**Alternative III Proposed Action Performance Based**
Visitation		acceptable to BLM will be developed during Plan of Development (POD) processing.	standards.
Compressors	Compression facility locations not restricted in elk ranges.	Compression facilities within crucial winter and parturition ranges would be restricted.	Compression facilities would be located to meet performance-based elk and reclamation objectives.
Security Habitat	No security habitat standards.	All security habitat would be retained in the overlapping crucial ranges, 75% of elk security habitat would be retained in the non-overlapping crucial ranges and 50% in the yearlong range.	80% of elk security habitat would be retained within the yearlong and crucial ranges, and within each geographic phase.
Overhead Power	Overhead power lines are prohibited on BLM surface within FCPA.	Overhead power lines on BLM surface along drainages and existing corridors and roads.	Overhead power lines on BLM surface along road corridors.
ACEC	An ACEC would not be designated.	Establish an ACEC (33,757 acres) based on the citizen proposed boundaries (Figure 1-2) management prescriptions are as identified under the individual resource sections for this alternative.	An ACEC (33,757 acres) in the FCPA based on the citizen proposed boundaries (Figure 1-2) would not be designated.
Wildlife Habitat Management Area (WHMA)	No WHMA designation.	Designate a WHMA – elk crucial winter and parturition ranges.	A WHMA would not be designated.

In general, Alternative II would require additional restrictions on development in the FCPA. It would allow overhead power lines, restrict development, establish an Area of Critical Environmental Concern (ACEC) within portions of the FCPA, and designate a Wildlife Management Habitat Area (WHMA). There would be Timing Limitations (TLs) to protect crucial elk ranges, and maintain the prohibition of surface disturbance on steep slopes and erosive soil. Alternative III – the Proposed Action would be performance-based and allow gas development as long as developers could show that their actions would not cause undue or unnecessary degradation to the environment. TLs would be imposed on development to protect crucial elk ranges. This alternative would allow some overhead power lines; however, 80 percent of elk security habitat would be retained. This section summarizes the three alternatives analyzed in detail.

Leases, when purchased, contain stipulations and notices to inform the buyer of resource conditions existing on the lease for which protection may be required. Existing leases within the FCPA contain various stipulations concerning surface disturbance, surface occupancy, limited surface use, and timing limitations. Stipulations used by the BLM have evolved over the years; for example, stipulations prohibiting surface disturbance or occupancy have become limited (controlled) surface use or timing limitation stipulations. A lease is encumbered by the stipulations as written at the time of purchase. New stipulations or revised stipulation language are applied to future leases only; they do not affect previously issued leases. The PRB FEIS (pg. P-5) provides a history of stipulation evolution within the FCPA.

Development proposals must incorporate the stipulated resource protections unless a waiver, modification, or exception is formally requested by the operator and granted by the BLM. FCPA development proposals shall be held to the specific lease stipulations where they provide greater resource protection than the Final Fortification Creek RMPA, unless formally waived, modified, or excepted. Waiver, modification, and exception requests shall be considered during the environmental analysis process for the site-specific PODs. An alternative shall be evaluated containing the lease stipulations and another alternative with only the RMPA protections.

2.2.1. Alternative I, No Action

Alternative I represents the No Action Alternative required under NEPA and the Council on Environmental Quality (CEQ) regulations. Under this alternative, current management direction would be used to consider CBNG development within the FCPA and this direction was approved in the 1985 Buffalo Resource Area (BRA) Resource Management Plan (RMP) (BLM 1985a), its amendments (BLM 2001a), and the Powder River Basin Oil and Gas Final Environmental Impact Statement (PRB O&G FEIS; BLM 2003a).

There would be TLs for surface-disturbing and disruptive activities for elk crucial winter and parturition ranges. Overhead power lines would be prohibited on BLM surface land in the FCPA. Surface-disturbing activities on slopes greater than 25 percent and on erosive soils would not be allowed, but there could be exceptions. Other standard stipulations would apply.

2.2.2. Alternative II, Prescriptive

Alternative II is a prescription-based approach where BLM prescribes the conditions for CBNG development. Development would be prohibited on slopes greater than 25 percent and on erosive soils, water management facilities and compressors would be located outside elk crucial

winter and parturition ranges, and activities to support surface water discharge would not be authorized. Alternative II is also the most conservation oriented; there would be no exceptions enabling wells or facilities to be located on steep slopes, erosive soils, or within the elk crucial ranges. A work activity management plan would be required to reduce elk disturbance, and there is an increased emphasis on retaining security habitat within the crucial ranges (retain all security habitat within the overlapping crucial ranges). The citizen proposed ACEC of 33,757 acres and a WHMA of approximately 52,069 acres would be established.

CBNG development would be managed through a geographically-phased approach with no provision for exception. Construction and drilling activities are confined to one phase at a time. Each geographic phase is approximately one-third of the planning area, providing the elk with two-thirds of the planning area free of construction and drilling disturbance. Each phase of development would last three years and would be followed by one year of successful reclamation before proceeding to the next area. Livestock grazing may need to be managed to ensure successful reclamation.

There would be TLs for the elk crucial winter and parturition ranges applied to surface-disturbing and disruptive activities. Overhead power lines would be allowed on BLM surface land within existing road corridors and along drainages.

2.2.3. Alternative III – the Proposed Action, Performance Based

Alternative III is a performance-based approach where BLM has defined elk and reclamation performance standards (Appendix B) for industry to achieve with their development plans. Operators would supply comprehensive annual development plans detailing which areas are to be developed each year and explaining how the performance standards would be achieved. Operator performance will be closely monitored by the BLM. BLM may authorize additional drilling if BLM determines that the performance standards have been met or less drilling if performance standards are not met. The citizen proposed ACEC and a WHMA would not be established as the performance standards would ensure the important and relevant resource values are conserved.

The pace of CBNG development would be based on the performance standards and the geographic phases, following an orderly “bolt-on” approach. Operators would confine their development operations to a small geographic area annually, approximately one-third of a phase area. This approach provides the opportunity to concurrently allow a small development area within another geographic phase while still providing the elk with sufficient area free of construction and drilling disturbance. All development is dependent upon meeting the performance standards. With the “bolt-on” approach, new infrastructure would expand from, and tie into existing infrastructure. CBNG development would be expected to generally follow the three geographic phases of Alternative II. Development would start in the eastern third of the Southeast phase and annually progress clockwise.

Existing stipulations for steep slopes, fragile watersheds, and elk crucial habitat would remain. Exceptions could be granted if the operator proposed an acceptable plan explaining how the performance standards would be achieved. Eighty percent of the elk security habitat would be retained within each geographic phase. Overhead power lines would be allowed on BLM surface land within road corridors.

2.2.4. Detailed Description of Alternatives

All three alternatives are described in detail in Table 2-2.

2.3 Alternatives Considered but Not Analyzed in Detail

Some issues raised during the scoping process were considered, but not carried forward for further analysis. As discussed throughout the Scoping Report (Appendix C; BLM 2008c), these issues were generally resolved by evaluating whether they met the purpose and need of the plan. These issues are briefly discussed below.

2.3.1. Expanding the Boundary of the WSA

BLM did not recommend the WSA for wilderness in the 1985 RMP because of the area's oil and gas potential; further, protecting valid existing rights is a preliminary planning criteria listed in the FR NOI. Protection of valid existing rights is also consistent with direction in BLM Consideration of Lands with Wilderness Characteristics in the Land Use Planning Process (BLM 2011). Currently nearly all of the FCPA is leased for oil and gas development. The Federal land surface surrounding the Fortification Creek WSA (Figure 1-2) has been inventoried and does not show that these lands have wilderness characteristics (Appendix D).

In addition, the lands adjacent to the Fortification Creek WSA have manageability issues; private and state lands would be “landlocked” by proposals to increase the size of the WSA, BLM would be required to provide access to these landlocked private and state lands, and access across Federal lands would further impact the size and character of these lands.

2.3.2. Providing Public Access into the WSA

Access to the Fortification Creek WSA is difficult because of the land ownership pattern (Figure 1-2). Proposals to acquire or exchange lands to improve access to the Fortification Creek WSA do not meet the purpose and need for the plan amendment, which is to provide management actions to allow for orderly mineral development while protecting public lands and resources.

2.3.3. Wilderness Characteristics

An alternative managing for the preservation of wilderness characteristics outside the WSA was not included because with the exception of the WSA, no other public lands within the FCPA possess wilderness characteristics. The boundary of the WSA is determined by private lands and road ways (WWA 2004). BLM inventoried 33,280 acres within the Fortification Creek Unit (WY-060-24) in 1978 (BLM 1978) and re-inventoried 28,100 acres in 1979 (BLM 1979). The 1979 inventory identified additional roads and intrusions not discovered in the initial inventory, concluded that 12,419 acres possessed sufficient wilderness characteristics to warrant further study, and recommended the 12,419-acre portion to be approved as a WSA (BLM 1979). BLM has managed the WSA to preserve its wilderness characteristics. The remainder of the unit has been managed for multiple uses including mineral development. The BLM has received citizen proposals to expand the WSA in 1994 and 2004 (WWA 2004). The citizen proposal is to expand the WSA by including continuous public surface to the southeast and to the west of the WSA.

BLM updated the wilderness inventory in preparation of this PRMPA/EA (BLM 2011) (Appendix D). The road inventory indicates that the areas determined not to possess wilderness characteristics in 1979 do not possess wilderness characteristics today. Most of the roads in the

Fortification Creek area were constructed for conventional oil and gas exploration during the 1970s. Many continue to be used for livestock management, hunting, and fluid mineral activities.

A road along lower Bull Creek extending to the Little Bull Creek fork (T52N, R76W, Section 12, 13, and 19) has been upgraded to accommodate CBNG activity including seven existing wells and four unauthorized applications to drill (APDs) (Wyoming Oil and Gas Conservation Commission [WOGCC] March 15 data, 2010a). Most of the road and wells are located on private surface. There is a cabin and CBNG monitoring wells on public surface in T52N, R77W, Section 12. The Bull Creek Road continues upstream until Bull Creek enters the WSA (T52N, R76W, Section 20); the road turns south and forms approximately 3.25 miles of the southwestern WSA boundary before connecting with the Fortification Creek Road (T51N, R76W, Section 5). This is a constructed road consistently used for livestock management. There are several salt blocks along the road, a windmill powered stock well (T52N, R76W, Section 19), and a solar powered stock well (T52N, R76W, Section 20). There are also flags and well stakes, evidence of CBNG surveying. The Bull Creek Road divides the citizen wilderness proposal from the WSA.

A constructed road leaves the Bull Creek Road (T52N, R77W, Section 12) heading south past an abandoned stock water reservoir (T52N, R77W, Section 13). The constructed dam apparently failed. Although there were stakes from CBNG surveying, this section of road has not been maintained and appears to be seldom used. The navigable portion of the road ends in southern T52N, R77W, Section 13 at a landslide. The constructed road continues south, turns west, and connects with a well-used road running north and south through T52N, R77W, Section 14. This road is within the western subunit discussed in the previous paragraph.

Another constructed road with regular and consistent use for livestock management and big-game hunting, and proposed for CBNG development, extends north from Fortification Creek (T51N, R76W, Section 15) forming the WSA boundary in places and terminating at the headwaters of Deer Creek (T52N, R76W, Section 23), also the WSA boundary. This road divides the southeastern portion of the citizen wilderness proposal from the WSA.

Federal mineral leases have been issued throughout the FCPA outside the WSA including within the citizen wilderness proposal area. CBNG companies have been in the field in recent years actively preparing their APDs. Most non-Federal mineral acreage has ongoing CBNG activity. Lands and resources outside the WSA do not exhibit a high degree of naturalness. There is no opportunity for solitude or primitive unconfined recreation outside of the WSA. Unroaded areas, dissected from the WSA, are of insufficient size for wilderness consideration.

Finally, with the exception of solitude, which is not present outside the WSA, the resources the citizen's proposal is designed to protect (wildlife, vegetation, and hunting) are analyzed across a reasonable range of alternatives within this PRMPA/EA.

2.3.4. Canceling or Exchanging Leases in Crucial and Parturition Elk Ranges

As noted in the NOI and throughout the public scoping process meetings, BLM affirmed that all existing rights would be preserved. This included the lease rights that had been granted when the minerals were leased. The purpose of this PRMPA/EA is not to change land use allocations but to clarify the management decisions to allow for orderly mineral development. BLM believes that CBNG development can occur without causing undue or unnecessary damage to the public lands and therefore it is not necessary to cancel the leases. This issue did not meet the purpose and need of the plan.

2.3.5. Requiring Directional Drilling

BLM did not include directional drilling in the alternatives because this is a drilling technique and BLM would evaluate drilling techniques in the site-specific POD. The management decisions being evaluated would still apply to directional drilling, (i.e., soil and slope limitations, elk security habitat thresholds, etc.). Additionally, BLM is not anticipating that directional drilling will be used in the FCPA because this drilling technique has not been proven in the PRB coal beds because it is difficult to maintain well bore integrity in the soft coals.

2.3.6. No Hunting

The State is responsible for managing wildlife populations, not the BLM. This issue is outside the authority of the BLM and does not meet the purpose and need. Hunting is an essential management tool for the WGFD to manage the elk population. The population is monitored annually and hunting quotas adjusted accordingly.

2.3.7. Citizen Proposal

An alternative was presented to BLM by the Powder River Basin Resource Council in a letter dated October 23, 2009. This alternative called for a number of actions including:

- Burying power lines;
- Using reclamation success as the only criteria for moving to the next phase of development;
- Expanding the planning area to the full yearlong range;
- Expanding the WSA and designating an expanded ACEC;
- Restricting well visitation;
- Adaptive management to protect the elk;
- Locating water management facilities outside the yearlong range;
- Providing year-round water sources for elk; and
- Prohibiting direct produced water discharge.

This alternative was not analyzed in its entirety for several reasons. Foremost, the proposed actions are included in some form within the alternatives being fully analyzed or are beyond the scope of this RMPA. Proposed actions were not included in this PRMPA/EA because:

- Power lines are considered to be essential for CBNG development. The current RMP decision does not allow for overhead power lines on BLM surface; thereby, placing an unfair burden on the non-Federal surface owners. Burying power lines often results in more surface disturbance than overhead power lines.
- Reclamation criteria have been included within the action alternatives.
- The FCPA was established in the 1975 framework plan. Many of the RMP-level decisions being evaluated are tied to the planning area boundary. This, therefore, became the planning area boundary used during scoping and only the planning area that has been used in scoping can be used in the RMPA. The entire yearlong range will be further evaluated in the BFO RMP revision.

- The Federal land surface surrounding the Fortification Creek WSA has been inventoried and does not possess wilderness characteristics.
- An expanded ACEC will not be evaluated because the relevance and importance evaluation did not include the expanded area.
- Well visitation is addressed within the action alternatives. To meet the purpose and need, a reasonable amount of visitation is necessary.
- Adaptive management based on performance measures is the foundation of the Proposed Action.
- Location of water management facilities is addressed within the action alternatives. However, an alternative requiring placement of water management facilities outside the elk yearlong range was not considered because 80 percent of the surface outside the yearlong range is private and this would place an unfair burden on private landowners.
- Water availability is an issue only during the summer (not year-round), and the action alternatives address summer water sources.
- BLM cannot prohibit produced water discharge. Wyoming Department of Environmental Quality (WDEQ) has the authority over this action.

2.3.8. Greenhouse Gases and Global Climate Change

The Council on Environmental Quality's Draft NEPA Guidance on the Consideration of the Effects of Climate Change and Greenhouse Gas Emissions suggest that agencies consider an evaluation if the proposed project will result in 25,000 metric tons per year of GHGs. This suggestion is not a minimum level that will trigger a NEPA analysis, but guidance, leaving discretion to the agency.

Potential emissions for the Preferred Alternative, are far less than 1 percent of US GHG emissions and 0.01 percent of Wyoming GHG emission. In terms of what could trigger a NEPA analysis, the Preferred Alternative is estimated to produce 7,384 metric tons over the life time of the project. This is far less than the 25,000 metric tons per year suggested by CEQ.

There is some venting of gas at gas wells in the FCPA, but no flaring. The gas companies try to minimize venting, as it is a loss of gas and therefore profits. EPAs Natural Gas STAR program not only suggests control technologies that can be used to reduce GHGs but also lists the oil and gas companies that have partnered with EPA in this program. More than 40 percent of the leases in the FCPA are held by companies in this partnership.

Review of the Draft Inventory of Greenhouse Gas Emissions and Sinks (EPA 2011) indicates that total Greenhouse Gasses (GHGs) from all sources in the U.S. was 6,639.7 million metric tons in 2009. The total GHGs from all sources in Wyoming is 56 million metric tons. Estimated emissions for the Preferred Alternative are approximately 0.0001 percent of U.S. and 0.0033 percent of Wyoming GHG emissions.

2.4 Alternative Comparison

This section summarizes the three alternatives, which are analyzed in detail in Chapter 4. These alternatives were developed to analyze management goals and objectives within a reasonable range of management actions, and to assist decision makers and the public in understanding the potential consequences and benefits of alternative scenarios. Considerations in the formulation of the alternatives include the following:

- The alternatives are intended to represent a reasonable range of alternatives with an associated array of management actions;
- The action alternatives are consistent with the purpose and need for the PRMPA/EA;
- No alternatives were analyzed that would clearly conflict with existing laws or regulations; and
- CBNG development is consistent with FLPMA.

Not all management actions described under each alternative would specifically be permitted by adoption of that alternative through the planning process. For example, although CBNG development would be allowed under all alternatives, actual development would occur only after proposed well locations, road and pipeline alignments, and other facility plans have gone through permitting and review, including site-specific NEPA analysis. Furthermore, while the assumptions associated with the alternatives represent reasonable projections of what could occur, it is impossible to predict with certainty the precise outcome of any of the alternatives because of the large number of variables involved. Impacts from actual development may differ from the scenarios presented.

Under all of the alternatives, any action or development must be consistent with applicable Federal, State, and local laws and regulations. Nothing presented in the following impact analysis of the alternatives should be construed as exempting activities from applicable legal or regulatory requirements.

The management actions for each of the alternatives are listed in detail in Table 2-2 by resource or resource use. Each resource or resource use includes the BLM goals and objectives from the 2001 BFO RMP (BLM 2001a) and the PRB O&G FEIS (BLM 2003a). Many of the resources or resource uses have management actions that are common to all alternatives and these are listed first. Management actions that differ by alternative are listed under the appropriate alternative.

Table 2-2 Management Actions for Alternatives I Through III		
Air Quality and Climate		
Alternative I **No Action**	**Alternative II** **Prescriptive**	**Alternative III – the Proposed Action** **Performance Based**
Goals: 1. Maintain or enhance air quality, protect public health and safety and sensitive natural resources, and minimize emissions that could result in acid rain, violations of air quality standards, or reduced visibility (BLM 2001a).		
Management Actions Common to All Alternatives: 1. Any BLM-initiated actions or authorizations that result in air quality or visibility deterioration will be conditioned to avoid violating Wyoming and national air quality standards. 2. Dust control measures will be required to increase visibility and reduce particulate impacts for all construction and other surface-disturbing activities. 3. During construction, emissions of particulate matter from well pad and resource road construction will be minimized by application of water, or other dust suppressants, with at least 50 percent control efficiency. Roads and well locations constructed on soils susceptible to wind erosion could be appropriately surfaced or otherwise stabilized to reduce the amount of fugitive dust generated by traffic or other activities, and dust inhibitors (surfacing materials, non-saline dust suppressants, and water) could be used as necessary on unpaved collector, local and resource roads that present a fugitive dust problem. The use of chemical dust suppressants on BLM surface will require prior approval from the BLM-authorized officer (PRB O&G Record of Decision [ROD], p. A-39; BLM 2003c).		

Soil Resources			
Goals: 1. Maintain, improve, or restore soil health and productivity; and prevent or minimize erosion and compaction while supporting multiple use management.			
Management Actions Common to All Alternatives: 1. Management actions on BLM lands would be consistent with achieving or maintaining the Standards for Healthy Rangelands and Guidelines for Livestock Grazing Management for Public Lands Administered by the Bureau of Land Management in the State of Wyoming (BLM 1997). 2. BLM would use soil survey interpretations to predict soil behavior, limitation, or suitability for a given activity or action. 3. Prior to authorizing any surface-disturbing activity, BLM would evaluate the activity and, if necessary, apply mitigation measures, relocate the activity to a more suitable soil type, or deny the authorization. 4. Authorized surface-disturbing activities would be subject to an onsite evaluation to develop mitigation (if necessary), apply best management practices (BMPs), and plan for reclamation. Site-specific measures would be developed for soils susceptible to erosion (water and wind), soils with high sodium and salt content, soils with sparse vegetation, areas with low effective precipitation, droughty soils, and/or shallow soils. 5. Areas where the erosion potential cannot be effectively controlled or mitigated for, and reclamation treatments to BLM standards would likely be unsuccessful would be avoided.			
Objective	**Alternative I No Action**	**Alternative II Prescriptive**	**Alternative III – the Proposed Action Performance Based**
Surface-Disturbance Objective: Conserve soil resources.	Surface-disturbing activities may be controlled or excluded on slopes greater than 25 percent. No surface-disturbing activities on badlands, rock outcrop, and slopes susceptible to mass failure. Surface-disturbing activities may be restricted or excluded on soils with a severe erosion hazard. Standard lease terms and conditions would apply. Exceptions may apply.	No surface-disturbing activities on soils with a severe erosion hazard, badlands, rock outcrop, or slopes susceptible to mass failure. No surface-disturbing activities on slopes greater than 25 percent. Standard lease terms and conditions would apply. No exceptions.	Operators would submit a disturbance and reclamation plan with their APDs when specified by BLM. With acceptable plan, surface disturbing activities may be authorized on slopes greater than 25 percent and on soils with a severe erosion hazard where reclamation goals are achievable. The operator would propose an acceptable disturbance and reclamation plan, which would take into account the performance-based standards for soil reclamation (Appendix B). The operator would be required to meet

			these performance-based standards for soil reclamation.

Water Resources
Goals: 1. Maintain or improve surface and groundwater quality consistent with existing and anticipated uses and applicable State and Federal water quality standards, provide for availability of water to facilitate authorized uses, and minimize harmful consequences of erosion and surface runoff from BLM-administered public land (BLM 2001a).
Management Actions Common to All Alternatives: 1. The rights to water-related projects on public lands will be filed with the Wyoming State Engineer's Office (WSEO) in order to obtain valid water rights. 2. A Wyoming Department of Environmental Quality (WDEQ) permit is necessary for water discharge. 3. Locate discharge points in areas that will minimize erosion and impacts to the receiving channel, existing improvements, and downstream users (PRB O&G ROD, p. A-30; BLM 2003c). 4. Locate discharge points in stable, low gradient drainage systems and below active headcuts, when possible. If discharge is located above a headcut, mitigation measures will be required by the BLM Authorized Officer on a site-specific basis. Some mitigation measures will require engineering design (PRB O&G ROD, p. A-30; BLM 2003c). 5. All discharge points will require energy dissipation measures (PRB O&G ROD, p. A-30; BLM 2003c). 6. Discharge points, regardless of National Pollutant Discharge Elimination System (NPDES) status or previous use, may not be authorized by BLM. Sites may be moved or otherwise mitigated by the BLM Authorized Officer during onsite inspections where environmental issues exist (PRB O&G ROD, p. A-30; BLM 2003c). 7. Cumulative produced water discharge must not exceed the naturally occurring 2-year peak flow of the receiving channel (PRB O&G ROD, p. A-30; BLM 200c). 8. Discharge points will not be located in playas or enclosed basins unless it can be demonstrated that they will not result in adverse impacts. Discharges into valley bottoms with no defined low-flow channel will generally not be allowed, but will be reviewed on a site-specific basis (PRB O&G ROD, p. A-30; BLM 2003c). 9. Channel Crossings (PRB O&G ROD, p. A-30; BLM 2003c): – Minimize channel disturbance as much as possible by limiting pipeline and road crossings. – Avoid running pipelines and access roads within floodplains or parallel to a stream channel. – Channel crossings by roads and pipelines will be constructed perpendicular to flow. Culverts will be installed at appropriate locations for streams and channels crossed by roads as specified in the BLM Manual 9112 - Bridges and Major Culverts (BLM 2009b) and Manual 9113 - Roads. Streams will be crossed perpendicular to flow, where possible. All stream crossing structures will be designed to carry a 25-year discharge event or other capacities as directed by BLM. – Channel crossings by pipelines will be constructed so that the pipe is buried at least 4 feet below the channel bottom.

Water Resources			
10. Low-water crossings will be constructed at original streambed elevation in a manner that will prevent any blockage or restriction of the existing channel. Material removed will be stockpiled for use in reclamation of the crossings (PRB O&G ROD, p. A-30; BLM 2003c). 11. Concerns regarding the quality of discharged CBNG water on downstream irrigation use may require operators to increase the amount of storage of CBNG water during the irrigation months and allow more surface discharge during the non-irrigation months (PRB O&G ROD, p. A-30; BLM 2003c). 12. The operator will be required to provide a reclamation bond for impoundments over Federal minerals in the amount specified by a qualified Professional Engineer for the impoundments to be used for the management of CBNG water. The bond amount will be submitted within 90 days after POD approval and will be approved by BLM prior to commencing construction (PRB O&G ROD, p. A-30; BLM 2003c). 13. The operator will supply a copy of the complete approved SW-4, SW-3, or SW-CBNG permits to BLM as they are issued by WSEO for impoundments (PRB O&G ROD, p. A-30; BLM 2003c). 14. The operator will supply a copy of the complete approved Chapter 3 permit to construct associated with treatment facilities to BLM as they are issued by WDEQ (PRB O&G ROD, p. A-30; BLM 2003c).			
Objective	**Alternative I No Action**	**Alternative II Prescriptive**	**Alternative III – the Proposed Action Performance Based**
Water Management Facilities Objective: Manage elk disturbance and displacement.	Location of water management facilities is not restricted in elk ranges.	Reservoirs and water management facilities would be located outside crucial winter range and parturition range.	When water discharge is authorized by the State of Wyoming, location of water management facilities shall meet performance-based objectives (See: Elk and Reclamation Standards, Appendix B).
Water Discharge Objective: Conserve ephemeral and intermittent stream communities.	Authorize activities associated with the surface discharge of produced water when permitted by the State of Wyoming.	Do not authorize activities (roads, pipelines, etc.) associated with water management infrastructure for the direct discharge of produced water into ephemeral or intermittent drainages.	Authorize activities associated with the surface discharge of produced water when permitted by the State of Wyoming.
Water Sources Objective: Protect summer water sources utilized by elk and livestock.	Replacement of impacted domestic wells in accordance with water well agreement. Operators required to offer water well agreements to the owners of record for permitted water	Operators will provide summer water sources for livestock and wildlife if current sources (permitted through the WSEO) become unavailable and that loss is directly attributable to	Operators will provide summer water sources for livestock and wildlife if current sources (permitted through the WSEO) become unavailable and that loss is directly attributable to

Water Resources			
	wells within 0.5 mile of producing Federal CBNG wells.	development of CBNG. Water will be provided until those lost sources are again available and/or other permanent sources are developed.	development of CBNG. Water will be provided until those lost sources are again available and/or other permanent sources are developed.

Vegetation Resources
Goals: Maintain or improve the diversity of plant communities to support livestock needs, wildlife habitat, watershed protection, and acceptable visual resources, and reduce the spread of noxious weeds (BLM 2001a).
Management Actions Common to All Alternatives: 1. Management actions affecting vegetation will be designed to meet overall resource management objectives and will be consistent with the policy to protect or improve biodiversity and water quality. 2. Livestock stocking rates will not be increased. **Noxious Weeds** 1. In cooperation with county weed and pest districts, cooperative integrated weed control programs are being implemented on public land in conjunction with control work on adjoining deeded and State lands. 2. Weed educational material will be reviewed during pre-construction onsite meetings with operators, subcontractors, and landowners and will be attached to approved Applications for Permit to Drill (APDs) and PODs (PRB O&G ROD, p. A-32; BLM 2003c). 3. Moist soils near wetlands, streams, lakes, or springs in the project area will be promptly revegetated if construction activities impact the vegetation in these areas. Revegetation will be designed to avoid the establishment of noxious weeds. 4. Operators in areas with identified weed infestations or suitable Ute ladies'- tresses orchid habitat will be required to submit an integrated pest management plan prior to APD approval. Mitigation will be determined on a site-specific basis and may include measures such as spraying herbicides prior to entering areas and washing vehicles before leaving infested areas. Infestation areas of noxious weeds have been identified through the county Weed and Pest Districts and are available at the Buffalo BLM office. 5. The operator will be responsible for prevention and control of noxious weeds and weeds of concern on all areas of surface disturbance associated with the project (well locations, roads, water management facilities, etc.). Use of pesticides will comply with applicable Federal and State laws. Pesticides will be used only in accordance with their registered uses and within limitations imposed by the Secretary of the Interior. Prior to the use of pesticides on public land, the holder will obtain from the BLM Authorized Officer written approval of a plan showing the type and quantity of material to be used, pest(s) to be controlled, method of application, location of container storage and disposal, and any other information deemed necessary by the BLM Authorized Officer to such use.

Fish and Wildlife Resources

Goals:

1. Maintain biological diversity of plant and animal species (BLM 2001a).
2. Support Wyoming Game and Fish Department (WGFD) strategic plan population objective levels to the extent practical and consistent with BLM multiple-use management requirements (BLM 2001a).
3. Maintain, and where possible, improve forage production and quality of rangelands, fisheries, and wildlife habitat (BLM 2001a).
4. Provide habitat for threatened and endangered and special status plant and animal species on all public lands in compliance with the Endangered Species Act (ESA) and approved recovery plans to the extent possible (BLM 2001a).
5. Provide habitat for elk and other big game species (BLM 2001a).
6. Support big game and fisheries management levels identified in the WGFD's 2007–2011 Strategic Plan (WGFD 2006a).
7. Protect the isolated elk herd in the FCPA while allowing CBNG development.

Management Actions Common to All Alternatives:

1. Surface disturbance and disruptive activities would be restricted within elk crucial winter habitat from November 15 through April 30.
2. Surface disturbance and disruptive activities would be restricted within elk parturition habitat from May 1 through June 30.
3. Preclude new surface-disturbing activities within 0.5 mile of raptor nest sites to prevent increased stress to and/or displacement of animals during the critical period from February 1 through July 31.
4. Stock tanks would be required to be wildlife friendly with ramps to allow escape by small mammals and birds.

Objective	Alternative I No Action	Alternative II Prescriptive	Alternative III – the Proposed Action Performance Based
CBNG Development Objectives: Allow for the extraction of mineral resources, while protecting other resources. Minimize elk displacement.	CBNG development pace is not restricted geographically or temporally.	Tri-phased development would be implemented by geographical area. Development to occur over three years followed by one year of successful interim reclamation before proceeding to next area (original three phases).	Performance-based phased (Elk and Reclamation Standards, Appendix B) development would be implemented geographically with a “bolt on” approach. Grazing management should be a component of the operator submitted disturbance and reclamation plan.
Well Metering and Visitation Objective:	Well metering and visitation are not restricted in the FCPA.	A work activity management plan, acceptable to the authorizing officer, shall be developed during POD	Metering and visitation will meet performance-based objectives. (Elk and Reclamation Standards,

Fish and Wildlife Resources			
Manage elk disturbance and displacement.		processing. The plan shall include all POD related construction, metering and monitoring, maintenance, and operation activities. Provisions shall be made for emergencies.	Appendix B).
Water Management Facilities Objective: Manage elk disturbance and displacement.	Location of water management facilities is not restricted in elk ranges.	Reservoirs and water management facilities would be located outside crucial winter range and parturition range.	When water discharge is authorized by the State of Wyoming, location of water management facilities shall meet performance-based objectives (See: Elk and Reclamation Standards, Appendix B).
Water Sources Objective: Protect summer water sources used by elk and livestock.	Replacement of impacted domestic wells in accordance with water well agreement. Operators required to offer water well agreements to the owners of record for permitted water wells within 0.5 mile of producing Federal CBNG wells.	Operators will provide summer water sources for livestock and wildlife if current sources (permitted through the WSEO) become unavailable and that loss is directly attributable to development of CBNG. Water will be provided until those lost sources are again available and/or other permanent sources are developed.	Operators will provide summer water sources for livestock and wildlife if current sources (permitted through the WSEO) become unavailable and that loss is directly attributable to development of CBNG. Water will be provided until those lost sources are again available and/or other permanent sources are developed.
Compression Facilities Objective: Manage elk disturbance and displacement.	Location of compression facilities is not restricted within elk ranges.	Compression facilities within crucial winter range and parturition habitat shall be limited to the minimum necessary, non-wellhead facilities to transport CBNG off the Federal lease.	Compression facilities will meet performance-based objectives (Elk and Reclamation Standards, Appendix B).
Elk Security Habitat Objective: Provide sufficient elk habitat.	No elk security habitat standards.	Security habitat standards shall follow WGFD recommendations: all identified security habitat within overlapping crucial winter range (CWR) and parturition range (PR) shall be retained, where crucial ranges (CWR and PR) do not overlap, 75 % of the identified security habitat shall	Retain 80 percent of elk security habitat as measured from roads within all seasonal ranges and within each geographic phase.

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		be retained. Fifty percent of security habitat will be retained in the yearlong range outside of the crucial ranges.	

Special Status Species
Goals: 1. Maintain biological diversity of plant and animal species (BLM 2001a). 2. Support WGFD strategic plan population objective levels to the extent practical and to the extent consistent with BLM multiple-use management requirements (BLM 2001a). 3. Maintain and, where possible, improve forage production and quality of rangelands, fisheries, and wildlife habitat (BLM 2001a). 4. Provide habitat for threatened and endangered and special status plant and animal species on all public lands in compliance with the ESA and approved recovery plans to the extent possible (BLM 2001a). 5. Protect special status species while allowing CBNG development.
Management Actions Common to All Alternatives: 1. Known populations of threatened and endangered species (plants and animals) will be protected as mandated by law. 2. The operator will locate impoundments to avoid sagebrush shrublands, where practical. 3. Containment impoundments will be fenced to exclude wildlife and livestock. If they are not fenced, they will be designed and constructed to prevent entrapment and drowning. 4. All stock tanks will include a ramp to enable trapped small birds and mammals to escape. See Idaho BLM Technical Bulletin 89-4 entitled Wildlife Watering and Escape Ramps on Livestock Water Developments: Suggestions and Recommendations. 5. Noise mufflers will be installed on the exhaust of compressor engines to reduce the exhaust noise. 6. Where noise impacts to existing sensitive receptors are an issue, noise levels will be required to be no greater than 55 decibels (dBA) measured at a distance of 0.25 mile from the appropriate booster (field) compressor. When background noise exceeds 55 dBA, noise levels will be no greater than 5 dBA above background. This may require the installation of electrical compressor motors at these locations. **Bald Eagle:** 1. Site-specific project areas will be evaluated for suitable bald eagle nesting and roosting habitat prior to permit approval. Suitable nesting habitat (USFWS 2007a) is any mature stand of trees or individual tree capable of supporting a bald eagle nest in association with an adequate food supply. Suitable roosting habitat is defined as any mature stand of conifer or deciduous trees where eagles consistently perch during winter. 2. Special habitats for raptors, including wintering bald eagles, will be identified and considered during the review of Sundry Notices. 3. Surveys for active bald eagle nests and winter roost sites will be conducted within suitable habitat by a BLM-approved biologist. Surface-disturbing activities will not be permitted within 1 mile of suitable habitat prior to survey completion. 4. A disturbance-free buffer zone of 0.5 mile will be established year-round for all bald eagle nest sites. A TL buffer zone of 1 mile will be established for all bald eagle nest sites from February 15 through August 15. 5. A disturbance-free buffer zone of 0.5 mile will be established year-round for all bald eagle roost sites. A TL buffer zone of 1 mile will be

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established for all bald eagle roost sites from November 1 through April 1. 6. Within 1 mile of bald eagle winter roost sites additional measures such as remote monitoring and restricting maintenance visitation to between 9:00 a.m. and 3:00 p.m. may be necessary to prevent disturbance from November 1 through April 1. 7. Additional mitigation measures may be necessary if the site-specific project is determined by a BLM biologist to have adverse effects on bald eagles or their habitat. **Black-footed Ferret:** 1. Prairie dog colonies will be avoided wherever possible. 2. If any black-footed ferrets are located, the U.S. Fish and Wildlife Service (USFWS) will be consulted. Absolutely no disturbance will be allowed within prairie dog colonies inhabited by black-footed ferrets. 3. Additional mitigation measures may be necessary if the site-specific project is determined by a BLM biologist to have adverse effects on black-footed ferrets or their habitat. In the event that a black-footed ferret is located during construction or operation, the USFWS's Wyoming Field Office (307-772-2374) and the USFWS' Law Enforcement Office (307-261-6365) will be notified within 24 hours. **Blowout Penstemon:** 1. Site-specific project areas will be evaluated for suitable habitat prior to permit approval. 2. Suitable habitat will be avoided wherever possible. 3. If suitable habitat cannot be avoided, surveys will be conducted in compliance with USFWS standards by a BLM-approved biologist or botanist. **Mountain Plover:** 1. Site-specific project areas will be evaluated for suitable mountain plover nesting habitat prior to permit approval. Flat areas of shortgrass prairie or low shrubs with a prevalence of bare ground characterize suitable mountain plover nesting habitat. Typically the vegetation height is less than 4 inches, and bare ground is greater than 30 percent. In the event that a mountain plover is located during construction or operation, the USFWS's Wyoming Field Office (307-772-2374) and the USFWS' Law Enforcement Office (307-261-6365) will be notified within 24 hours. 2. A mountain plover nesting survey following USFWS protocol will be conducted prior to permit authorization. Additional measures such as monitoring and activity restrictions may be applied if mountain plovers are documented. 3. A disturbance-free buffer zone of 0.25 mile will be established around all occupied mountain plover nesting habitat between March 15 and July 31. 4. Construction of ancillary facilities (for example, compressor stations and processing plants) will not be located within 0.5 mile of known nesting areas. The threat of vehicle collision to adult plovers and their broods will be minimized, especially within breeding aggregation areas. 5. Where possible, roads will be located outside of plover nesting areas.

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6. Work schedules and shift changes will be set to avoid the periods from 30 minutes before to 30 minutes after sunrise and sunset during June and July, when mountain plovers and other wildlife are most active. 7. BLM will monitor all road-associated carcasses, jackrabbit-sized and larger, along project (operator-maintained) roads. The presence of carrion could attract mountain plover predators. 8. Project-related features that encourage or enhance the hunting efficiency of predators of mountain plover will not be constructed within 0.25 mile of known mountain plover nest sites. 9. Creation of hunting perches or nest sites for avian predators within 0.5 mile of identified nesting areas will be avoided by burying power lines, by using the lowest possible structures for fences and other structures, and by incorporating perch-inhibiting devices into their design. 10. When aboveground markers are used on capped and abandoned wells, they will be no taller than 4 feet with perch-inhibiting devices on the top to avoid creation of raptor hunting perches within 0.5 mile of nesting areas. 11. Reclamation of areas of previously suitable mountain plover habitat will include the seeding of vegetation to produce suitable habitat for mountain plover. **Sage-Grouse:** 1. Surface disturbing activities or surface occupancy is prohibited or restricted on or within one quarter (0.25) mile radius of the perimeter of occupied or undetermined sage-grouse leks (WY-IM-2010-12; BLM 2009a). 2. Disruptive activity is restricted on or within one quarter (0.25) mile radius of the perimeter of occupied or undetermined sage-grouse leks from 6 pm to 8 am from March 15 – May 15 (WY-IM-2010-12; BLM 2009a). 3. Surface disturbing and/or disruptive activities are prohibited or restricted from March 15 – June 30 within suitable sage-grouse nesting and early brood-rearing habitat and within habitat important for connectivity (WY-IM-2010-12; BLM 2009a). 4. Surface disturbing and/or disruptive activities in mapped or modeled sage-grouse winter habitats/concentration areas that support Core Area populations, are prohibited or restricted from November 15 – March 14. 5. For any surface-disturbing activities proposed in sagebrush shrublands, the operator will conduct clearance surveys for sage-grouse breeding activity during the sage-grouse's breeding season before initiating the activities. The surveys must encompass all sagebrush shrublands within 0.5 mile of the proposed activities. 6. The operator will locate facilities so that noise from the facilities at any nearby sage-grouse or sharp-tailed grouse display grounds does not exceed 49 dBA (10 dBA above background noise) at the display ground. Note: POD-level site specific NEPA analyses will evaluate sage-grouse management actions consistent with Wyoming BLM Policy IM-WY-2010-012 (BLM 2009a). **Sharp-tailed Grouse:** 1. Surface-disturbing activities within 250 yards of a sharp-tailed grouse strutting/dancing ground will be restricted or prohibited. 2. Prohibit surface-disturbing activities within sharp-tailed grouse nesting habitats. An additional 0.5-mile radius would be established beyond

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the 250-yard lek radius, to prevent increased stress to and/or displacement of animals during the critical time period from April 1 through May 31.

Note: The WGFD recommends a 0.25 mile surface use buffer and two mile TL buffer for sharp tailed grouse leks which will be evaluated during POD level site specific NEPA analyses.

Raptors:

1. Preclude new surface-disturbing activities within 0.5 mile of raptor nest sites to prevent increased stress to and/or displacement of animals during the critical period from February 1 through July 31.

Ute Ladies'-tresses Orchid:

1. Site-specific project areas will be evaluated for suitable Ute ladies'-tresses orchid habitat prior to permit approval. Suitable habitat is characterized by moist soils near springs, lakes, or perennial streams; most occurrences are in alluvial substrates along riparian edges, gravel bars, old oxbows, and moist to wet meadows in the floodplains of perennial streams (USFWS 1995).
2. Suitable habitat will be avoided wherever possible.
3. If suitable habitat for Ute ladies'-tresses cannot be avoided, surveys will be conducted in compliance with USFWS standards (USFWS 1995) by a BLM-approved biologist or botanist. Surveys can only be conducted between July 20 and August 31.

Objective	Alternative I No Action	Alternative II Prescriptive	Alternative III – the Proposed Action Performance Based
Overhead Power Objective: Retain visual resources surrounding the WSA.	Overhead power lines are prohibited on BLM surface within FCPA.	Overhead power line network would extend from existing overhead lines along drainages and using existing corridors and roads to minimize cross-country power line construction. Network of parallel lines approximately following drainages and existing roads.	Overhead power on BLM surface limited to within road corridors to manage within the existing visual class.
		The operator will locate aboveground power lines, where practical, at least 0.5 mile from any sage-grouse breeding or nesting grounds to prevent raptor predation and sage-grouse collision with the conductors. Power poles within 0.5 mile of any sage-grouse breeding ground will be raptor-proofed to prevent raptors from perching on the poles.	

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		The operator will construct power lines to minimize the potential for raptor collisions with the lines. Potential modifications include burying the lines, avoiding areas of high avian use (for example, wetlands, prairie dog towns, and grouse leks), and increasing the visibility of the individual conductors.
		The operator will limit the construction of aboveground power lines near streams, water bodies, and wetlands to minimize the potential for waterfowl colliding with power lines.

Cultural Resources		
Alternative I **No Action**	**Alternative II** **Prescriptive**	**Alternative III – the Proposed Action** **Performance Based**
Goals: 1. Avoid or mitigate significant impacts to historic properties.		
Management Actions Common to All Alternatives: 1. Require archaeological inventory for all Federal undertakings, regardless of surface ownership. 2. Identify historic properties. 3. Design projects to avoid or mitigate impacts to historic properties prior to approval. 4. Mitigate impacts to historic properties inadvertently discovered during or after construction.		

Geologic Resources		
Alternative I **No Action**	**Alternative II** **Prescriptive**	**Alternative III – the Proposed Action** **Performance Based**
Goals: 1. Maintain or enhance opportunities for mineral exploration and development while maintaining other resource values (BLM 2001a).		
Management Actions Common to All Alternatives: 1. BLM will provide for the efficient use of the mineral resources. 2. The mineral owners are entitled to access their minerals to explore for and develop them and to prudently use an area of the land surface and surface resources that are directly necessary to those exploration and development activities.		

Paleontological Resources		
Alternative I **No Action**	**Alternative II** **Prescriptive**	**Alternative III – the Proposed Action** **Performance Based**
Goals: 1. Protect the scientific value of significant fossils.		
Management Actions Common to all Alternatives: 1. Paleontological inventories will be targeted to specific areas or will be issue-driven, as needed. 2. Large, conspicuous, and/or scientifically significant fossils or localities found during development will be reported to BLM. 3. Evaluation of discoveries during construction will be conducted by a BLM-approved professional paleontologist within five working days. 4. Adverse impacts to paleontological resources will be mitigated as necessary.		

Visual Resources		
Goals: 1. Maintain or improve scenic values, visual quality, and establish visual resource management priorities in conjunction with other resource values (BLM 2001a). 2. Retain visual resources within and surrounding the WSA.		
Management Actions Common to All Alternatives: 1. No activity or occupancy is allowed within 200 feet of the edge of State and Federal highways. 2. Facilities or structures such as power lines, oil wells, and storage tanks are required to be screened, painted, and designed to blend with the surrounding landscape except where safety indicates otherwise. 3. Any facilities or structures proposed in or near WSAs will be designed so as not to impair wilderness suitability. 4. The FCPA is designated and managed as Visual Resource Management (VRM) Class III. 5. The WSA is managed under interim guidance for non-impairment, (i.e., VRM Class I) 6. The operator will complete the following measures where practical: use existing well pads where feasible, use vegetative and topographic screening when siting well locations, and avoid highwall cuts. 7. The operator will mount lights at compressor stations and other facilities on a pole or building and direct them downward to illuminate key areas within the facility while minimizing the amount of light projected outside the facility (PRB O&G ROD, p. A-38; BLM 2003c). 8. The operator will use buried power lines to each well, where feasible, to reduce the linear element in the landscape.		
Alternative I **No Action**	**Alternative II** **Prescriptive**	**Alternative III – the Proposed Action** **Performance Based**
Overhead power lines are prohibited on BLM surface lands within the FCPA.	Overhead power line network would extend from existing overhead lines along drainages and using existing corridors and roads to minimize cross-country power line construction. Network of parallel lines approximately following drainages and existing roads.	Overhead power on BLM surface limited to within road corridors to manage within the existing visual class.

Fuels and Fire		
Alternative I **No Action**	**Alternative II** **Prescriptive**	**Alternative III – the Proposed Action** **Performance Based**
Goals: 1. To restore the natural role of fire in the ecosystem (BLM 2001a). 2. To cost-effectively protect life, property, and resource values from wildfire (BLM 2001a). 3. To use prescribed fire to achieve multiple-use management goals (BLM 2001a).		
Management Actions Common to all Alternatives: 1. Unwanted wildland fires will be suppressed. The use of some types of suppression equipment will be restricted in some areas, and fire and suppression damage will be rehabilitated. 2. Wildfires will be managed in all areas of the resource area. Priority will be given to suppressing fires in or threatening higher-value resources (the WSA) and keeping fires from spreading onto private, State, or other Federal lands. Protecting human life will be the highest priority. 3. Heavy equipment (dozers) will be restricted from being used for wildfire suppression in the WSA and areas of known cultural values. 4. Aerial retardant use will be restricted to keep retardant out of water sources. Specific restrictions on retardant use apply to the WSA. 5. Helispot construction is prohibited in the WSA. 6. Firelines that are constructed by heavy equipment or on steep slopes will be rehabilitated to prevent or control erosion. Rehabilitation includes, but is not limited to, water barring and reseeding. 7. Prescribed burns will be used as a tool to reach management objectives planned for areas in conjunction with items such as range and wildlife habitat management projects.		

Rangeland

Goals:

1. Manage livestock grazing in order to be consistent with Standards for Healthy Rangelands and Guidelines for Livestock Grazing Management for Public Lands Administered by the Bureau of Land Management in the State of Wyoming (BLM 1997); maintain a thriving natural ecological balance, multiple-use relationships, and productive forage resources.
2. Maintain or improve forage production and range condition to provide a sustainable resource base for livestock grazing on the public lands while improving wildlife habitat and the watershed (BLM 2001a).

Management Actions Common to All Alternatives

1. Livestock grazing is allowed on all public lands in the FCPA.
2. Any permanent increases in the amount of forage produced are considered for wildlife and watershed protection before additional livestock use is authorized.
3. Fences will be constructed to maintain wildlife mobility in important habitat areas. Fences on public land that are hindering natural movement of wildlife will be modified to conform to BLM standards. See BLM Handbook H-1741-1 for fence specifications.
4. Reservoirs, wells, troughs, and pipelines will be constructed to provide water in dry areas and to disperse grazing use. The grazing lessee or other cooperator will be required to maintain water in all troughs located on public land during the frost-free period (April through October) for wildlife.
5. All stock tanks will include a ramp to enable trapped small birds and mammals to escape. See Idaho BLM Technical Bulletin 89-4 entitled Wildlife Watering and Escape Ramps on Livestock Water Developments: Suggestions and Recommendations.

Objective	Alternative I No Action	Alternative II Prescriptive	Alternative III – the Proposed Action Performance Based
Extraction of Mineral Resources Objectives: Allow for the extraction of mineral resources, while protecting other resources. Minimize elk displacement.	CBNG development pace is not restricted geographically or temporally.	Tri-phased development would be implemented by geographical area. Development to occur over three years followed by one year of successful interim reclamation before proceeding to next area (original three phases).	Performance-based phased (Elk and Reclamation Standards – Appendix B) development would be implemented geographically with a "bolt on" approach. Grazing management should be a component of interim reclamation.
Water Resources Objective:	Replacement of impacted domestic wells in accordance with water well	Operators will provide summer water sources for livestock and wildlife if	Operators will provide summer water sources for livestock and wildlife if

Protect summer water sources utilized by elk and livestock.	agreement. Operators required to offer water well agreements to the owners of record for permitted water wells within 0.5 mile of producing Federal CBNG wells.	current sources (permitted through the WSEO) become unavailable and that loss is directly attributable to development of CBNG. Water will be provided until those lost sources are again available and/or other permanent sources are developed.	current sources (permitted through the WSEO) become unavailable and that loss is directly attributable to development of CBNG. Water will be provided until those lost sources are again available and/or other permanent sources are developed.

Recreation		
Alternative I **No Action**	**Alternative II** **Prescriptive**	**Alternative III – the Proposed Action** **Performance Based**
Goals: 1. Provide outdoor recreational opportunities on BLM-administered public land while providing for resource protection, visitor services, and the health and safety of public land visitors (BLM 2001a).		
Management Actions Common to All Alternatives: 1. Special recreation permits (SRPs) are issued for commercial competitive and large-scale nonprofit organized recreational events on a case-by-case basis.		

Transportation		
Alternative I **No Action**	**Alternative II** **Prescriptive**	**Alternative III – the Proposed Action** **Performance Based**
Goals: 1. Manage access to CBNG leases to ensure that the BLM non-impairment standard is not violated.		
Management Actions Common to All Alternatives: 1. Long-term occupancy of the public lands for roads, power lines, pipelines, communication sites, and irrigation ditches is authorized by granting a right-of-way (ROW). ROWs are to be removed and reclaimed upon termination of the grant. 2. Transmission lines and transportation facilities will be located within identified corridor areas to the extent feasible.		

Lands and Realty		
Alternative I **No Action**	**Alternative II** **Prescriptive**	**Alternative III – the Proposed Action** **Performance Based**
Goals: 1. Avoid the potential of inadvertent trespass by people accessing the public lands; and improve access and manageability of the public lands (BLM 2001a). 2. Support the multiple-use management goals of the various BLM resource programs; respond to public requests for land use authorizations, sales, and exchanges; and acquire access to serve administrative and public needs (BLM 2001a). 3. Provide outdoor recreational opportunities on BLM-administered public land while providing for resource protection, visitor services, and the health and safety of public land visitors (BLM 2001a).		
Management Actions Common to All Alternatives: 1. Long-term occupancy of the public lands for roads, power lines, pipelines, communication sites, and irrigation ditches is authorized by granting a ROW. ROWs are to be removed and reclaimed upon termination of the grant. 2. Transmission lines and transportation facilities will be located within identified corridor areas to the extent feasible. 3. Withdrawals for surface and/or minerals will be considered on a case-by-case basis. 4. Priority is given to acquiring public land in areas adjacent to major blocks of public land, especially in areas of high recreational potential. 5. Easements that will provide access to contiguous blocks of public lands for recreation and administrative purposes will be pursued.		

Fluid Minerals – CBNG

Goals:

1. Allow for the extraction of mineral resources while protecting other resources.
2. Facilitate the extraction of CBNG while minimizing the effects on the landscape that would impact the resource values in the FCPA.
3. Identify stipulations for new leases to ensure that development impacts would not impact resource values in the FCPA.
4. Identify stipulations, Conditions of Approval (COAs) and BMPs for exploration, development, production, and reclamation to ensure that activities would not impact resource values in the FCPA.
5. Minimize elk displacement.

Management Actions Common to All Alternatives:

1. Authorization for activities on existing mineral leases would be governed by valid existing rights.
2. Implement standard lease terms (individual leases).
3. No CBNG or conventional oil and gas development would occur within the WSA.
4. All pipelines will be located in corridors.
5. The operator will locate impoundments to avoid sagebrush shrublands where practical.
6. Containment impoundments will be fenced to exclude wildlife and livestock. If they are not fenced, they will be designed and constructed to prevent entrapment and drowning.
7. Noise mufflers will be installed on the exhaust of compressor engines to reduce the exhaust noise.
8. Where noise impacts to existing sensitive receptors are an issue, noise levels will be required to be no greater than 55 dBA measured at a distance of 0.25 mile from the appropriate booster (field) compressor. When background noise exceeds 55 dBA, noise levels will be no greater than 5 dBA above background. This may require the installation of electrical compressor motors at these locations.
9. All stock tanks will include a ramp to enable trapped small birds and mammals to escape. See Idaho BLM Technical Bulletin 89-4 entitled Wildlife Watering and Escape Ramps on Livestock Water Developments: Suggestions and Recommendations.
10. Surface disturbance and disruptive activities would be restricted within elk crucial winter habitat from November 15 through April 30.
11. Surface disturbance and disruptive activities would be restricted within elk parturition habitat from May 1 through June 30.

Special Status Species:

Special Status Species management actions applicable to Fluid Minerals are listed under Special Status Species alternatives.

Objective	Alternative I No Action	Alternative II Prescriptive	Alternative III – the Proposed Action Performance Based
CBNG Development	CBNG development pace is not	Tri-phased development would be	Performance-based phased (Elk and

Fluid Minerals – CBNG			
Objectives: Allow for the extraction of mineral resources, while protecting other resources. Minimize elk displacement.	restricted geographically or temporally.	implemented by geographical area. Development to occur over three years followed by one year of successful interim reclamation before proceeding to next area (original three phases).	Reclamation Standards, Appendix B) development would be implemented geographically with a "bolt on" approach. Grazing management should be a component of the operator submitted disturbance and reclamation plan.
Well Metering and Visitation Objective: Manage elk disturbance and displacement.	Well metering and visitation are not restricted in the FCPA.	A work activity management plan, acceptable to the authorizing officer, shall be developed during POD processing. The plan shall include all POD related construction, metering and monitoring, maintenance, and operation activities. Provisions shall be made for emergencies.	Metering and visitation will meet performance-based objectives (Elk and Reclamation Standards, Appendix B).
Water Management Facilities Objective: Manage elk disturbance and displacement.	Water management facility locations are not restricted.	Reservoirs and water management facilities would be located outside crucial winter range and parturition range.	When water discharge is authorized by the State of Wyoming, location of water management facilities shall meet performance-based objectives (See: Elk and Reclamation Standards, Appendix B).
Water Source Objective: Protect summer water sources utilized by elk and livestock.	Replacement of impacted domestic wells in accordance with water well agreement. Operators required to offer water well agreements to the owners of record for permitted water wells within 0.5 mile of producing Federal CBNG wells.	Operators will provide summer water sources for livestock and wildlife if current sources (permitted through the WSEO) become unavailable and that loss is directly attributable to development of CBNG. Water will be provided until those lost sources are again available and/or other permanent sources are developed.	Operators will provide summer water sources for livestock and wildlife if current sources (permitted through the WSEO) become unavailable and that loss is directly attributable to development of CBNG. Water will be provided until those lost sources are again available and/or other permanent sources are developed.
Compression Facilities Objective:	Location of compression facilities is not restricted within elk ranges.	Compression facilities within crucial winter range and parturition habitat	Compression facilities will meet performance-based objectives (Elk

Fluid Minerals – CBNG			
Manage elk disturbance and displacement.		shall be limited to the minimum necessary, non wellhead facilities to transport CBNG off the Federal lease.	and Reclamation Standards, Appendix B).
Security Habitat Objective: Provide sufficient elk habitat.	No security habitat standards.	Security habitat standards shall follow WGFD recommendations: all identified security habitat within overlapping crucial winter range (CWR) and parturition range (PR) shall be retained, where crucial ranges (CWR and PR) do not overlap, 75% of the identified security habitat shall be retained. 50% of security habitat will be retained in the yearlong range outside of the crucial ranges.	Retain 80% of elk security habitat as measured from roads within all seasonal ranges and within each geographic phase.
Overhead Power Objective: Retain visual resources surrounding the WSA.	Overhead power lines are prohibited on BLM surface within FCPA.	Overhead power line network would extend from existing overhead lines along drainages and using existing corridors and roads to minimize cross-country power line construction. Network of parallel lines approximately following drainages and existing roads.	Overhead power on BLM surface limited to within road corridors to manage within the existing visual class.
		The operator will locate aboveground power lines, where practical, at least 0.5 mile from any sage-grouse breeding or nesting grounds to prevent raptor predation and sage-grouse collision with the conductors. Power poles within 0.5 mile of any sage-grouse breeding ground will be raptor-proofed to prevent raptors from perching on the poles.	
		The operator will construct power lines to minimize the potential for raptor collisions with the lines. Potential modifications include burying the lines, avoiding areas of high avian use (for example, wetlands, prairie dog towns, and grouse leks), and increasing the visibility of the individual conductors.	
		The operator will limit the construction of aboveground power lines near	

Fluid Minerals – CBNG		
		streams, water bodies, and wetlands to minimize the potential for waterfowl colliding with power lines.

Special Designations			
Goals: 1. Ensure continued public use and enjoyment of recreational activities while protecting and enhancing natural and cultural values; improve opportunities for high-quality outdoor recreation; and improve visitor services related to safety, information, interpretation, and facility development and maintenance. 2. Allow orderly development of mineral resources while protecting wildlife habitat and watershed areas, and maintaining wilderness values (naturalness, solitude, and primitive and unconfined recreation).			
Management Common to All Alternatives: 1. The WSA will be managed, according to the Interim Management Plan (BLM 1995b), to maintain wilderness characteristics. 2. Vehicle travel is limited to designated roads and vehicle routes.			
Objective	**Alternative I No Action**	**Alternative II Prescriptive**	**Alternative III – the Proposed Action Performance Based**
ACEC Objective: Retain the relevant and important resource values.	The citizen proposed ACEC (33,757 acres) would not be designated.	Establish the citizen proposed ACEC (33,757 acres). ACEC management prescriptions would be defined in the Decision Record.	The citizen-proposed ACEC (33,757 acres) would not be designated. Performance standards (elk and reclamation) have been determined sufficient to protect resource values.
Wildlife Habitat Management Area Objective: Effectively manage the unique wildlife habitat values.	No Wildlife Habitat Management Area (WHMA) designation.	Establish a WHMA within the elk parturition and crucial winter ranges (extend outside FCPA).	No WHMA designation.

3.0 AFFECTED ENVIRONMENT

3.1 Resources

3.1.1. Air Quality

This section discusses the regulatory framework and current condition of the air resource and climate of the Fortification Creek Planning Area (FCPA).

3.1.1.1. Regional Setting and Regulatory Framework

Federal and State governments have established ambient air quality standards for criteria air pollutants, including carbon monoxide (CO), nitrogen dioxide (NO_2,), sulfur dioxide (SO_2), particulate matter (PM) less than or equal to 10 microns in size (PM_{10}), PM less than or equal to 2.5 microns in size ($PM_{2.5}$), ozone, and lead. Ozone is typically not emitted directly from emission sources, but at ground level it is created by a chemical reaction between ozone precursors, including oxides of nitrogen (NO_x) and volatile organic compounds (VOCs). Therefore, the U.S. Environmental Protection Agency (EPA) regulates emissions of VOCs.

With respect to National Ambient Air Quality Standards (NAAQS), the EPA classifies all locations in the United States as either "attainment" (including "unclassified"), "non-attainment," or "maintenance" areas. These classifications are determined by comparing actual monitored air pollutant concentrations with their applicable Federal standards. All three counties in the FCPA region are classified as attainment areas for all pollutants. The city of Sheridan is a non-attainment area for PM_{10}; however, Sheridan is northwest of the FCPA (EPA 2008).

With respect to visibility, under Sections 169 and 401 of the Clean Air Act (CAA), there are several programs in place to protect visibility. These programs include the National Visibility Program, Prevention of Significant Deterioration for the review of potential impacts from new and modified sources, the secondary NAAQS for PM_{10} and $PM_{2.5}$, and provisions for acid deposition control. In 1987, the Interagency Monitoring of Protected Visual Environments (IMPROVE) visibility network was established as a cooperative effort among the EPA, the National Oceanic and Atmospheric Administration (NOAA), the National Park Service (NPS), the U.S. Forest Service (USFS), the U.S. Fish and Wildlife Service (USFWS), the Bureau of Land Management (BLM), and State governments to determine current conditions, track progress towards national visibility goals, and to provide information on types and sources of pollutants.

Under the CAA Amendments of 1977, Congress established a system for the prevention of significant deterioration (PSD) to protect areas that are not classified as non-attainment (i.e., cleaner than the NAAQS). A "PSD increment" classification system was implemented based on the amounts of additional NO_2, PM, and SO_2 degradation that would be allowed above existing baseline levels for various areas. A Class I area would have the greatest limitations, where virtually any degradation would be considered unacceptable. A Class II area would permit moderate deterioration and controlled growth. National parks of more than 6,000 acres and wilderness areas and memorial parks of more than 5,000 acres were defined as Mandatory Federal Class I areas under the 1977 Amendments. In addition to more stringent ambient air increments, Class I areas are also protected by the regulation of Air Quality Related Values (AQRVs) by the Federal Land Managers (FLMs) responsible for the areas. Typically, FLMs are concerned about detectable changes to AQRVs, such as visibility, flora, fauna, and water and soil

chemistry. Currently, the FCPA is classified as a Class III area. The mandatory Federal Class I areas closest to the FCPA and their approximate distances from the FCPA are as follows:

- Yellowstone National Park, Wyoming – 310 miles to the west;
- Grand Teton National Park, Wyoming – 365 miles to the west;
- Wind Cave National Park, South Dakota – 195 miles to the east; and
- Badlands National Park, South Dakota – 280 miles to the east.

Several other wilderness areas and reservations are within 150 miles of the FCPA; they are not mandatory Federal Class I areas however, and they include:

- Cloud Peak Wilderness, Bighorn National Forest, Wyoming – 60 miles to the west;
- Black Elk Wilderness, Black Hills National Forest, South Dakota – 150 miles to the east;
- The Northern Cheyenne Reservation, Montana – 60 miles to the north; and
- The Crow Reservation, Montana – 50 miles to the northwest.

The wilderness areas are not mandatory Federal Class I areas because they were not designated prior to the CAA. The reservations are considered Class I areas, but are not designated as mandatory under the CAA.

The existing air quality of the FCPA, as well as future air quality impacts, would be based on the pollutants and Class I Area parameters listed in Table 3-1. This table summarizes the NAAQS, Class I and Class II Significant Impact Levels (SILs), PSD allowable increments for Class I and Class II areas, and AQRVs for Class I areas.

Under the National Environmental Policy Act (NEPA), potential air quality impacts due to activities in the FCPA must be compared to applicable air quality standards. While comparisons are intended to evaluate a "threshold of concern" for potentially significant direct project impacts, they do not necessarily represent a cumulative analysis. Some regulatory analyses are the responsibility of the State air quality agency (under EPA oversight) and would be conducted during the permitting process.

The NAAQS and Wyoming Ambient Air Quality Standards (WAAQS) describe the upper limits for specific air pollutant concentrations at locations where the public has access. The six criteria pollutants are lead, ozone, SO_2, NO_x, CO, and $PM_{2.5}$. In addition to the six criteria pollutants, the Wyoming Department of Environmental Quality (WDEQ) measures PM_{10}. These standards, along with PSD increments and calculated background, are listed in Table 3-1.

Table 3-1 Assumed Background Air Pollutant Concentrations, Applicable Ambient Air Quality Standards, and PSD Increment Values

Air Pollutant	Monitoring Interval	Primary NAAQS	Secondary NAAQS	Wyoming Standards	PSD Class I Increments	PSD Class II Increments
Carbon Monoxide	1-hour	35 ppm	–	35 ppm	–	–
	8-hour	9 ppm	–	9 ppm	–	–
Lead	Quarterly	1.5	1.5 µg/m^3	1.5 µg/m^3	–	–

Table 3-1 Assumed Background Air Pollutant Concentrations, Applicable Ambient Air Quality Standards, and PSD Increment Values						
Air Pollutant	**Monitoring Interval**	**Primary NAAQS**	**Secondary NAAQS**	**Wyoming Standards**	**PSD Class I Increments**	**PSD Class II Increments**
	Rolling Average	µg/m^3				
Nitrogen dioxide	Annual Average	53 ppb	53 ppb	0.05 ppm	2.5	25
Nitrogen dioxide	1-hour	100 ppb	–	–		
Ozone	24-hour	–	–	0.05 ppm		
Ozone*	8-hour	0.075 ppm	0.075 ppm	0.08 ppm	–	–
Ozone	1-hour	12 ppm	12 ppm	–		
PM_{10}	24-hour	150 µg/m^3	150 µg/m^3	150 µg/m^3	4	30
$PM_{2.5}$	24-hour	35.0 µg/m^3	35 µg/m^3	35 µg/m^3	–	–
	Annual Average	15.0 µg/m^3	15 µg/m^3	15 µg/m^3	–	–
Sulfur dioxide	1-hour	75 ppb	–	0.5 ppm (3-hour)	25	512
	24-hour	0.14 ppm	0.5 ppm	0.10 ppm	5	91
	Annual Average	0.03 ppm	0.5 ppm	0.02 ppm	2	20

Key:
µg/m^3 = Micrograms per cubic meter.
– = Not applicable.
*The primary and secondary O_3 ambient air quality standards are met at an ambient air quality monitoring site when the 3-year average of the annual fourth-highest daily maximum 8-hour average O_3 concentration is less than or equal to 0.075 ppm.

3.1.1.2. Current Conditions and Trends

Climate

Most of the FCPA is classified as semiarid cool steppe, where evaporation exceeds precipitation. Summers are relatively short and warm, while winters are long and cold. Average daily temperatures range from 5 degrees Fahrenheit (°F) to 10°F (low), and from 30°F to 35°F (high) in mid-winter, and from 55°F to 60°F (low) and from 80°F to 85°F (high) in mid-summer. Prevailing winds are from the southwest; however, local wind conditions reflect mountain and valley channeling. Air pollutant mixing and transport along valley drainages are relatively low, while dispersion improves along ridge and mountaintops.

Air Quality

The CAA provides visibility protection in mandatory Federal Class I areas. There are no Class I areas within 100 miles of the FCPA. Visibility is monitored at two stations in the Powder River Basin (PRB), but not within the FCPA.

Two monitors representative of the area include those in Thunder Basin National Grassland (background) and Campbell County (downwind of coal bed natural gas [CBNG] development). These monitors measure meteorology, ozone, and NO_x. The Thunder Basin monitor also has a full suite of visibility measuring capacity. These monitors indicate that air quality is good. NO_x is in decline and ozone is below the proposed ozone standard (WDEQ 2008a).

Methane is a greenhouse gas that acts to trap heat in the Earth's atmosphere, contributing to global warming (U.S. Geological Survey [USGS] 2000). Coal mining and venting from oil and gas wells represent approximately 10 percent of the nationwide global contribution to methane in the atmosphere.

Current management requires that as part of the fluid mineral permit process, regulatory agencies will conduct additional studies and monitoring and require mitigation as needed to achieve air quality standards.

The WDEQ maintains an extensive network of air quality monitors throughout the state. PM_{10} is the most commonly measured parameter. One air quality monitor is present near the FCPA (in Arvada, Wyoming; Figure 1-2) and PM_{10} is the only NAAQS parameter measured at this location. There have been no exceedances of the PM_{10} standard since the air monitor was installed in 2002. Lead, ozone, SO_2, NO_x, and CO are not measured in the FCPA. There are no visibility monitors in the FCPA.

Although specific air quality monitoring is not conducted throughout most of the FCPA because of the rural nature of the area, air quality conditions have historically been very good. This is the result of few emissions sources and good atmospheric dispersion conditions. However, with the increase in CBNG activity, air quality could be deteriorating.

Venting from oil and gas wells contributes methane to the atmosphere. Venting or flaring of methane for conventional wells may occur for a few days or up to a month during initial completion and testing of a well and may persist temporarily until a pipeline is connected. Operators are allowed to vent up to 50 million cubic feet (MMCF) over a 30-day period of initial production; anything in excess of this level requires approval by BLM.

In CBNG wells, gas and water are separated at the wellhead and any gas is flared (burned off); however, there is no flaring of methane. There are no estimates of the volume of methane vented or flared in the FCPA or the PRB. However, in accordance with Onshore Oil and Gas Operations Order No.5 (BLM 1989a), the operators are obligated to measure the vented gas and report the results to BLM.

3.1.2. Soil Resources

Soils within the FCPA have developed in residual material and alluvium in a climatic regime characterized by cold winters, warm summers, and low precipitation. The upland soils are derived from both residual material (flat-lying, interbedded sandstone, siltstone, and shale) and stream alluvium. Valley soils have developed in unconsolidated stream sediments including silt, sand, and gravel (BLM 2003a). Exposed bedrock is present on steep slopes.

3.1.2.1. Regional Setting and Regulatory Framework

The FCPA is included in the soil surveys of Campbell, Johnson, and Sheridan counties. The soil complexes present in the FCPA are shown on Figure 3-1. Soils in the project area are generally upland soils, but valley and stream terrace soils are locally present. Rock outcrop (sandstone and shale) and clinker have poor revegetation potential, but provide valuable wildlife habitat because of their irregular terrain (BLM 2003a).

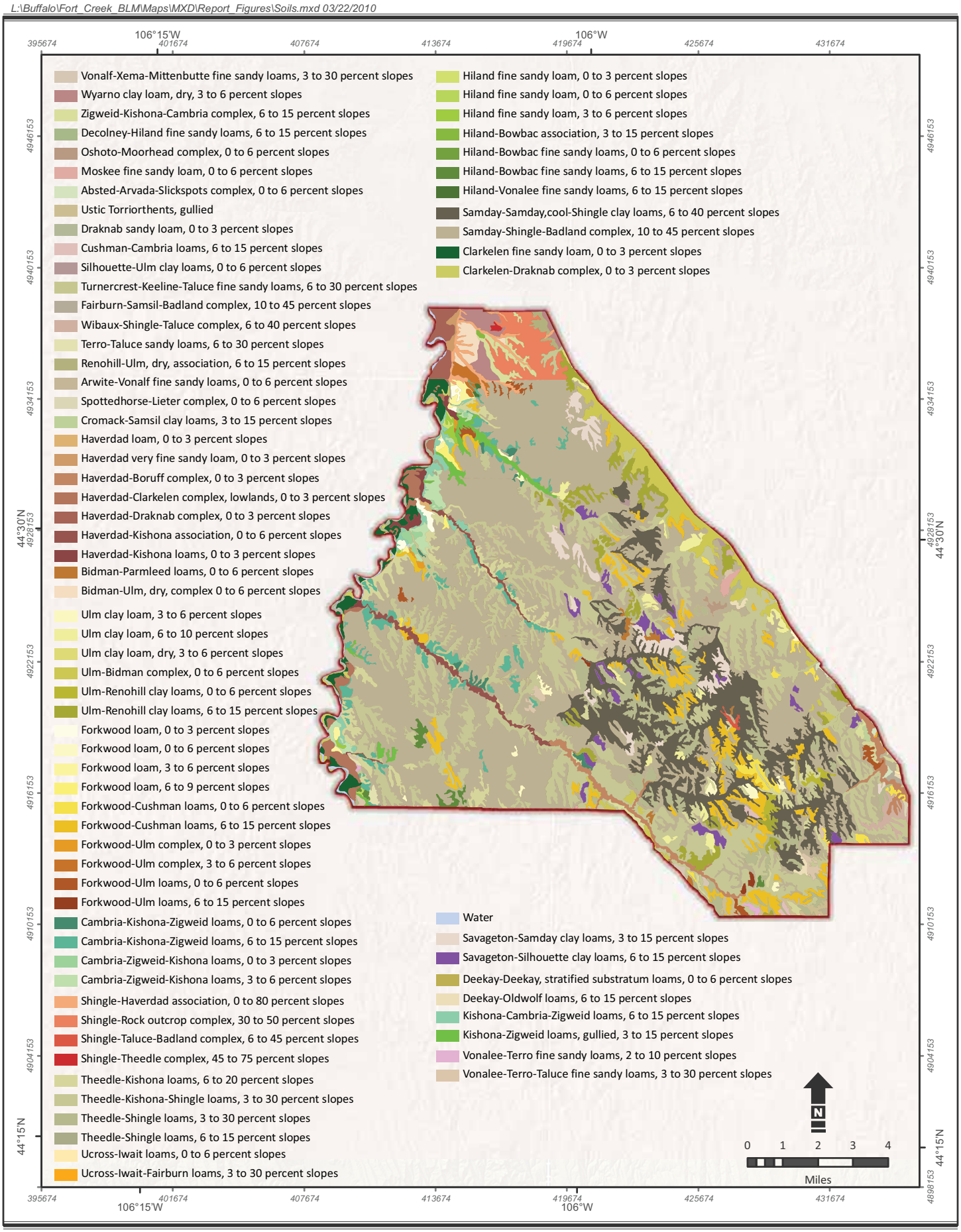
The Wyoming Standards for Healthy Public Rangelands (BLM 1995a) include resource goals for maintaining healthy ecosystems. Standard #1 states that soils are stable and allow for water infiltration to provide for optimal plant growth and minimal surface runoff. The following factors contribute to soil stability.

Slope Hazard

A soil's stability is greatly affected by the slope on which it occurs. In general, the greater the slope, the greater the potential for slumping, landslides, and water erosion. Approximately 33,694 acres (33 percent) in the FCPA have slopes of 25 percent or more. Slopes greater than 25 percent are shown on Figure 3-2. Soils with slopes of less than 25 percent may also be prone to high erosion because of the soil type, particle size, texture, or amount of organic matter. Dominant soil types in the FCPA with severe erosion potential, as defined by the Natural Resources Conservation Service (NRCS; U.S. Department of Agriculture [USDA] NRCS 2007), are listed in Table 3-2 along with the number of acres and percentage of the FCPA. Soils with high erosion potential will be evaluated during plan of development (POD)-specific NEPA analyses.

Table 3-2 Soils with Severe Erosion Potential

Map Unit Name	Soil Erodibility Rating	Acres	Percentage of FCPA
Forkwood-Cushman loams, 6 to 15 percent slopes	Severe	3,970	4
Samday-Samday, cool-Shingle clay loams, 6 to 40 percent slopes	Severe	10,777	11
Samday-Shingle-Badland complex, 10 to 45 percent slopes	Severe	37,242	37
Savageton-Silhouette clay loams, 6 to 15 percent slopes	Severe	1,005	1
Theedle-Kishona loams, 6 to 20 percent slopes	Severe	2,491	2.5
Theedle-Kishona-Shingle loams, 3 to 30 percent slopes	Severe	17,054	17
Theedle-Shingle loams, 3 to 30 percent slopes	Severe	3,951	4
Ulm-Renohill clay loams, 6 to 15 percent slopes	Severe	1,927	2



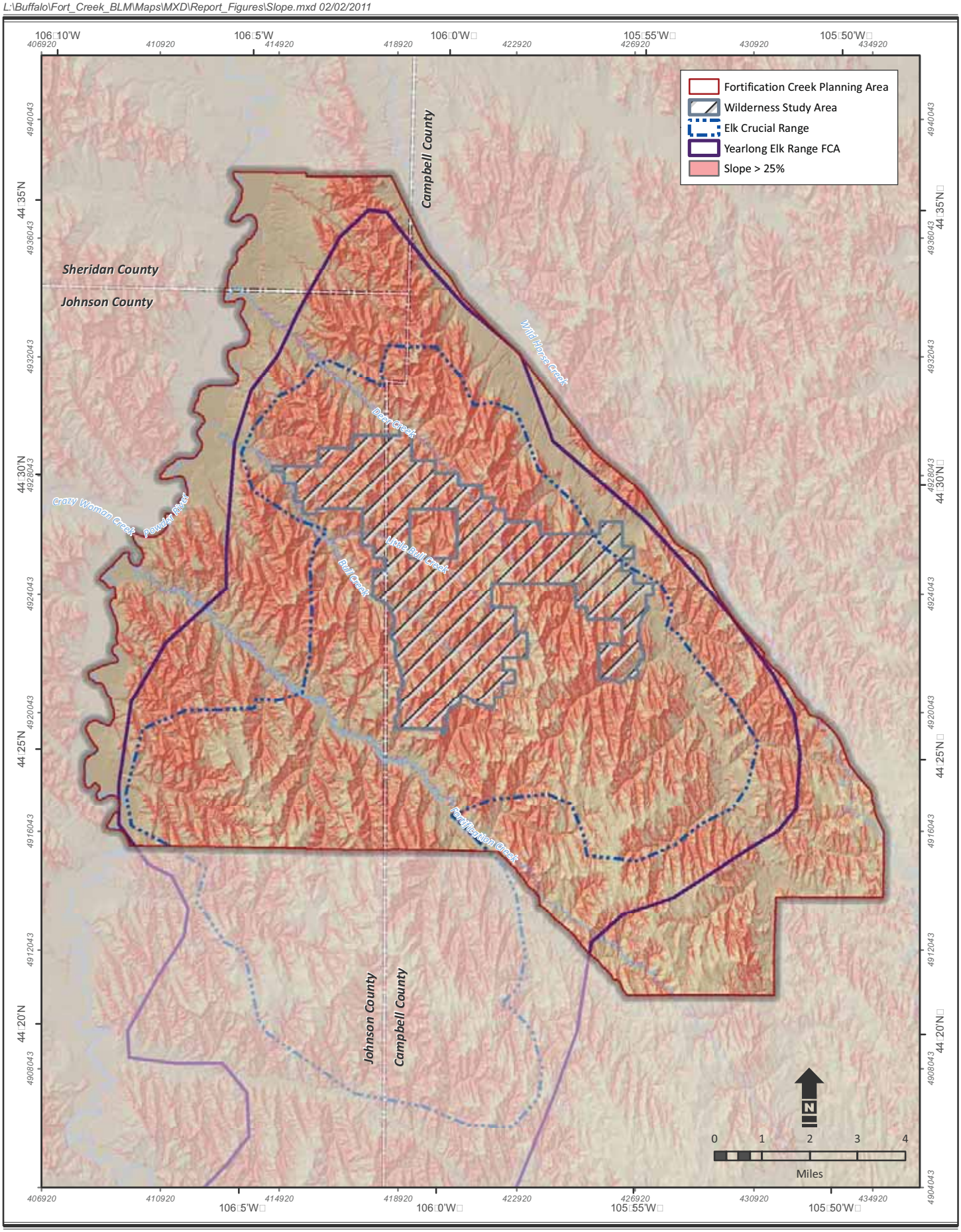
Source:
Soils - SSURGO, USDA

Figure 3-1

Soil Classification

Campbell, Johnson, and Sheridan Counties, Wyoming

L:\Buffalo\Fort_Creek_BLM\Maps\MXD\Report_Figures\Slope.mxd 02/02/2011



Source:
Boundaries/Lease Properties - Bureau of land Management 2009
Topography - United States Geological Survey 2005

Figure 3-2

Slopes Greater Than or Equal to 25 Percent

Fortification Creek Planning Area

As noted by the USDA, "Other contributing factors to slope stability include slope length, slope aspect and colluviums. Slope length has considerable control over runoff and potential accelerated water erosion. Slope aspect is the direction toward which the surface of the soil faces. Slope aspect may affect soil temperature, evapotranspiration, winds received, and soil moisture. Colluvium is poorly sorted debris that has accumulated at the base of slopes, in depressions, or along small streams through gravity, soil creep, and local wash. It consists largely of material that has rolled, slid or fallen down the slope under the influence of gravity. The rock fragments in colluviums are usually angular, in contrast to the rounded, water work cobbles and stones in alluvium and glacial outwash" (USDA 1993).

Erosion hazard potential for the FCPA is summarized in Table 3-3.

Table 3-3 Erosion Hazard Potential

	Slight	Moderate	Severe
Total Acres	9,965	6,584	84,337
% in the FCPA	9.9%	6.5%	83.4%

Water Erosion Hazard

Soils that have potential water erosion hazards are classified based on soil permeability classes, K-factor, and slope. K-factor is one of six factors used in the Universal Soil Loss Equation to predict annual rate of soil loss due to water erosion. Soil structure; percentage of silt, sand, and organic matter; and permeability all affect the K-factor of a soil. The higher the K-factor value, the more susceptible the soil is to water erosion. These values were calculated for soil types in the FCPA based on the NRCS Soil Survey Geographic (SSURGO) data.

One-third of the FCPA contains slopes of 25 percent and greater. At slopes greater than 25 percent, most soil types are subject to water erosion; only the most permeable and lowest K-factor soils are not subject to water erosion. Soils with severe water erosion hazard generally coincide with slopes greater than or equal to 25 percent in the FCPA.

Compaction/Shrink-Swell Potential

Compaction and shrink-swell potential affect a soil's ability to support construction activities and be successfully reclaimed. Soil compaction reduces the pore space for air and water and impedes root growth. Reclamation of a tightly compacted clay soil is extremely difficult without loosening the soil's full compacted depth before seeding.

Shrink-swell potential is the potential for volume change in a soil with a gain or loss in moisture. In soils with high shrink-swell potential, rapid changes in volume can damage structures and roads. As identified in the Powder River Basin Oil and Gas Final Environmental Impact Statement (PRB O&G FEIS; BLM 2003a), shrink-swell potential soils exist along the Powder River at the western boundary of the FCPA.

Biological Crust

Biological crusts are a living community of bacteria, microfungi, cyanobacteria, green algae, mosses, liverworts, and lichens that grow on or just below the soil surface. Biological crusts can

heavily influence the morphology of the soil surface, stabilize soil, fix carbon and nitrogen, and can either increase or decrease infiltration. The percent cover and the components of the crust can vary across short distances.

Biological crusts are present in the FCPA, particularly in areas with shallow soils. These crusts have not been well studied in the area; therefore, their current extent or survival trend is unknown.

Poor Revegetation Potential

Soils with poor revegetation potential occur throughout the FCPA. Currently, soil conditions in the FCPA are being impacted by CBNG development as well as traditional activities, including livestock grazing and wildlife use. Much of the area is covered with soils that are easily damaged by use or disturbance or are difficult to revegetate or otherwise reclaim. Soil impacts (e.g., roads, linear pipeline scars, and artificial wet areas) can be readily observed in the area. This high erosion potential could result in higher suspended sediment and turbidity levels in the Powder River.

In the absence of recoverable topsoil as is common throughout the FCPA, the surface organic matter in the form of vegetation, litter, and biological crust are critical to maintaining the integrity and viability of the soil. Soil reclamation suitability in the FCPA is shown on Table 3-4.

Table 3-4 Reclamation Suitability Within the FCPA

	Fair	Poor	Not Rated (water)
Total Acres	41,543	59,343	216
% in FCPA	41.1%	58.7%	0.2%

3.1.2.2. Current Conditions and Trends

The Wyoming Standards for Healthy Public Rangelands (BLM 1995a) include resource goals for maintaining healthy ecosystems. Standard #1 states that soils are stable and allow for water infiltration to provide for optimal plant growth and minimal surface runoff.

Under current management, surface occupancy and disturbance are not allowed on slopes of 25 percent or more. No surface disturbance is allowed in areas of severe erosion from March 1 to June 15. Conservation practices and State of Wyoming Best Management Practices (BMPs) are applied to surface-disturbing activities as needed (BLM 2001a). The 25 percent slope restriction in the FCPA is consistent with the Buffalo Field Office (BFO) Resource Management Plan (RMP) (BLM 2001a) and most other BLM Wyoming RMPs, and is the BLM Wyoming State Office lease notice. Exceptions can be applied on a case-by case basis.

As CBNG development has increased in and around the FCPA, soils have become cumulatively affected across the landscape. Effects to soils related to CBNG development are primarily associated with the construction of roads, well pads, water pipelines, gas pipelines, water-handling facilities, compressors, production facilities, and electric lines.

Direct impacts to soils result from the clearing of vegetation; excavating, stockpiling, compacting, and redistributing soils during construction and reclamation; and storing or discharging produced CBNG water. Clearing vegetation exposes the soil to erosion and can result in a loss of organic matter. Excavation for facility pads and roads can lead to slope steepening in cut-and-fill areas, mixing of soil layers, and a breakdown of soil structure. Removal and stockpiling of soils for reclamation can also result in the mixing of soil profiles and contribute to a loss of soil structure. Soil compaction during road building and CBNG construction activities can decrease pore space and cause a loss of soil structure, as well (BLM 2003a). Some sites may be unsuitable for oil and gas development because they have no reclamation potential and cannot be mitigated.

Discharged CBNG water can be very high in sodium bicarbonate. The sodium bicarbonate can clog the soil pores and retard infiltration from wastewater impoundments (BLM 2003a). This sodium imbalance can cause soil structure to break down and the soil particles to disperse, particularly in clayey soils. All of these effects have been shown to diminish the soil's resistance to water and wind erosion as well as the response to reclamation efforts.

Depending on infiltration rates, the storage and/or discharge of CBNG-produced water is likely altering the physical and chemical properties of soils in the FCPA. In some instances, where CBNG produced water that is rich in sodium bicarbonate and barium, barium sulfate precipitates onto the soil surface (BLM 2003a).

In addition to CBNG development activities, soils in the area are continuing to be affected by traditional activities such as livestock grazing, wildlife, and increased traffic on new and existing roads. Because all the rangeland allotments that have been assessed to date have been found to be meeting rangeland health standards, it is likely that livestock are not having a substantial impact on soils in the area (through compaction and/or vegetation removal). Wildlife are also having a minimal impact on soils resources, based on their numbers in relation to the size of the area.

Road dust generated from increasing traffic on unpaved roads in the area is displacing soil locally. Traffic may also be increasing sedimentation into nearby streams, particularly at stream crossings.

3.1.3. Water Resources

3.1.3.1. Regional Setting and Regulatory Framework

The FCPA lies within the 4th-level Upper Powder River subbasin and within three 5th-level watersheds: Powder River–Barber Creek (USGS Hydrologic Unit Code [HUC] # 1009020206), Powder River–Fortification Creek (HUC # 1009020207), and Wild Horse Creek (HUC # 1009020208). These watersheds are further divided into eight 6th-level subwatersheds. The percent of FCPA land area contained within each include:

- Powder River – OK Creek watershed (HUC # 1009020206) (1.8 percent);
- Powder River – Bull Creek watershed (HUC # 1009020206) (33.3 percent);
- Powder River – Turner Draw watershed (HUC # 1009020206) (7.6 percent);
- Lower Fortification Creek watershed (HUC # 1009020207) (17.7 percent);
- Upper Fortification Creek watershed (HUC # 1009020207) (11.7 percent);

- Wildhorse Creek – Cedar Draw watershed (HUC # 1009020208) (10.0 percent);
- Wildhorse Creek – Rough Creek watershed (HUC # 1009020208) (12.4 percent); and
- Wildhorse Creek – Hay Creek watershed (HUC # 1009020208) (5.4 percent) (Wyoming Geographic Information Science Center [WGISC] 2007).

Subbasin watersheds and subwatersheds along with surface water features are shown on Figure 3-3.

The plains region of the PRB is semiarid with average annual precipitation in the FCPA of approximately 10 to 14 inches per year. Stream channels in the FCPA vary from typically meandering with relatively flat slopes, to steep, highly incised slopes with prominent erosion features. These streams are ephemeral, flowing mainly in direct response to rainstorms and snowmelt. The perennial Powder River forms the western boundary of the FCPA. The FCPA contains no municipal water sources.

Standard #5 of the Wyoming Standards for Healthy Public Rangelands states that water quality should meet State standards. BLM management actions or use authorizations will comply with all Federal and State water quality laws, rules, and regulations to address water quality issues that originate on public lands. Provisions for the establishment of water quality standards are included in the Clean Water Act, as amended, and the Wyoming Environmental Quality Act, as amended. Regulations are found in Part 40 of the Code of Federal Regulations (CFR) and in Wyoming's Water Quality Rules and Regulations. The latter regulations contain Water Quality Standards for Wyoming Surface Waters.

Water quality indicators include chemical (pH, conductivity, and salinity), physical (sediment, temperature, and turbidity), and biological characteristics (aquatic invertebrates, fish populations, and aquatic vegetation).

Surface Water

The FCPA is dissected by numerous ephemeral draws and drainages, primarily flowing to the northwest. The principal drainages include Mickleberry Creek, Deer Creek, Bull Creek, and Fortification Creek. Wild Horse Creek borders the eastern edge of the FCPA and the Powder River borders the western edge. Surface water features are shown on Figure 3-3.

Numerous small reservoirs also occur throughout the area.

Groundwater

Groundwater resources that are at or near the land surface within the PRB are contained in unconsolidated Quaternary alluvial or basin fill deposits or in semi-consolidated to consolidated lower Tertiary sandstones and coal beds that are the uppermost aquifers in the Northern Great Plains aquifer system. Clinker, which is also an aquifer, has formed from some of the lower Tertiary sediments. Groundwater discharge from the FCPA is principally by groundwater outflow (loss to gaining streams, springs, and seeps), evapotranspiration, and well pumping (BLM 2003a).

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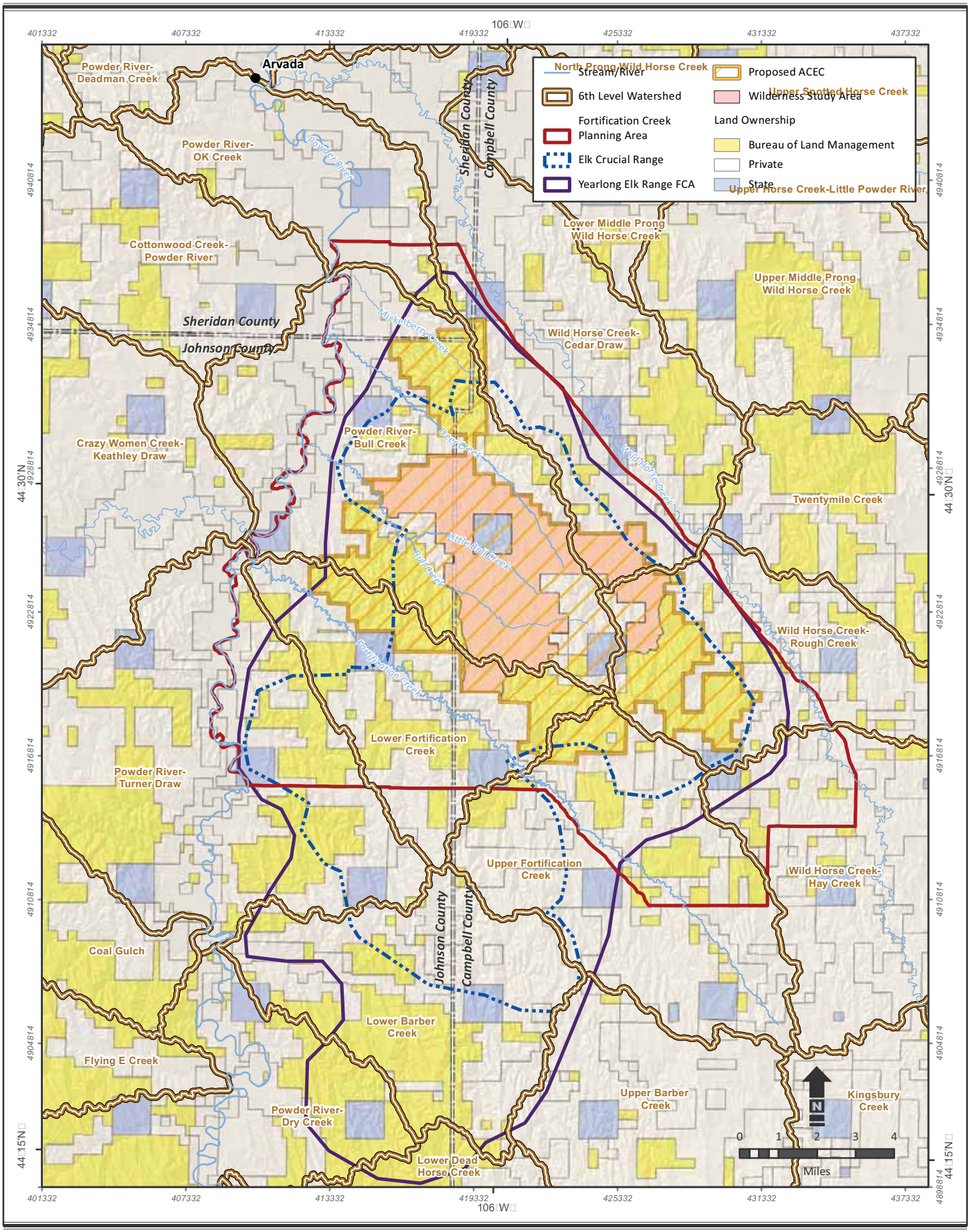

Source:
Mineral Estate/Boundaries - Bureau of land Management 2009
Topography - United States Geological Survey 2005
Hydrography - National Hydrography Dataset 2003

Figure 3-3

Watershed and Surface Water Features

Campbell, Johnson, and Sheridan Counties, Wyoming

A query of the Wyoming State Engineer's Office (WSEO) Ground Water Rights Database indicates 29 flowing wells are registered within the FCPA. The location of free-flowing wells are shown on Figure 3-4. Geologic variability makes it difficult to identify, without intensive site-specific work, which wells have hydraulic communication with the underlying coal and therefore would be impacted by CBNG development (BLM 2007a).

Seeps and Springs

Seeps and springs occur where groundwater or overland flow is discharged to the surface. The locations of springs are usually controlled by topography, faults, or contacts between rock layers or unconsolidated materials that represent a barrier to water movement. Numerous seeps and springs occur within the FCPA in association with topographic relief, discontinuous stratigraphy, and at the base of clinker deposits. The primary source of recharge to seeps and springs in the FCPA is assumed to be infiltration of precipitation and seepage from streams and rivers (BLM 2003a).

3.1.3.2. Current Conditions and Trends

CBNG developers use a variety of methods to dispose of the water extracted during CBNG operations. The primary method in the FCPA is to use direct surface discharge from outfalls. Outfalls may feed into small stock reservoirs, constructed infiltration impoundments, or other facilities before the outflows reach surface drainages. Discharges of CBNG produced water into surface drainages have a greater influence on surface flows than surface discharge into flowthrough stock reservoirs or infiltration impoundments. Water production modeling conducted as part of the 2003 PRB O&G FEIS (BLM 2003a) indicates that water production in the FCPA is "high" (greater than 79,000,000 barrels per year). Existing CBNG discharge outfall density per section ranges from less than one CBNG outfall location over most of the FCPA to five to 10 CBNG outfall locations along the FCPA boundaries (BLM 2003a). Currently, only one WDEQ-issued National Pollutant Discharge Elimination System (NPDES) permit (WYPDES) authorizes discharge of produced water to a channel in the FCPA (WDEQ 2008b).

BLM estimated water production within the FCPA to be greater than 79 million barrels per year (BLM 2003a). Based on this modeling and a complete FCPA buildout, it was estimated that approximately 70 percent (55.3 million barrels per year) of produced CBNG water would be directly discharged into existing ephemeral drainages, and 25 percent (19.75 million barrels per year) of produced CBNG water will be retained through development of water impoundments. The remaining 5 percent (3.95 million barrels per year) of produced CBNG water may be lost through evaporation or infiltration.

The modeling assumed full field development, 80-acre well spacing, and that the primary method of water disposal would be surface discharge. However, certain aspects of the FCPA and the current water management trends need to be recognized. Full field development is not anticipated because of the restraints the difficult terrain presents for CBNG development and the potential constraints placed on development by this PRMPA/EA. Water management strategies that are likely to be implemented within the FCPA are diverse including piping to water treatment facilities with subsequent discharge into the Powder River, direct discharge to ephemeral channels, discharge to impoundments, injection to water bearing formations within or outside the FCPA, and land application on non-Federal lands along the edges of the FCPA.

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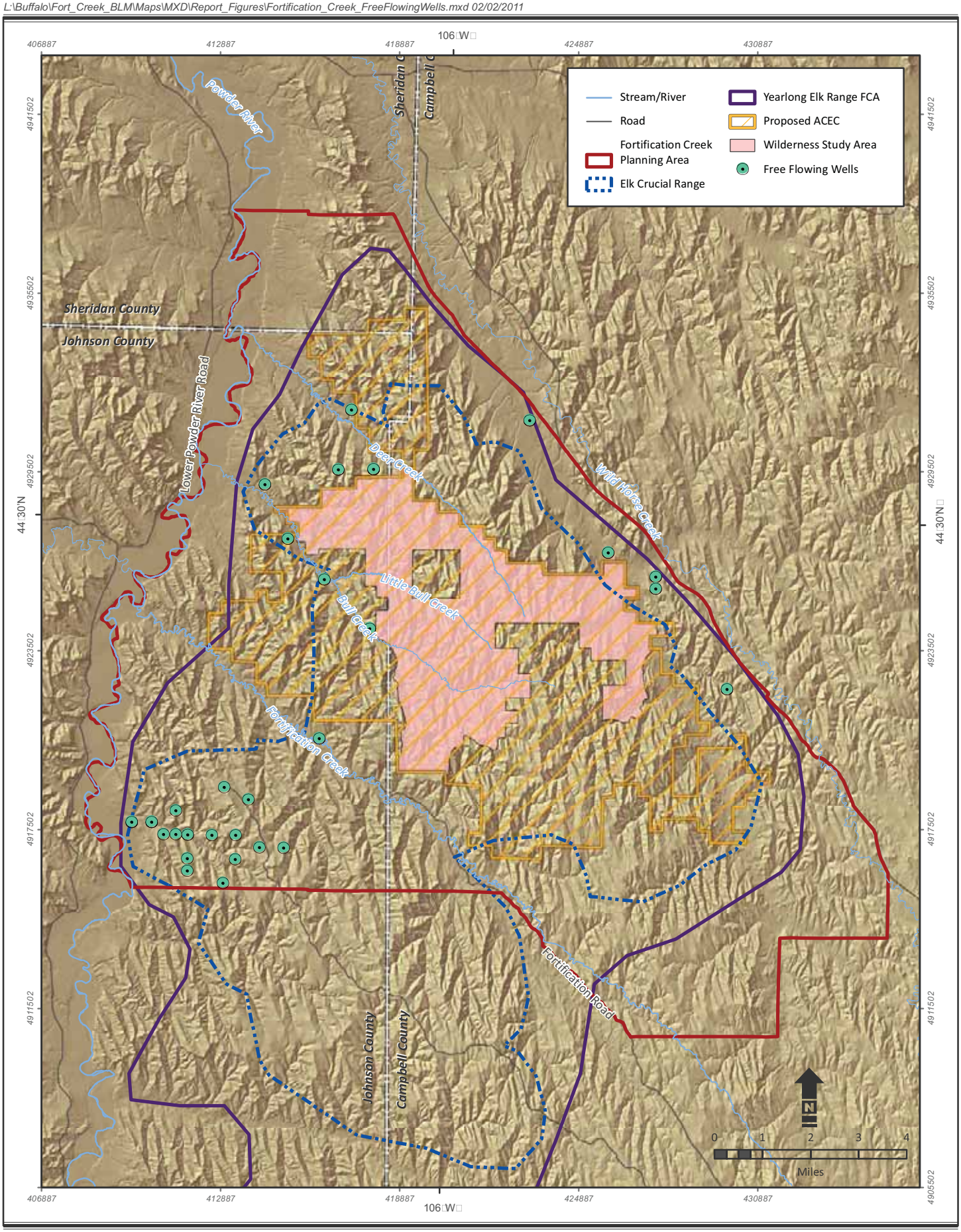

Source:
Mineral Estate/Boundaries - Bureau of land Management 2009
Topography - United States Geological Survey 2005
Hydrography - National Hydrography Dataset 2003

Figure 3-4

Free Flowing Wells

Campbell, Johnson, and Sheridan Counties, Wyoming

The average initial water production in the FCPA is 26.3 gallons per minute (gpm) per well. The average initial water production was calculated from the Office of Natural Resources Revenue (ONRR) Oil and Gas Operations Reports (OGOR) data (April 20, 2010) for wells within the FCPA producing two years or less. Actual water production rates will vary depending on the coal seams being produced and the individual operator's water production practice. A review of water management plans prepared for proposed CBNG projects within the FCPA indicate that typical maximum production is expected for two years or less and declining to 0 gpm within 10 years. This contrasts slightly from the PRB O&G FEIS (BLM 2003) which projected a seven year average operational life of a CBNG well. A review of various aged CBNG wells across the PRB in 2006 concluded that the average water production over a well's life span is 3.1 gpm.

Some of the streams in the FCPA have been impacted by CBNG water. Wild Horse Creek and Fortification Creek currently receive CBNG discharge water to the extent that these ephemeral creeks have become perennial. The spatial extent of this flow in the FCPA is uncertain; however, there is a potential for operators to discharge up to 18 cubic feet per second (cfs) into Fortification Creek. WDEQ has already permitted this flow level. To date, there is only one outfall directly discharging treated water in the Fortification Creek drainage, outfall 001 of permit WY0052809. In accordance with WDEQ's assimilative capacity policy, discharges greater than Powder River ambient total dissolved solids (TDS) and dissolved sodium concentrations require assimilative capacity credits. Flow from this outfall is limited by the operator's assimilative capacity allocation. During August and September of each calendar year, there are no allocations for TDS and operators are required to treat direct discharges to Powder River ambient concentrations or cease discharge (WDEQ 2008b). Water discharged directly to ephemeral streams could result in changes to stream morphology and fish and vegetation habitats. Yearlong water discharge could disrupt seasonal water cycles that, in turn, affect spawning and migratory clues of aquatic species (Davis et al. 2006). Channel morphology may also be affected by increased discharge, particularly on the descending limb of the hydrograph following high-flow events when deposition occurs (reducing complexity, filling pools, altering deposition features, etc.).

Discharge of CBNG produced water will require assimilative capacity credits from WDEQ dependent upon the effluent limits set within the discharge permit. Treated water will require operators to use their assimilative capacity allotments depending upon which constituent they are treating for, and to what degree they are treating for TDS and dissolved sodium. Unless the operator elects to treat the discharge to ambient Powder River concentrations for TDS and dissolved sodium, assimilative capacity allotment usage is still required (WDEQ 2008b).

Some potential resource impacts include physical degradation (erosion/deposition), vegetative change (dryland to wetland species and introduction of noxious weeds), altering of soil chemical and physical properties and alteration of terrestrial and aquatic wildlife ecosystems including macroinvertebrates.

Reservoirs and impoundments currently used within the FCPA to manage CBNG produced water typically are open systems that are unlined to facilitate infiltration or are designed with an inlet (outfall) and outlet (high-and low-level outlet pipes) to allow water to flow through the structure. The majority of reservoirs in the Fortification Creek drainage are not permitted to allow discharge except in the event precipitation runoff causes the reservoir to fill and overtop, or the operator pursues a planned reservoir release and uses their assimilative capacity allotments. The

remaining Fortification Creek reservoirs are only allowed to discharge if runoff from a 50-year, 24-hour storm or greater causes the reservoir to fill and overtop (WDEQ 2008b).

Alternative methods of disposing of produced water that are being used, tested, or considered by CBNG operators in and surrounding the FCPA include evaporation enhancement (misters), injection, percolation, irrigation (land application/subsurface drip), surface containment, and treatment (BLM 2003a).

Road building and vegetation clearing associated with CBNG development is increasing sedimentation into stream channels and draws in the FCPA. Current CBNG development in the area is also affecting groundwater quality and quantity. CBNG produced water that is exposed at the surface typically undergoes immediate changes in chemical composition that are the result of introducing oxygen to the water. Sulfate-rich surface waters can mix with the extracted groundwater. Where CBNG produced water that is rich in sodium bicarbonate and contains barium has been mixed with sulfate-type water, barium has precipitated as barium sulfate (BLM 2003a).

Pumping at existing CBNG wells that dewaters or depressurizes the coal aquifers to stimulate gas desorption from the coal has possibly moved waters with different chemistry from overlying units into the coal aquifer through leakage. However, no quantitative estimate of changes in groundwater chemistry is possible because of the limited availability of data from groundwater quality monitoring in CBNG development areas (BLM 2003a).

Some level of aquifer drawdown is expected in the FCPA from CBNG development. Recent data from the Wyoming State Geological Survey (WSGS) indicates drawdown at monitoring wells in the Fortification Creek watershed (WSGS 2009). Three sets of existing monitoring wells are located in the FCPA: Bull Creek, Echeta, and Prima Cedar Draw. The location of these wells is shown on Figure 3-5. Drawdown for these wells is summarized in Table 3-5. As this table shows, drawdown is higher in the coal formations in response to well head gas pressure (WSGS 2009). But in all cases, the overlying sandstones were affected as well. Because the water in the coal formation and overlying sandstone is likely under confined conditions, additional long-term pumping could result in substantial drawdown in the overlying sandstone. This is the case because the majority of recharge to the sandstone aquifer likely occurs on a seasonal basis and outflow from the aquifer due to pumping would be expected to be higher than inflow of water from recharge during most of the year.

Water is an important factor for elk distribution during summer and fall. Almost all summer observations during the Wyoming Game and Fish Department's (WGFD's) 1990 study (WGFD 1990) were near springs, seeps, draws, or along major drainages. Collared elk locations during the 2007 study exhibited a similar preference, particularly for draws and drainages. An important water source for the FCPA elk is water wells used for domestic livestock. Several are free-flowing wells, where the pressure is sufficient to bring water to the surface without pumping. The flowing wells provide year-round water sources benefiting both livestock and wildlife (BLM 2007b). Free flowing wells in the FCPA are shown on Figure 3-4.

A Water Management Plan (WMP) is required with CBNG applications for permits to drill (APDs) and PODs. The WMP must address the handling of produced water during the testing and production of CBNG wells. The plan must provide adequate information for BLM to complete site-specific NEPA analyses and ensure compliance with all State and Federal requirements prior to approval. Appendix D (updated May 31, 2004) of the amended BFO RMP

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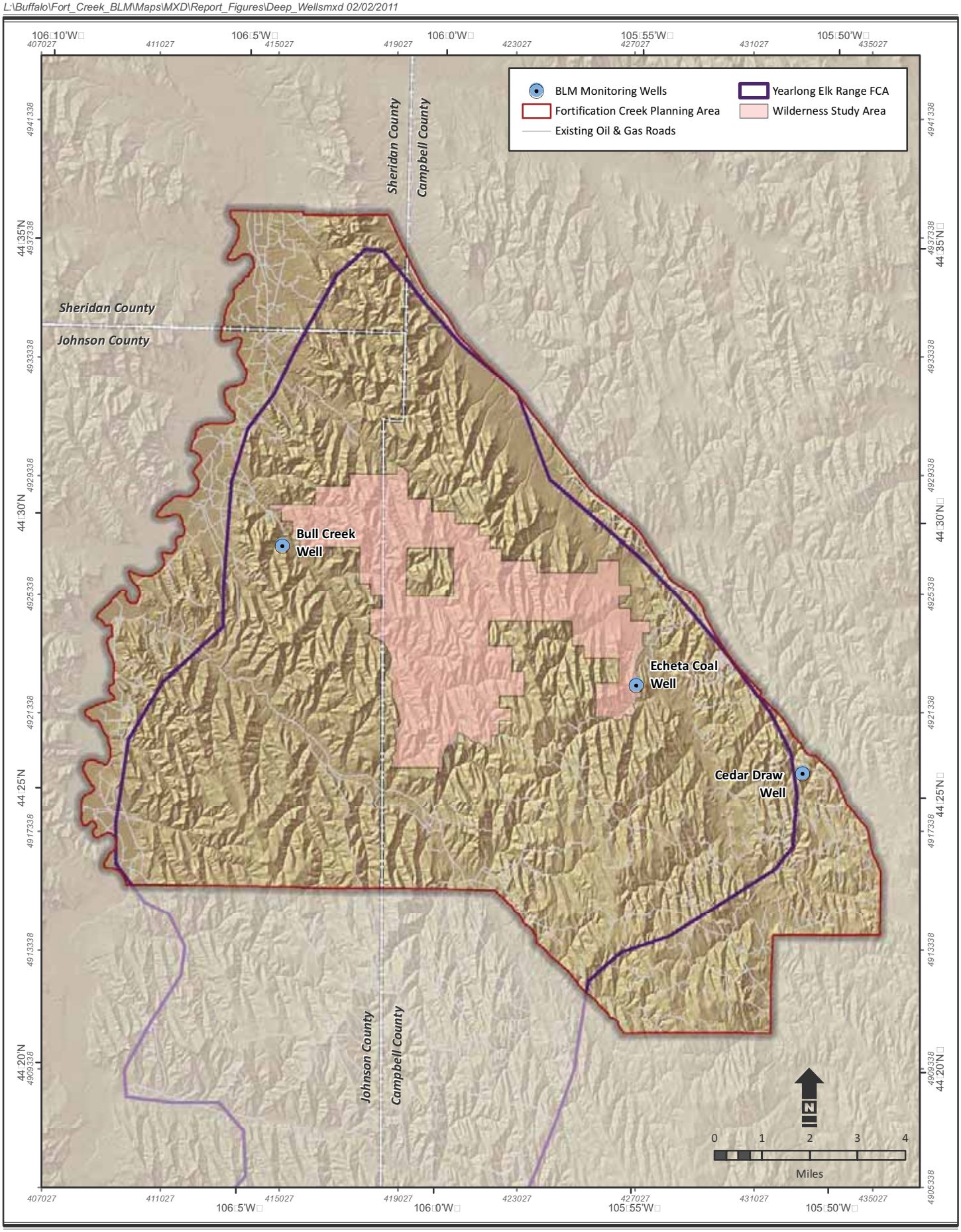

Source:
Mineral Estate/Boundaries - Bureau of land Management 2009
Topography - United States Geological Survey 2005

Figure 3-5

Monitoring Wells in the Fortification Creek Planning Area

Campbell, Johnson, and Sheridan Counties, Wyoming

Table 3-5 Drawdown in Fortification Creek Wells

Well Name	County	Formation	Top Depth (feet)	Bottom Depth (feet)	Drawdown (feet)	Years of Study
Bull Creek # 2	Johnson	Anderson Coal	1,338	1,430	17.1	2005-2006
Bull Creek # 3	Johnson	Wasatch Sandstone	1,202	1,238	Not reported	2005-2006
Bull Creek # 1	Johnson	Wasatch Sandstone	100 stratigraphic feet above the Anderson Coal	100 stratigraphic feet above the Anderson Coal	8.4	2005-2006
Echeta Coal Test Well	Campbell	Fort Union	861	867	78.9	1999-2006
Cedar Draw Coal Well	Campbell	Fort Union	1,577/1,572	1,674/1,675	196.6	2004-2006
Cedar Draw Sandstone Well	Campbell	Wasatch Sandstone	1,390	1,470	105.4	2004-2006

provides more details regarding the contents of WMPs (BLM 2001a). Actions that qualify under the Wyoming Storm Water Discharge Program require a Pollution Prevention Plan. Water rights, both surface and groundwater, are filed with the WSEO.

With increased CBNG development, the volume of produced water and number of discharge outfalls is increasing. Impoundments in the area have been found to be leaking water, which is affecting the hydrologic, soil, and vegetative conditions downgradient of these impoundments. Such leaks are encouraging the establishment of artificial wetland areas, which support riparian species and change soil characteristics to more hydric conditions.

Discharged CBNG water is generally very high in sodium bicarbonate. The sodium bicarbonate can clog the soil and retard infiltration from produced water impoundments. The elevated sodium level may cause soil structure to break down and the soil particles to disperse in specific areas, particularly in clayey soils. Discharged CBNG water can also pick up naturally occurring selenium from the soil. High selenium levels in surface waters have been identified as a concern for wildlife in the area (BLM 2003a).

There have been no new water rights issued within the last five years within the boundaries of the FCPA. However, unpermitted wells and diversions have been found within the area.

3.1.4. Vegetation Resources

3.1.4.1. Regional Setting and Regulatory Framework

Healthy vegetation is important for wildlife habitats, fire suppression, and reducing erosion. Vegetation in the FCPA is characterized as a mosaic of vegetation types that includes mixed grasslands, shrublands, riparian areas, and woodland areas. Vegetation types and their distribution in the FCPA are shown on Figure 3-6 and listed in Table 3-6. BLM uses the vegetation classifications in combination with soil classifications and the Natural Resources Conservation Service (NRCS) ecological site descriptions when evaluating PODs.

Table 3-6 Vegetation Classification in the FCPA

Vegetation Class	Total Area (acres)	Percentage of FCPA
Agricultural	99.7	0.1%
Juniper Woodland	1,737.2	1.7%
Herbaceous Rangeland	66,848.7	66.4%
Rock-Bare Soil	1,514.5	1.5%
Shrubland	30,451.5	30.3%
Total Vegetation Resources	100,651.6	100%

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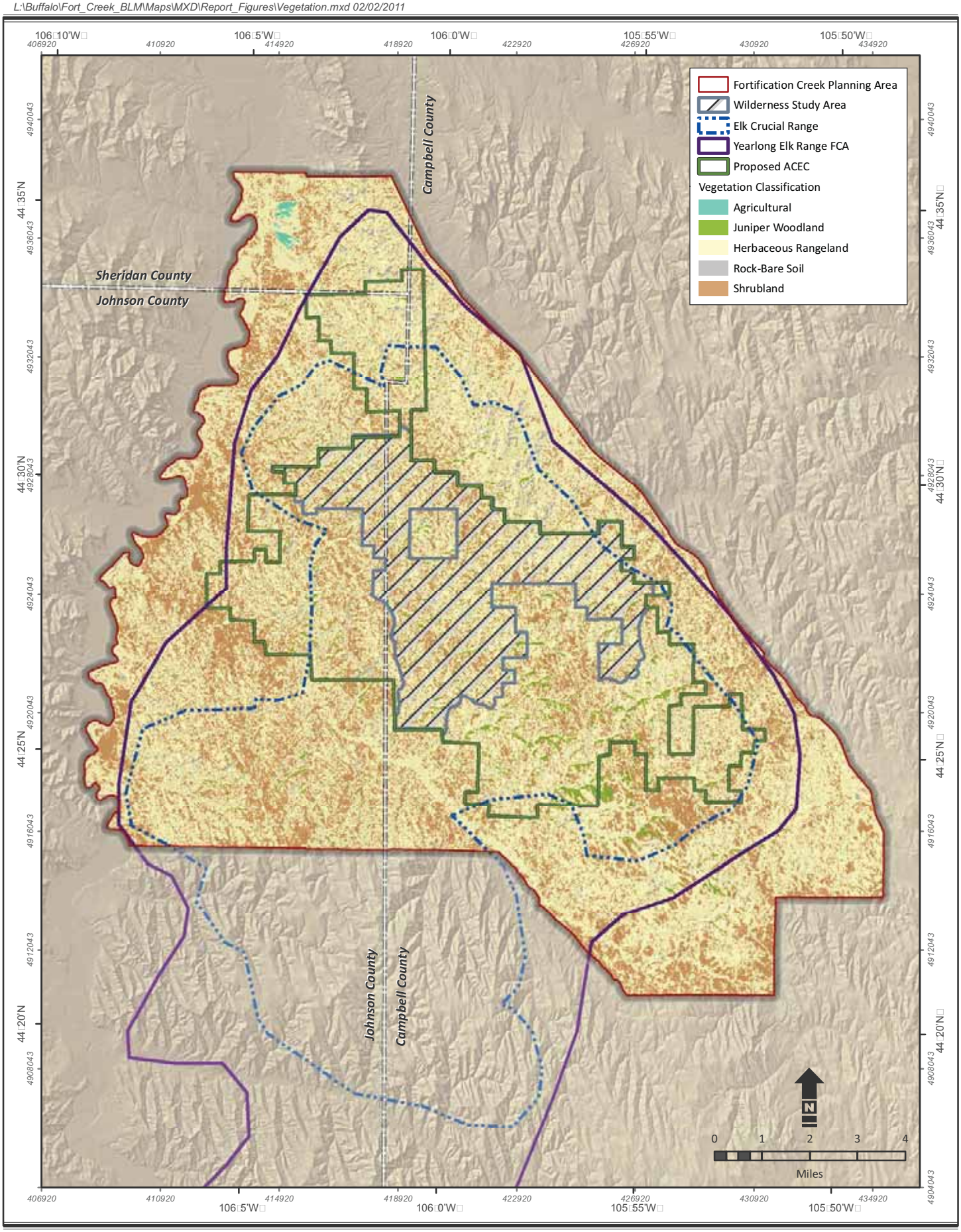

Source:
Boundaries/Lease Properties - Bureau of land Management 2009
Vegetation - NLCD 2001

Figure 3-6

Vegetation Classification

Fortification Creek Planning Area

WGFD land cover classifications mapping and resources were used to identify vegetation types within the FCPA. Nomenclature information was taken from the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service Plants online Database and Vascular Plants of Wyoming (Dorn 1992). Six land cover types were identified within the PRB: Agriculture Lands, Herbaceous Rangelands, Rock-Bare Soil, Sagebrush Shrubland, Woodland, and Water.

Indicators of vegetation habitat health are described in the Wyoming Standards for Healthy Public Rangelands (BLM 1995a). The goal for upland vegetation is a plant community appropriate to the site that is resilient, diverse, and able to recover from natural and human disturbance. Indicators include the following:

- Vegetative cover;
- Plant composition and diversity (species, age class, structure, successional stages, desired plant community);
- Bare ground and litter;
- Erosions (rills, gullies, pedestals, capping); and
- Water infiltration rates.

3.1.4.2. Current Conditions and Trends

The following sections briefly describe the vegetation types present in the FCPA. There are no threatened or endangered or special status plant species known to occur in the FCPA.

Herbaceous Rangeland

Herbaceous rangelands are a mixed grassland vegetative type including western wheatgrass (*Pascopyrum smithii*), thickspike wheatgrass (*Elymus lanceolatus*), needle-and-thread grass (*Hesperostipa comata*), blue grama (*Bouteloua gracilis*), junegrass (*Koeleria macrantha*), green needlegrass (*Nassella viridula*), bluebunch wheatgrass (*Pseudoroegneria spicata*), crested wheatgrass (*Agropyron cristatum*), little bluestem (*Schizachyrium scoparium*), Indian ricegrass (*Achnatherum hymenoides*), basin wildrye (*Leymus cinereus*), buckwheat (*Eriogonum* sp.), Japanese brome (*Bromus japonicus*), cheatgrass (*Bromus tectorum*), threadleaf sedge (*Carex filifolia*), prairie clover (*Dalea* sp.), soapweed yucca (*Yucca glauca*), hairy false goldenaster (*Heterotheca villosa*), common yarrow (*Achillea millefolium*), scarlet globemallow (*Sphaeralcea coccinea*), broom snakeweed (*Gutierrezia sarothrae*), prickly pear cactus (*Opuntia* sp.), yellow pincushion cactus (*Chaenactis* sp.), hedgehog cactus (*Echinocereus* sp.), prairie sagewort (*Artemesia frigida*), and Wyoming big sagebrush (*Artemisia tridentata var. wyomingensis*). Wyoming big sagebrush is a common shrub of this grass community in the PRB (Knight 1994). Cheatgrass is ubiquitous within both the mixed grass understory and the sagebrush shrubland. In some parts of the FCPA, in response to fire and other disturbances (grazing, livestock bedgrounds, and oil and gas operations), cheatgrass has become a monoculture.

Sagebrush Shrubland

Sagebrush shrubland includes a combination of sparse, moderately dense, and dense Wyoming sagebrush crown closure with a variety of understory grasses and forbs. The sagebrush shrubland is widely distributed and occupies a large part of the FCPA. Plant species seen in this community include Wyoming big sagebrush, snowberry (*Symphoricarpos albus*), skunkbush sumac (*Rhus*

trilobata), junegrass, prickly pear cactus, scarlet globemallow, and rabbitbrush (*Chrysothamnus* spp.).

Juniper Woodland

The juniper woodland vegetation type primarily includes Rocky Mountain juniper (*Juniperus scopulorum*) with widely scattered Ponderosa pine (*Pinus ponderosa*) and a sagebrush/grass understory. This vegetation type is encroaching into the sagebrush shrubland and herbaceous rangeland vegetation types.

Noxious Weeds

Noxious weeds present in the FCPA include diffuse knapweed (*Centaurea diffusa*), leafy spurge (*Euphorbia esula*), Russian knapweed (*Acroptilon repens*), Scotch thistle (*Onopordum acanthium*), spotted knapweed (*Centuria stoebe*), and tamarisk (saltcedar; *Tamarix* sp.). These species primarily occur along the Powder River. Canada thistle (*Cirsium arvense*), cheatgrass, Dalmatian toadflax (*Linaria dalmatica*), field bindweed (*Convolvulus arvensis*), and houndstongue (*Hieracium* sp.) are also present in the FCPA.

Rock-Bare Soil

Rock-bare soil includes rock outcrop, roads, sandbars, eroded gullies, or bare ground with less than 10 percent vegetation.

Water

Water includes a combination of livestock ponds and streams or open water in wetlands.

Trends

Increasing pressure on native vegetation habitats will continue with increasing CBNG and conventional oil and gas development. Native vegetation clearing for increasing CBNG development will encourage the establishment of opportunistic invasive species. Noxious weeds are increasing on all lands throughout the state, regardless of surface ownership. The potential for noxious weeds to continue spreading to new areas is great.

Noxious Weeds

Noxious weed management is mandated on Federal lands by the Federal Noxious Weed Act of 1974 (amended by Management of Undesirable Plants of Federal Lands, Section 15, 1990) and the Carson-Foley Act of 1968.

3.1.5. Fish and Wildlife Resources

Wildlife distribution, abundance, patterns of movement, and seasonal use are related to habitat type, quality, size, shape, and connectivity, as well as historic or existing land use. At a more local level, interrelationships such as competition and predation may also affect individual species.

Fish and wildlife species occur in a range of habitats throughout the area. While elk are the wildlife species of interest in the FCPA, other wildlife are present throughout the area including pronghorn antelope, mule deer, raptors, small mammals, game birds, waterfowl, amphibians, reptiles, and migratory birds. Additionally, aquatic species occur in rivers, streams, and livestock reservoirs.

3.1.5.1. Regional Setting and Regulatory Framework – Fish

With the exception of the Powder River, which forms the western boundary of the FCPA, most streams within the area are ephemeral and do not support resident fish populations. Because of CBNG water discharge to Wild Horse, this stream now runs year-round. During channel monitoring of Wild Horse Creek, native and exotic fish populations were observed by BLM personnel. The green sunfish, an exotic species, is present and other small soft-bodied fish were observed but not identified. Wild Horse Creek has not been monitored by the WGFD.

The Powder River is a rare example of a free-flowing prairie stream. No dams exist over its entire length. The river is a low-gradient meandering stream that contains highly fluctuating flows, high turbidity, and a very unstable sand bottom. The Powder River is naturally turbid and saline due to flowing through erodible sedimentary material (BLM 2003a). The entire Powder River and its tributaries support 32 known fish species, 25 of which are native (BLM 2003a). Table 3-7 lists the 19 fish species known to be resident or seasonally present in the Upper Powder River subwatershed, which contains the FCPA.

Table 3-7 Occurrence of Fish Species in the Upper Powder River Subwatershed

Common Name	Scientific Name	Origin
Black bullhead	*Ameirus melas*	Native
Channel catfish	*Ictalurus punctatus*	Native
Common carp	*Cyprinus carpio*	Introduced
Creek chub	*Semotilus atromaculatus*	Native
Flathead minnow	*Pimephales promelas*	Native
Flathead chub	*Platygobio gracilis*	Native
Goldeye	*Hiodon alosodies*	Native
Longnose dace	*Rhinichthys cataractae*	Native
Mountain sucker	*Catostomus platyrhynchus*	Native
Shorthead redhorse	*Maxostoma macrolepidotum*	Native
Plains killifish	*Fundulus zebrinus*	Introduced
Plains minnow	*Hybognathus placitus*	Native
River carpsucker	*Carpiodes carpio*	Native
Sand shiner	*Notropis stramineus*	Native
Shovelnose sturgeon	*Scaphirhynchus platorynchus*	Native
Stonecat	*Notorus flavus*	Native
Sturgeon chub	*Macrhybopsis gelida*	Native
Western Silvery minnow	*Hybognathus argyritis*	Native

Table 3-7 Occurrence of Fish Species in the Upper Powder River Subwatershed		
Common Name	**Scientific Name**	**Origin**
White sucker	*Catostomus commersoni*	Native

Source: BLM 2003a

3.1.5.2. Current Conditions and Trends

The status of fish populations in the FCPA is dependent on habitat and water quality conditions including changes in the timing and quantity of stream flows, sedimentation, concentrations of salts in streams, concentrations of metals (such as barium and selenium), changes in water temperatures and in species composition, accidental spills of fuels or drilling fluids, and transboundary effects on water quality.

WYPDES permits specify effluent limits that are designed to protect designated uses, such as agriculture, livestock watering, and aquatic health. Under the WDEQ permitting process, the quality of receiving water in the Powder River should not be degraded to levels below aquatic life standards in tributaries and mainstreams. However, the WYPDES does not have limits on water quantity. The BLM APD permitting process requires that WMPs be submitted before CBNG water can be discharged (BLM 2003a). Additionally, BLM analyzes both water quality and water quantity effects.

Most streams within the FCPA are ephemeral and do not support resident fish populations. Current CBNG development in the FCPA could affect fish populations in the Powder River if surface-discharged waters reach the river. Stream flows are currently being enhanced in the FCPA by CBNG discharged water and variably increased flows. Tributaries may collectively increase flow to the Powder River such that fish and aquatic species could be affected. CBNG wells in the FCPA that discharge produced water on the surface and wells that discharge water to infiltration impoundments may also have potential effects on fish and aquatic species in the Powder River.

Although the Powder River is a naturally turbid river, increased sedimentation into channels from road building may affect aquatic habitat conditions. Sediment from roads may carry seeds of invasive plant species such as saltcedar and Russian-olive and exacerbate an already serious problem. Sediment from roads may be especially damaging during low-flow periods when the river is relatively clear, and when larval fish inhabit shallow, low, or zero-velocity habitats. Increasing sediment to larval fish habitats can smother eggs directly or reduce primary food sources by covering epipelic benthos. Channel morphology may also be affected, particularly on the descending limb of the hydrograph following high-flow events when deposition occurs (reducing complexity, filling pools, altering deposition features, etc.).

The direct spilling of fuel or drilling fluids into drainages has the potential to be transported downstream to the Powder River and adversely affect native fish populations.

Under current development conditions in the area, streams within the FCPA are likely to continue to not support resident fish populations and other aquatic species. However, depending on the CBNG water management strategy used, it is likely that some reaches and pools of ephemeral streams could become perennial and potentially support fish and other aquatic

species. Wild Horse Creek has become perennial and supports native and non-native fish populations.

3.1.5.3. Regional Setting and Regulatory Framework – Wildlife

The FCPA contains three broad landscape categories: short- and mixed-grass prairie, sagebrush shrubland, and juniper woodlands. In addition to these habitats are relatively narrow but ecologically important riparian habitats along streams, ranging from minor ephemeral tributaries to Fortification and Wild Horse Creeks and canyon areas. Wildlife species that are likely to occur in these habitats of the FCPA are listed in Table 3-8 (BLM 2003a).

Table 3-8 Wildlife Species Likely to Occur in the Fortification Creek Planning Area

Common Name	Scientific Name	Habitat
Mammals		
Desert cottontail	*Sylvilagus audubonii*	Short- and mixed-grass prairie, Sagebrush shrub
Mountain cottontail	*Sylvilagus nuttallii*	Shrublands, Juniper woodlands
Black-tailed jackrabbit	*Lepus californicus*	Sagebrush shrub, Juniper woodlands
White-tailed jackrabbit	*Lepus townsendii*	Sagebrush shrub, Juniper woodlands
Ord's kangaroo rat	*Dipodomys ordii*	Short- and mixed-grass prairie, Sagebrush shrub
Western harvest mouse	*Reithrodontomys megalotis*	Short- and mixed-grass prairie
Deer mouse	*Peromyscus maniculatus*	Short- and mixed-grass prairie, Sagebrush shrub
Bushy-tailed woodrat	*Neotoma cinerea*	Juniper woodlands
Black-tailed prairie dog	*Cynomys ludovicianus*	Short- and mixed-grass prairie
Plains pocket gopher	*Geomys bursarius*	Short- and mixed-grass prairie
Northern pocket gopher	*Thomomys talpoides*	Sagebrush shrub
Prairie vole	*Microtus ochrogaster*	Short- and mixed-grass prairie, Sagebrush shrub
Sagebrush vole	*Lemmiscus curtatus*	Sagebrush shrub
Common porcupine	*Erethizon dorsatum*	Juniper woodlands
Coyote	*Canis latrans*	Short- and mixed-grass prairie
Red fox	*Vulpes vulpes*	Riparian
Raccoon	*Procyon lotor*	Riparian
American badger	*Taxidea taxus*	Short- and mixed-grass prairie
Mountain lion	*Felis concolor*	Juniper woodlands
Bobcat	*Lynx rufus*	Juniper woodlands

Table 3-8 Wildlife Species Likely to Occur in the Fortification Creek Planning Area		
Common Name	**Scientific Name**	**Habitat**
Rocky Mountain elk	*Cervus elaphus nelsoni*	Sagebrush shrub, Juniper woodlands
Mule deer	*Odocoileus hemionus*	Sagebrush shrub, Juniper woodlands
Pronghorn	*Antilocapra americana*	Short- and mixed-grass prairie, Sagebrush shrub
White-tailed deer	*Odocoileus virginianus*	Sagebrush shrub, Juniper woodlands
Birds		
Northern harrier	*Circus cyaneus*	Sagebrush shrub, Riparian
Cooper's hawk	*Accipter cooperii*	Riparian, Juniper woodlands
Golden eagle	*Aquila chrysaetos*	Sagebrush shrub, Juniper woodlands
Swainson's hawk	*Buteo swainsoni*	Short- and mixed-grass prairie, Sagebrush shrub
Ferruginous hawk	*Buteo regalis*	Short- and mixed-grass prairie
American kestrel	*Falco sparverius*	Short- and mixed-grass prairie, Sagebrush shrub, Riparian
Prairie falcon	*Falco mexicanus*	Short- and mixed-grass prairie
Sharp-tailed grouse	*Tympanuchus phasianellus*	Short- and mixed-grass prairie, Sagebrush shrub
Greater sage-grouse	*Centrocercus urophasianus*	Sagebrush shrub
Wild turkey	*Meleagris gallopavo*	Riparian, Sagebrush shrub
Mourning dove	*Zenaida macroura*	Juniper woodlands
Great horned owl	*Bubo virginianus*	Riparian, Canyons
Long-eared owl	*Asio otus*	Juniper woodlands, Riparian
Burrowing owl	*Athene cunicularia*	Short-grass prairie
Short-eared owl	*Asio flammeolus*	Riparian
Pinyon jay	*Gymnorhinus cyanocephalus*	Juniper woodlands
Horned lark	*Eremophila alpestris*	Short- and mixed-grass prairie, Sagebrush shrub
Mountain chickadee	*Poecile gambeli*	Juniper woodlands
Sage thrasher	*Oreoscoptes montanus*	Sagebrush shrub
Western tanager	*Piranga ludoviciana*	Juniper woodlands
Chipping sparrow	*Spizella passerina*	Juniper woodlands
Brewer's sparrow	*Spizella breweri*	Sagebrush shrub
Lark sparrow	*Chondestes grammacus*	Short- and mixed-grass prairie, Juniper woodlands

Table 3-8 Wildlife Species Likely to Occur in the Fortification Creek Planning Area		
Common Name	**Scientific Name**	**Habitat**
Sage sparrow	*Amphispiza belli*	Sagebrush shrub
Song sparrow	*Melospiza melodia*	Riparian
Vesper sparrow	*Pooecetes gramineus*	Short- and mixed-grass prairie, Sagebrush shrub
Western meadowlark	*Sturnella neglecta*	Short- and mixed-grass prairie, Sagebrush shrub
Yellow-headed blackbird	*Xanthocephalus xanthocephalus*	Riparian
Red-winged blackbird	*Agelaius phoeniceus*	Riparian
Amphibians and Reptiles		
Eastern short-horned lizard	*Phrynosoma douglasii brevirostre*	Sagebrush shrub
Bullsnake	*Pituophis catenifer*	Riparian
Prairie rattlesnake	*Crotalus viridis*	Sagebrush shrub, Canyons
Tiger salamander	*Ambystoma tigrinum*	Riparian
Northern leopard frog	*Rana pipiens*	Riparian
Woodhouse toad	*Bufo woodhousii*	Riparian

Source: BLM 2003a

Indicators of wildlife health are measured in the number of animals and habitat health including presence of appropriate habitat for breeding, cover, and forage. In shrub and grasslands key indicators of habitat health are availability of native plants and absence of weed species. In riparian areas both adequate water and native plants are important indicators. For big-game species, adequate forage capacity, presence of winter and parturition range, and security cover are critical. For raptors and birds, nesting areas are important components of species viability. For riparian species, including birds, reptiles, and fish adequate cover and water supply are necessary.

3.1.5.4. Current Conditions and Trends

Big-game species anticipated to occur in suitable habitats include pronghorn, mule deer, white-tailed deer, and elk. Pronghorn typically inhabit grasslands or semi-desert shrublands. Home ranges for pronghorn can vary between 400 and 5,600 acres according to season, habitat quality, population characteristics, and local livestock occurrence. Yearlong, winter yearlong, and winter pronghorn ranges are present in the FCPA. Pronghorn habitat is poor in the FCPA and most of the FCPA is outside the seasonal ranges. The overall population size for pronghorn is increasing. Mule deer habitat is present throughout the FCPA typified by winter and winter yearlong ranges. The number of mule deer in the herd, whose range is much larger than the FCPA, is currently stable at the WGFD objective. With the exception of areas along the Powder River and Wild Horse Creek, the FCPA provides poor white-tailed deer habitat.

Raptor presence in the FCPA is dependent on nesting availability and food sources, both of which are habitat characteristics. The raptors inhabit short- and mixed-grass prairie, sagebrush shrubland, or both, and feed on small rodents and mammals. Woodlands, rock outcrop, and riparian areas can also provide nesting habitat. Habitat fragmentation and human disturbance near nesting sites reduce the presence of raptors. Several raptors are likely present in the FCPA including the northern harrier, golden eagle, Swainson's hawk, ferruginous hawk, and prairie falcon. The Northern harrier, ferruginous hawk, and Swainson's hawk are considered summer residents, the golden eagle and prairie falcon are year-round residents, and the rough-legged hawk and bald eagle are winter migrants (BLM 2003a). The locations of active raptor nests in the FCPA are shown on Figure 3-7. There are few population estimates for raptors in the FCPA and when they occur their numbers tend to vary considerably. Consequently, it is difficult to determine whether populations are increasing or decreasing.

Upland game birds present in the FCPA include wild turkey (Merriam's) (*Meleagris gallopavo*), which is common, and the sharp-tailed grouse (*Tympanuchus phasianellus*). The greater sage-grouse (*Centrocercus urophasianus*) is also present in the FCPA and is discussed further in Section 3.1.6. The exotic gray (Hungarian) partridge *(Perdix perdix*) has been introduced and is present.

The occurrence and distribution of waterfowl are variable and influenced by aquatic and adjacent upland habitat, season, and land use practices. Rivers, streams, creeks, draws, and impoundments can provide suitable stopover habitat for the Canada goose (*Branta canadensis*), wood duck (*Aix sponsa*), mallard (*Anas platyrhynchos*), gadwall (*Anas strepera*), green-winged teal (*Anas crecca*), canvasback (*Aythya valisineria*), redhead (*Aythya americana*), great blue heron (*Ardea herodia*), killdeer (*Charaderius vociferous*), American avocet (*Recurvirostra americana*), black-necked stilt (*Himantopus mexicanus*), spotted sandpiper (*Actitis macularia*), and Wilson's phalarope (*Phalaropus tricolor*). Canada geese and other waterfowl also use CBNG impoundments as breeding habitat. CBNG produced water may be increasing available habitat for waterfowl by increasing the acreage of wetlands and ponds. However, streams and other water bodies could be affected by CBNG produced water. No estimates of population sizes for these waterfowl are available for the FCPA and it is difficult to determine whether populations are increasing or decreasing.

A wide variety of neotropical migrant birds use the FCPA during migration or breeding season. Few population data are available locally for these birds. Migratory birds are attracted by nesting availability and food sources, both of which are important habitat characteristics. All habitat types in the FCPA provide nesting and food opportunities for migratory birds. It is difficult to measure the effect on migrating bird populations from recent CBNG development; however, their available habitat continues to decrease.

One species of management concern that is potentially present in the FCPA is the McCown's longspur (*Calcarius mccownii*). This longspur nests in shallow natural or scraped depressions in short-grass prairie and shrublands. This species population is currently increasing in Wyoming. The long-billed curlew (*Numenius americanus*) is also potentially present. This species favors short-grass prairie near open water.

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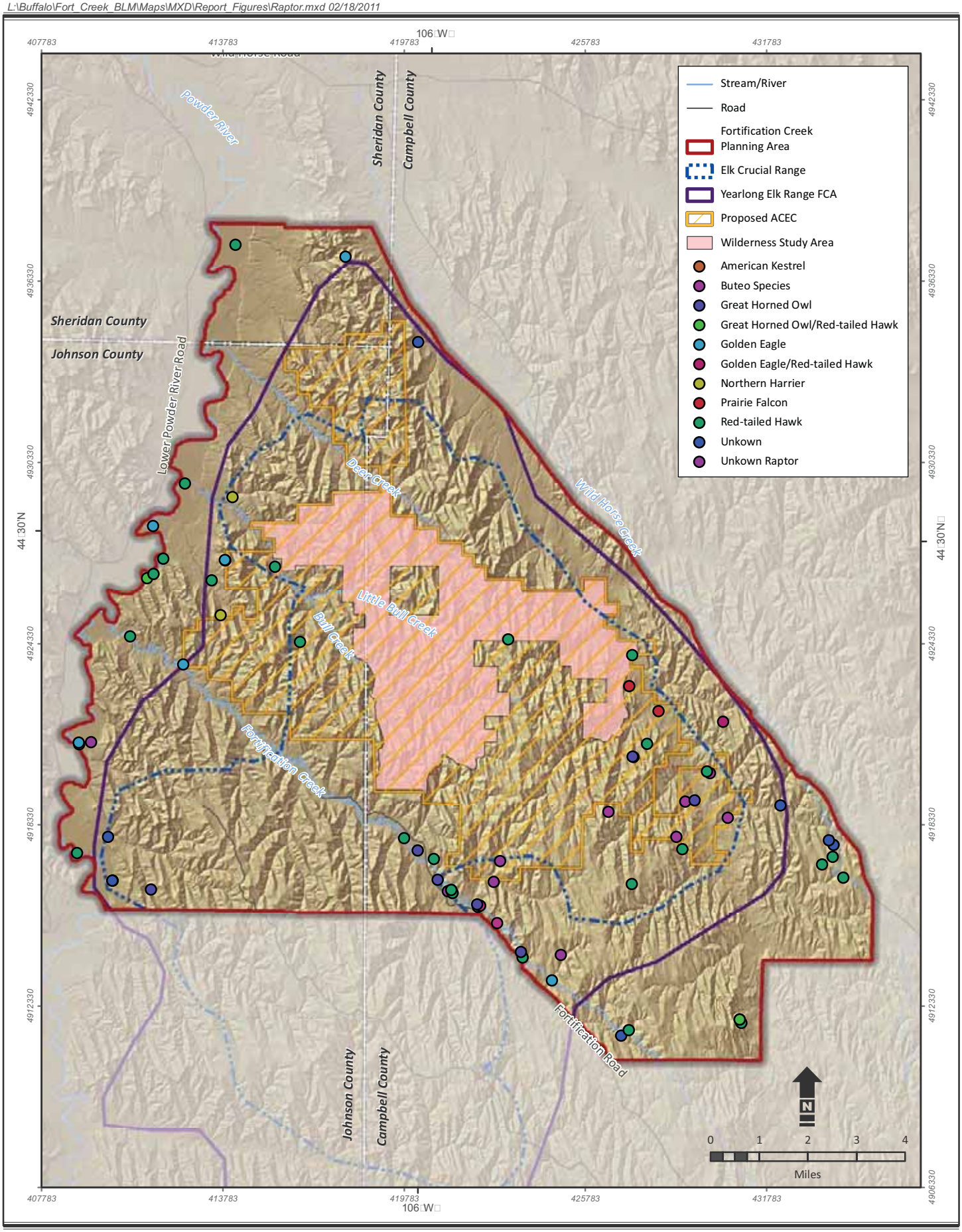

Source:
Topography - United States Geological Survey 2005
Hydrography - National Hydrography Dataset 2003

Figure 3-7

Raptor Nests

Campbell, Johnson, and Sheridan Counties, Wyoming

3.1.5.5. Regional Setting and Regulatory Framework – Elk

The FCPA lies within the center of the PRB and provides habitat for a geographically isolated elk herd. Although the elk are not a threatened or endangered or special status species, they are a species of interest because of their history, isolation, and hunting importance.

Elk historically occurred in the FCPA, but were extirpated prior to the 1950s. The current herd was established in 1952 and 1953 when WGFD and BLM introduced elk from Yellowstone National Park (WGFD 1990). Elk were transplanted into the area again in 1974 to increase herd size. In 1981, based upon landowner input related to crop damage, the WGFD set a population management objective for the herd of 150 head. The WGFD 2008 estimate of herd size was 219 elk (WGFD 2009). There has been discussion over the years of raising the herd unit objective, but landowner concern over higher population levels and the lack of public access for management have deterred the WGFD from raising the herd management objective (BLM 2007a).

Current elk habitat management in the BFO, as directed by the Buffalo RMP (BLM 2001a), includes a seasonal prohibition on surface disturbance or disruptive activities in elk winter range or where hiding cover is insufficient to meet the minimum needs of the elk (about 8,000 acres) (BLM 2001a). Disruptive activities are some type of activity, typically of human origin, which causes animals to shift their activity or alter their behavior such that reproductive success is negatively affected, or an individual's physiological ability to cope with environmental stress is compromised. Surface disturbance or disruptive activity is not allowed in elk crucial winter range (11,045 acres) between November 15 and April 30, or in elk parturition range (27,190 acres) between May 1 and June 30, when necessary. Elk ranges are shown on Figure 3-8.

As noted above, the WGFD has set a population management objective for the Fortification Creek elk herd of 150. Hunting is the primary management strategy for controlling herd size. Availability of crucial seasonal range for forage during winter and parturition in spring are factors affecting, and indicators of, long-term population sustainability. Availability of summer water is another significant component of elk habitat.

3.1.5.6. Current Conditions and Trends

Currently there are an estimated 219 elk in the Fortification Creek herd (WGFD 2009a). The productivity of a big-game herd is often used as an indicator of the overall health and welfare of a population. Relatively high herd productivity is closely associated with good nutritional resources resulting from a desirable forage/range condition, as well as variables such as slope, aspect, elevation, distance to road, distance to shrub cover, and habitat diversity (Sawyer et al. 2007). Twenty-nine flowing water wells (Figure 3-4) provide a valuable water source for the herd.

Pre-hunt productivity estimates indicate the Fortification Creek herd health is good to excellent (BLM 2007a). Blood samples taken from 36 adult cow elk in late March 2008 showed a greater than 90 percent pregnancy rate.

The herd is subjected to the increased impacts (wells, roads, weeds, and human presence) associated with the energy development that has occurred in the FCPA in the recent past. Road density has been positively correlated with reduced habitat effectiveness (Lyon 1983).

The current population of elk in the FCPA is stable to slightly decreasing (WGFD 2009a). The Fortification Creek elk harvest in 2008 consisted of 24 bulls, 26 cows, and 10 calves for a total of

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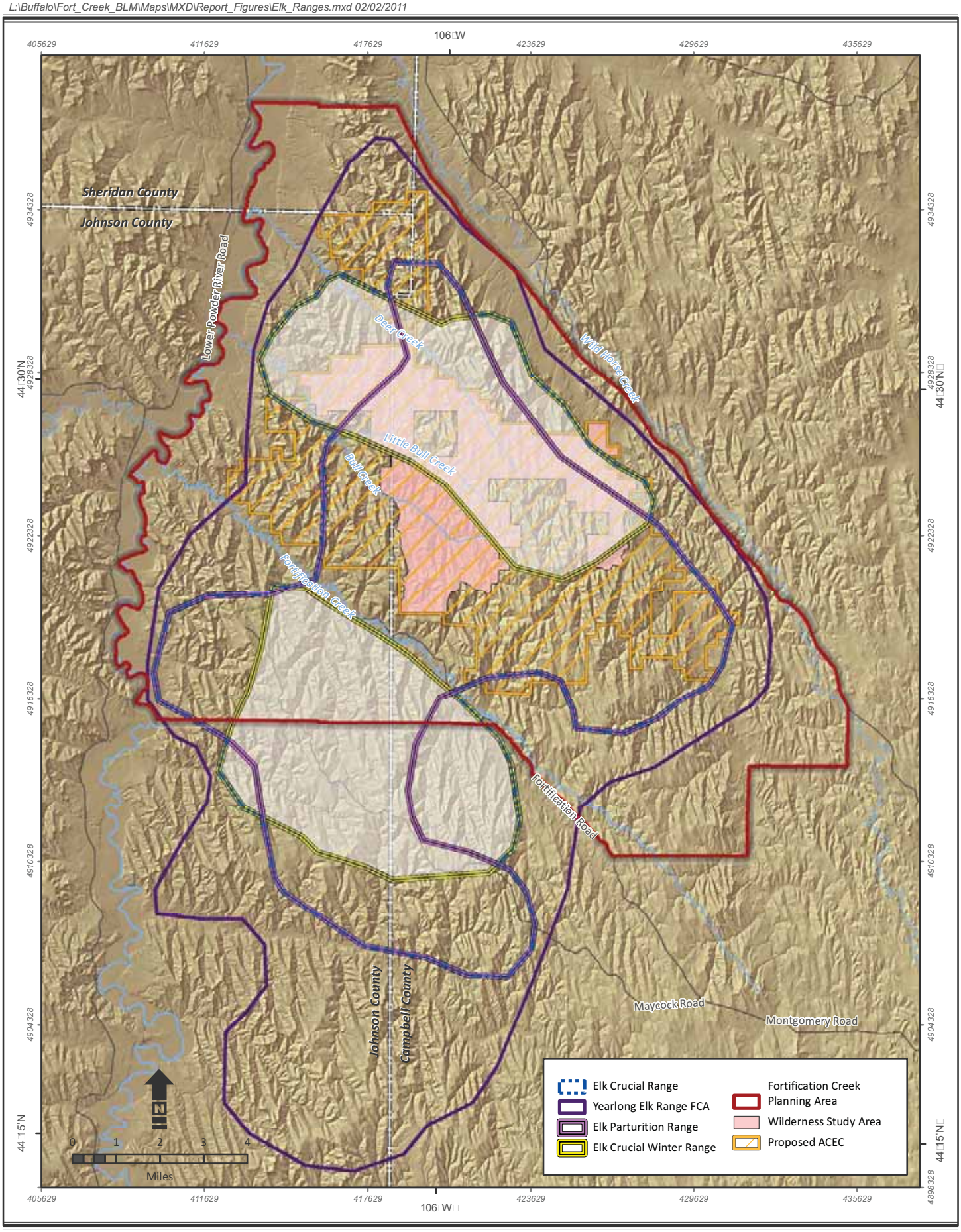

Source:
Mineral Estate/Boundaries - Bureau of land Management 2009
Topography - United States Geological Survey 2005
Hydrography - National Hydrography Dataset 2003

Figure 3-8

Seasonal Elk Ranges in the Fortification Creek Planning Area

Campbell, Johnson, and Sheridan Counties, Wyoming

60 animals harvested (WGFD 2009a). Longer-term trends are tied to forage and habitat availability. Radio-telemetry studies were conducted on the Fortification Creek elk herd in the early 1990s and in 2005 (BLM 2001a and 2007). Results of these studies indicate that the FCPA elk are actively selecting areas away from existing natural gas wells and roads. Radio-collared elk avoided available habitat that was within 1.7 miles of well sites and within 0.5 mile of roads.

Based on analyses of road density, topography, and vegetation in combination with radio monitoring, it appears that the FCPA elk are choosing to occupy the WSA and other remote areas to avoid mineral development. CBNG development in the southern yearlong range is likely to concentrate the elk herd within the WSA and undeveloped portions of the FCPA.

Availability of water from the existing free-flowing water wells could decrease because of CBNG drawdown. Because access to water is an important component of elk habitat, this decrease in well availability could lead to a downward trend in the elk population; however, additional water sources associated with CBNG water could increase water supply.

3.1.6. Special Status Species Resources

3.1.6.1. Regional Setting and Regulatory Framework

A number of species have been afforded special status by Federal and State agencies including the USFWS, BLM, and WGFD. The Federal Land Policy and Management Act (FLPMA) requires that BLM manage public lands in a manner that would protect the quality of scientific, ecological, and environmental values (including native plants and animals) and that would protect certain public lands in their natural condition. BLM Manual 6840 states that the BLM policy requires management consistent with the principles of multiple use for the conservation of candidate species and their habitats and to ensure that actions authorized, funded, or carried out do not contribute to the need to list any of these species as threatened or endangered. The BLM State Director may designate sensitive species, frequently in cooperation with WGFD. This designation includes species that could become endangered or extinct in the state (BLM 2003a).

Special status designations vary by agency and some species may be identified by multiple agencies. Special status designations include:

- Species listed as threatened or endangered, proposed for listing as threatened or endangered, or considered as a candidate for listing as threatened or endangered by the USFWS;
- Species listed as sensitive by BLM; and
- Species categorized by WGFD as Native Species Status (NSS)1, NSS2, or NSS3, which have the highest priority for conservation of the species on the State sensitive list (BLM 2003a).

“Endangered species” include those species that are in danger of extinction throughout all or a significant portion of its range. The USFWS may also designate critical habitat for species defined as endangered. The term “threatened species” means any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. The USFWS may also designate critical habitat for species listed as threatened. Candidate species are those for which the USFWS has sufficient information on biological vulnerability and threats to warrant issuance of a proposed rule for listing, but for which publication of a proposed rule for listing is precluded by other higher-priority listing actions (BLM 2003a).

In Wyoming, the WGFD uses a matrix of habitat and population variables to determine conservation priority. The three highest priority designations are:

- NSS1: Species with ongoing significant loss of habitat and with populations that are greatly restricted or declining (extirpation appears possible);
- NSS2: Species where (1) habitat is restricted or vulnerable and populations are greatly restricted or declining, or (2) there is ongoing significant loss of habitat and populations that are declining or restricted in numbers and distribution; and
- NSS3: Species whose (1) habitat is not restricted, but populations are greatly restricted or declining, (2) habitat is restricted or vulnerable and populations are declining or restricted in numbers or distribution, or (3) significant habitat loss is ongoing but the species is widely distributed and population trends are thought to be stable.

3.1.6.2. Current Conditions and Trends

The USFWS has identified the following species potentially in the FCPA as endangered, threatened, or proposed: Ute ladies'-tresses orchid (*Spiranthes diluvialis*), which is listed as threatened (USFWS 2007a). Since the PRB O&G FEIS (BLM 2003a) was published, the bald eagle was delisted. The mountain plover (*Charadrius montanus)* was proposed as threatened at the time of the PRB O&G FEIS (BLM 2003a); however, the listing proposal was withdrawn (USFWS 2007b). On June 29, 2010, USFWS provided public notice in the Federal Register for reinstating that portion of the December 5, 2002, proposed rule that concerned the listing of the mountain plover as threatened under the Endangered Species Act of 1973, as amended (Act) (USFWS 2010).The FCPA is outside the recovery area for the grizzly bear (*Ursus arctos*) and gray wolf (*Canis lupis)*. The blowout penstemon (*Penstemon haydenii*) has recently been added to the list of threatened and endangered species potentially occurring within the BFO; however, modeling indicates that suitable habitat is not present within the FCPA.

Wyoming BLM sensitive species that may be present in the FCPA include the following:

- Black-tailed prairie dog (*Cynomys ludovicianus*);
- Mountain plover;
- Yellow-billed cuckoo (*Coccyzus americanus*);
- Bald eagle;
- Northern goshawk (*Accipiter gentilis*);
- Peregrine falcon (*Falco peregrinus*);
- Greater sage-grouse;
- Burrowing owl (*Athene cunicularia*);
- Loggerhead shrike (*Lanius ludovicianus*);
- Sage thrasher;
- Brewer's sparrow (*Spizella breweri*);
- Baird's sparrow (*Ammodramus bairdii*);
- Sage sparrow (*Oreoscoptes montanus*);
- Long-billed curlew;
- Fringed myotis (*Myotis thysanodes*);

- Northern leopard frog (*Rana pipiens*); and
- Porter's sagebrush (*Artemisia porteri*).

The list of WGFD sensitive species, with NSS values 1 to 3, potentially present in the FCPA includes the following:

- Ferruginous hawk – NSS3;
- Merlin (*Falco columbarius*) – NSS3;
- Peregrine falcon – NSS3;
- Long-billed curlew – NSS3;
- Long-legged myotis (*Myotis volans*) – NSS2;
- Western small-footed myotis (*Myotis ciliolabrum*) – NSS3;
- Little brown myotis (*Myotis lucifugus*) – NSS3;
- Snowy egret (*Egretta thula*) – NSS3;
- Sturgeon chub (*Macrhybopsis gelida*) – NSS1;
- Western silvery minnow (*Hybognathus argyritis*) – NSS1;
- Goldeye (*Hiodon alosodies*) – NSS2;
- Shovelnose sturgeon (*Scaphirhynchus platorynchus*) – NSS2;
- Flathead chub (*Platygobio gracilis*) – NSS3; and
- Plains minnow (*Hybognathus placitus*) – NSS3.

The special status species potentially present in the FCPA are based on appropriate habitat types. Specific surveys for many of these species have not been conducted in the FCPA and their presence is unknown.

Greater sage-grouse lek locations are shown on Figure 3-9 and indicate that there is one lek within the FCPA, one more within the elk yearlong range south of the FCPA, and five within 4 miles of the FCPA. Greater sage-grouse leks surround the entire FCPA. The FCPA is not within a State of Wyoming designated sage-grouse core area. In March 2010, USFWS determined listing the greater sage-grouse as threatened under the ESA was warranted but precluded due to species with more immediate threats of extinction; thus, it has been added to the USFWS list of candidate species for future evaluation.

In December 2009, BLM-Wyoming released Instruction Memorandum (IM) No. WY-2010-012, titled, "Greater Sage-grouse Habitat Management Policy on Wyoming Bureau of Land Management Administered Public Lands Including the Federal Mineral Estate" (BLM 2009a) This document was intended to provide direction to BLM-Wyoming Field Offices on sage-grouse habitat management for future actions and resource management planning. The policy provides consistent management practices for conserving sage-grouse and their habitats.

This guidance states that it is BLM-Wyoming's policy is to manage sage-grouse seasonal habitats and maintain habitat connectivity in support of population objectives set by the WGFD. The guidance is structured to use an adaptive management approach to habitat conservation, restoration, and enhancement. BLM-Wyoming's goal is to work toward sage-grouse habitat

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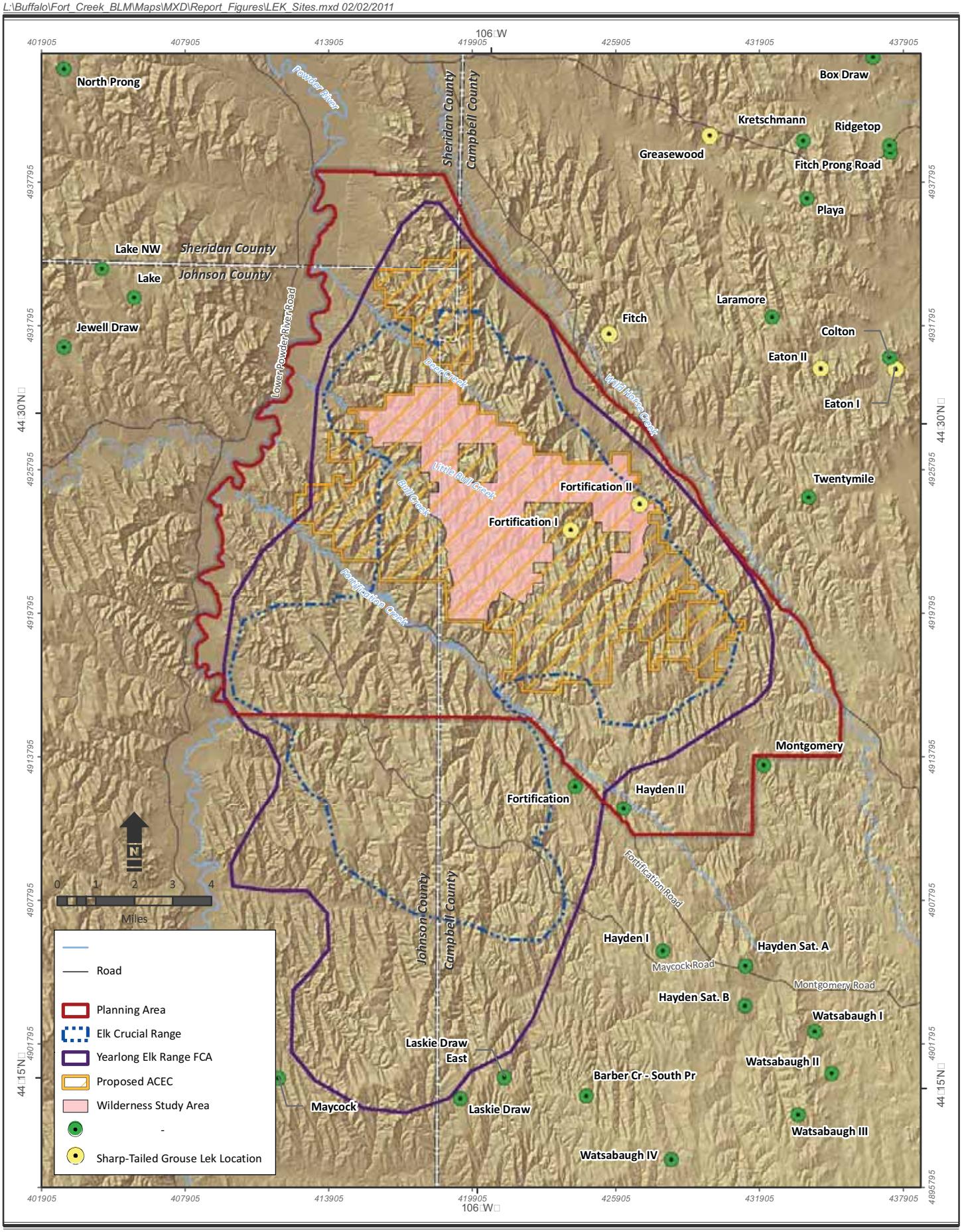

Source:
Geology - United States Geological Survey 1994
Topography - United States Geological Survey 2005
Hydrography - National Hydrography Dataset 2003

Figure 3-9

Location of Grouse Leks in the Fortification Creek Area

Campbell, Johnson, and Sheridan Counties, Wyoming

conservation in concert with the WGFD, local sage-grouse working groups, and other partners and stakeholders (BLM 2009a).

Trends for special status species in the FCPA cannot be determined at this time because there are few site-specific surveys. CBNG companies survey for some special status species (raptor nests, bald eagle nests and winter roosts, sage-grouse leks, sharp-tailed grouse leks, and prairie dog colonies) and are supposed to report any special status species observed. General trends including habitat fragmentation, human-caused disturbance, and habitat destruction will result in a decrease in the population numbers, and likely in the number of species.

3.1.7. Cultural Resources

Cultural resources for the PRB were described in detail in the PRB O&G FEIS (BLM 2003a) and in the Class I Cultural Resource Survey of the Fortification Creek Planning Area, Campbell, Johnson, and Sheridan Counties, Wyoming (Cultural Resource Analysts, Inc. 2008). At that time, 8,120 cultural resource sites and 2,831 isolated finds had been identified in the PRB, generally scattered throughout the basin. Prehistoric sites contained scattered artifacts, camps, habitation features, rock features, bones, rock art, and lithic sources along with human bones, features, and multicomponent sites. Historic sites included rural, urban, transportation, military, and exploration sites as well as a number of sites of unknown classification.

3.1.7.1. Regional Setting

Archaeological sites are divided into prehistoric and historic resources. Prehistoric sites in the PRB are older than 200 years while historic sites are between 200 and 50 years old. The prehistoric period relates to occupation of the area exclusively by Native Americans, while the historic period reflects the advance of Euro-Americans into the PRB.

The prehistoric period can be divided into three broad temporal periods based on artifact types and subsistence strategies (Frison 1991):

- Paleoindian (11,500 to 8,000 years ago);
- Archaic (8,000 to 1,500 years ago);
  - Early Plains Archaic (8,000 to 5,000 years ago),
  - Middle Plains Archaic (5,000 to 2,500 years ago),
  - Late Plains Archaic (2,500 to 1,500 years ago); and
- Late Prehistoric and Protohistoric (1,500 to 200 years ago).

As is common throughout the Northwest Plains, archaeological evidence from the earliest periods of prehistory is rarely documented in the PRB. Paleoindian, Early Plains Archaic, and Middle Plains Archaic Period sites represent 21 percent of dated sites located within the region (BLM 2003a). Late Plains Archaic sites represent approximately 25 percent of all dated sites found within the PRB. Late Prehistoric Period sites are relatively common, representing nearly half (45.1 percent) of all dated sites in the PRB. Evidence of Protohistoric sites in the PRB is exceedingly rare.

Paleoindian sites, such as the Sisters Hill site and the Carter-Kerr McGee site, do occur in the PRB (Frison 1991). Paleoindian sites are typically marked by the presence of large lancolate

projectile points and subsistence focused on now extinct megafauna. No Paleoindian sites are documented in the FCPA, although further research may prove otherwise.

The Archaic period is divided into the Early, Middle, and Late Plains Archaic Periods. The Archaic Period represents a shift from the big game hunting subsistence during the Paleoindian period to a broad-based hunting and gathering pattern, likely because of major climactic events. Ground stone implements are more common and projectile point styles diversify into a variety of side-notched, stemmed, and corner-notched types. Significant Archaic sites such as the Mavrakis-Bentzen-Roberts Site and the Powder River site are very close to the FCPA. The Mooney site is a significant Late Plains Archaic site located within the FCPA.

The Late Prehistoric is distinguished from the Archaic by the introduction of the bow and arrow, the use of ceramic technology, intensification of plant resource exploitation, and an increase in human population. The majority of prehistoric sites located in the PRB are Late Prehistoric. Significant Late Prehistoric sites such as the Big Goose and Piney Creek sites are within the PRB. No Late Prehistoric sites are documented in the FCPA, although further research may prove otherwise.

The Protohistoric Period is probably the least understood time frame in the region. The term *protohistoric* refers to the transitional period between the prehistoric and historic periods. The period begins with the introduction of the horse (Ewers 1980) and European trade goods into the region and ends with the development of the fur-trading era 150 years ago. Protohistoric sites are characterized by trade goods including glass trade beads and metal projectile points. No Protohistoric sites are documented in the FCPA, although further research may prove otherwise.

The Historic Period in Wyoming is divided into seven thematic periods including the Protohistoric – AD 1720 to 1800, Early Historic – AD 1800 to 1842, Pre-Territorial – AD 1842 to 1868, Territorial – AD 1868 to 1890, Expansion – AD 1890 to 1920, Depression – AD 1920 to 1939, and Modern – AD 1939 to Present. The historic themes are associated with broad nationwide events, which are reflected in the archaeological record. Sites associated with the Expansion, Depression, and Modern thematic periods are known to exist in the FCPA, although further research may reveal sites related to other historic periods.

3.1.7.2. Regulatory Framework

Section 106 of the National Historic Preservation Act (NHPA) requires Federal agencies to take into account the effects that Federal undertakings may have on historic properties. The implementing regulations of Section 106, found at 36 CFR 800, outline the process Federal agencies must follow in order to comply with the law. BLM signed a National Programmatic Agreement in 1997 with the National Council of State Historic Preservation Officers (NCSHPO) and the Advisory Council, which streamlined the consultation process between those agencies. As allowed by the National Programmatic Agreement, the Wyoming BLM and the Wyoming State Historic Preservation Office (SHPO) entered into a Protocol Agreement, which further streamlined the consultation process in 2006.

In complying with the requirements of Section 106 of the NHPA, the agency essentially complies with its NEPA requirements relating to cultural resources. According to the Wyoming Protocol Agreement, prior to approving any Federal undertaking, BFO is required to make determinations of eligibility and effect on historic properties in consultation with the Wyoming SHPO and other consulting parties (such as Native American tribes, landowners, applicants,

etc.). Inventories of the area of proposed effect are required in order to locate historic properties. The policy of BLM is to avoid historic properties as a first choice (BLM Manual 8140.C; BLM 2004a). If avoidance is not feasible, mitigation may become necessary. Mitigation most often consists of data recovery through excavation, but may also occur as project redesign, extensive historic research and documentation, or other methods. If a historic property is inadvertently discovered and impacted during the construction phase, mitigation is typically required. Sites that are not eligible for listing on the National Register of Historic Places (NRHP) do not need to be avoided or mitigated and may be destroyed by a project.

The PRB O&G FEIS (BLM 2003a) states that 8,120 cultural resource sites had been identified in the PRB by 2003. According to the Wyoming Cultural Records Office (WYCRO), as of April 2008, there were 12,510 documented cultural sites in the PRB (Young 2008). This reflects the discovery of 4,390 sites in less than 4.5 years as a result of increased CBNG development.

To date, 277 pedestrian inventories comprising over 21,900 acres located 183 cultural sites in the FCPA. The inventories primarily relate to compliance with Section 106 of the NHPA connected to oil and gas development, pipelines, power lines, telephone lines, range improvements, and seismic projects. The majority of the inventoried areas are in the eastern and southwestern portions of the FCPA. Prehistoric sites in the FCPA include lithic scatters, camps, and habitation sites. Historic sites include artifact scatters, homesteads and ranching operations, a historic town site, roads, and railroads. The majority of the identified sites are along the eastern and southwestern portions of the FCPA. This most likely correlates to the higher density of inventories in those areas and does not reflect higher site density. Only 12 sites are documented in the WSA and proposed Area of Critical Environmental Concern (ACEC), most likely reflecting a lack of inventory for those areas. Summaries of cultural resource sites in the FCPA are listed in Tables 3-9 and 3-10.

Table 3-9 Prehistoric Site Types within the FCPA

Site Type	Number of Sites	Number of Eligible Sites
Artifact scatter	58	9 (16%)
Camp	36	26 (72%)
Multicomponent	0	0
Habitation features	12	6 (50%)
Rock features	4	3 (75%)
Animal processing sites	1	1 (100%)
Rock art	1	1 (100%)
Lithic source	0	0
Feature only	1	0
Human remains	0	0
Cultural landscape	0	0

Table 3-10 Historic Site Types within the FCPA		
Site Type	**Number of Sites**	**Number of Eligible Sites**
Artifact scatter	13	1 (8%)
Historic camp	7	0
Habitation/ranching/agriculture	41	11 (27%)
Townsite	1	0
Mining/industrial	2	1 (50%)
Road/transportation	10	3 (30%)
Other	2	0

Most prehistoric and historic sites throughout the PRB are located on the surface and have no buried component. Because of the limited amount of archaeological data available from a surface scatter of artifacts, these sites are typically determined to be not eligible for the NRHP. Sites with buried components can contain intact living surfaces, features, bone, and charcoal which preserve important archaeological information. Sites with intact buried deposits, especially stratified deposits, are typically determined to be eligible.

Historic sites are evaluated relating to their association with historic events or people. Historic structures can also be evaluated based on their design or construction. For example, a trash scatter associated with stock herding or a typical homestead that does not have any connection with specific important events or people would normally be evaluated as not eligible for the NRHP. As another example, a homestead that was built by a very skilled craftsman and is associated with an important event in history would typically be evaluated as eligible.

Sites are also evaluated relating to their importance to the identity of a specific group. In the PRB, these types of evaluations are typically conducted for sites that are important to Native Americans. Determinations of eligibility for these types of sites are always conducted in consultation with representatives of the associated groups. For example, the Pumpkin Buttes was recently evaluated as a traditional cultural property (TCP) in consultation with representatives from 15 tribes; however, it is important to note that a TCP is different than a sacred site. Sacred sites are typically individual sites such as cairns, stone circles, or rock art rather than geographic features. Sacred sites are not necessarily eligible for the NRHP, but are afforded protection through legislation such as the American Indian Religious Freedom Act (AIRFA) and Executive Order 13007.

Summary

On average, one archaeological site is present for every 120 acres within the study area and one eligible or unevaluated site is present for every 338 acres. This matches the assumption made in the 1982 Oil and Gas Plan for the FCPA which predicted, "…about five archaeological sites per square mile." or approximately one site per 128 acres (BLM 1982). Inventories throughout the entire PRB show there is approximately one site per every 137 acres, with roughly one eligible or unevaluated site for every 436 acres. Considering this data, there is approximately the same density of archaeological sites in the FCPA that there is in the rest of the PRB. Additionally, there are no known sensitive archaeological sites within the FCPA that require special

management such as a TCP, historic district, or a significant site that retains its integrity of setting.

3.1.8. Geologic Resources

3.1.8.1. Regional Setting and Regulatory Framework

The FCPA is within the PRB, a northwest-southeast trending structural basin. Geologic formations of interest within the PRB are the Oligocene White River Formation, the Eocene Wasatch Formation, and the Paleocene Fort Union Formation. Figure 3-10 presents a geologic map of the FCPA (USGS 1994). The White River Formation, composed of tuffaceous claystone and siltstone with conglomerate lenses near its base, outcrops as isolated erosional remnants. The Wasatch Formation is the predominant formation and consists primarily of mudstone and sandstone with smaller amounts of conglomerate, carbonaceous shale, and coal. The Fort Union Formation consists of sandstone, conglomerate, siltstone, and coal beds. Both the Wasatch and Fort Union Formations contain the economically viable coal beds of the PRB. Unconsolidated and poorly consolidated Quaternary alluvial deposits are present along rivers and major drainages occurring as floodplains, stream terraces, and alluvial fans (BLM 2003a).

The Wasatch Formation outcrops in the FCPA, while Quaternary alluvium occupies the bottoms of streambeds and draws. Both the Wasatch Formation and underlying Fort Union Formation are coal-bearing units that contain CBNG. Landslides due to steep slopes and surface exposure of shale, clay, brittle sandstone, or sandy materials on slopes underlain by clayey layers are present throughout the FCPA. Both natural (precipitation, erosion, weathering, storms, rain-on snow events, wildfires, and earthquakes) and manmade (removal of vegetation on slopes, construction on slopes, destabilizing slopes, prescribed burns, and vibration from traffic or blasting) factors can contribute to landslide susceptibility.

No specific laws apply to management or use of geologic resources in the FCPA, except as they pertain to mineral extraction (Section 3.2.5) and protection of paleontological resources (Section 3.1.9).

3.1.8.2. Current Conditions and Trends

There is no information on landslides in the FCPA. While Wyoming is considered to have a high potential for earthquakes, relatively few earthquakes with a magnitude greater than 2.5 have been reported near the FCPA (WSGS 2007). The number of new conventional oil and gas wells is decreasing in the FCPA, although the number of CBNG wells is increasing.

3.1.9. Paleontological Resources

3.1.9.1. Regional Setting and Regulatory Framework

The primary geologic formations in the PRB are the Eocene Wasatch Formation and the Paleocene Fort Union Formation. Vertebrate fossils have been found in both of these formations, primarily in the southern portions of the PRB. Wasatch Formation fossil localities include 106 localities recorded at the University of Colorado Museum, four localities recorded at the University of Wyoming Museum of Geology, and 46 localities noted or collected by Delson (1971) for the American Museum of Natural History (BLM 2003a).

Except for a very small portion of the Fort Union Formation in the north, the FCPA is underlain by the Wasatch Formation. The Wasatch Formation was described as a Class 5 formation in the PRB O&G FEIS (BLM 2003a) using the USFS Potential Fossil Yield Classification (PFYC).

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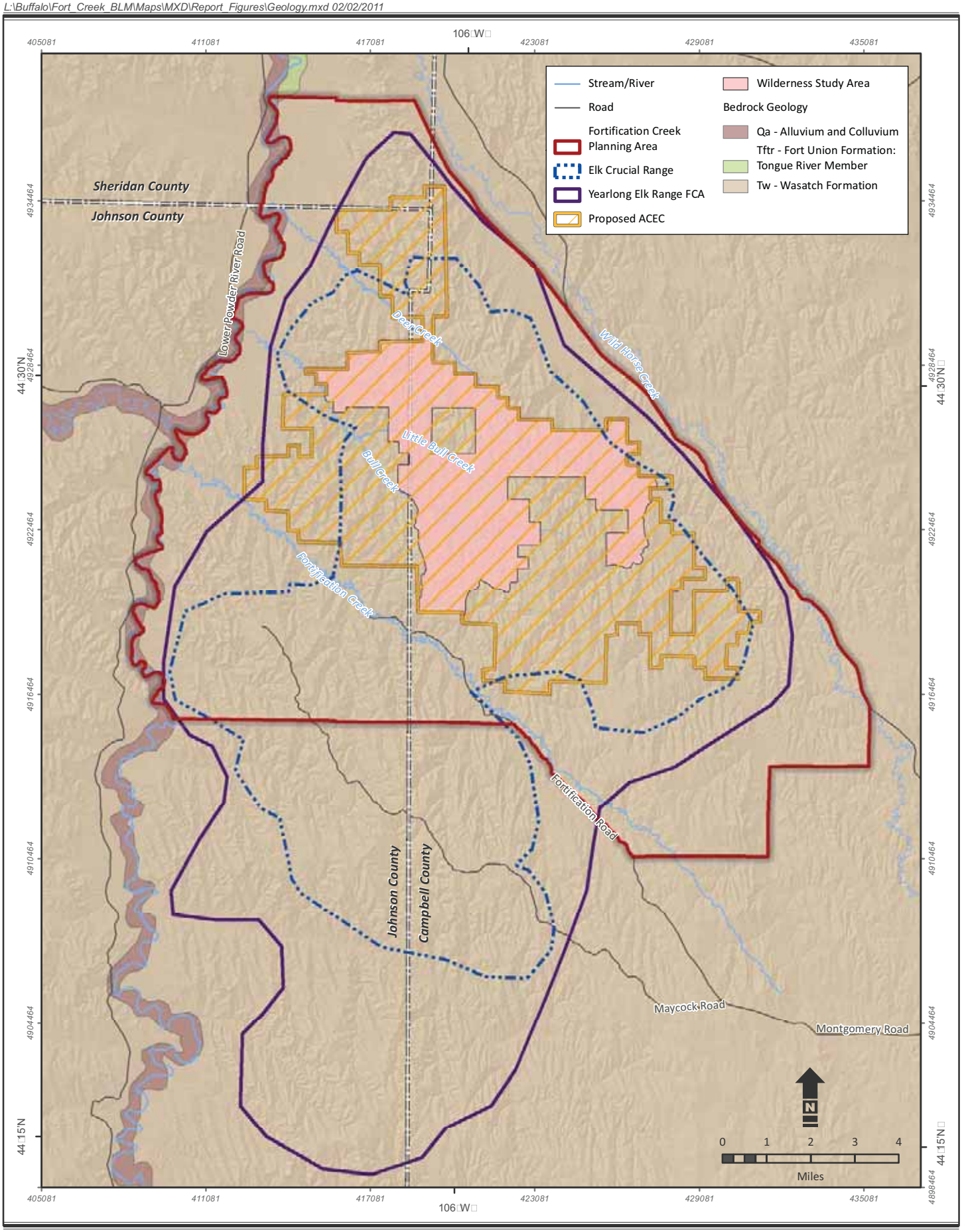

Source:
Geology - United States Geological Survey 1994
Topography - United States Geological Survey 2005
Hydrography - National Hydrography Dataset 2003

Figure 3-10

Geologic Map of Planning Area

Campbell, Johnson, and Sheridan Counties, Wyoming

Class 5 formations are considered "highly fossiliferous units that regularly and predictably produce vertebrate fossils or scientifically significant non-vertebrate fossils that are at high risk of natural degradation or human-caused adverse impact" (BLM 2003a). Recent research (Moses 2007) suggests that the Wasatch Formation of the PRB is different from the formation of the same name in southwestern Wyoming and northeastern Utah. The Wasatch of the PRB derives from different parent material and does not appear to be as highly fossiliferous as it is in the southwest. As a result of the recent research, Dale Hanson, the former BLM State Paleontologist, has suggested downgrading the Wasatch of the PRB to a Class 3 formation (Hanson 2008).

There is no specific law or regulation relating to how Federal agencies manage paleontological resources. Although FLPMA does require public lands to be managed in a way that protects the "...quality of scientific ..." and other values. NEPA requires "…important historic, cultural and natural aspects of our national heritage..." be protected, and that "…a systematic, interdisciplinary approach which will insure the integrated use of the natural and social sciences ...in planning and decision making..." be followed. The BLM policy, as stated in the BLM 8270 Manual (BLM 1998b), is to, "Mitigate adverse impacts to paleontological resources as necessary." The manual also states that, "Any field surveys and/or inventories intended to protect paleontological resources will be targeted to specific areas or be issue driven as needed." The BLM Handbook H-8270-1 states, "A paleontological field survey is carried out by a qualified paleontologist whenever a field office level analysis of existing planning or other data indicates that vertebrate fossils or noteworthy occurrences of invertebrate or plant fossils are, or are likely to be, present in an area proposed for surface disturbance."

3.1.9.2. Current Conditions and Trends

Current management requires that if large, conspicuous, and/or scientifically significant fossils or localities are found during development projects, the find will be reported to BLM and construction will be suspended within 250 feet of the find. An evaluation of the discovery will be conducted by a BLM-approved professional paleontologist within five working days (BLM 2003a).

R.J. Moses conducted a paleontological study of the FCPA for BLM (Moses 2007). A literature review and a limited field survey were conducted within the FCPA in Johnson and Campbell counties. Moses determined paleontological studies of the Wasatch Formation are focused on the southern portion of the PRB and that there are no studies in the FCPA. PRB studies indicate that vertebrate fossils are present in the Wasatch Formation in the Pumpkin Buttes-Sussex region. No fossil localities are noted in the FCPA and only anecdotal accounts point to the potential for vertebrate fossils. The field survey did not locate vertebrate fossils and Moses suggests there is limited potential for fossil discovery. Moses states, "Due to the small likelihood of fossil discovery over the extent of the Fortification Creek area, extensive blanket surveys seem unnecessary" (Moses 2007).

3.1.10. Visual Resources

3.1.10.1. Regional Setting and Regulatory Framework

The Visual Resource Management (VRM) system is used by BLM to inventory and manage visual resources on public lands. There are four VRM classes with the following objectives:

- Class I Objective: Preserve the existing character of the landscape. The level of change to the characteristic landscape should be very low and must not attract attention.

- Class II Objective: Retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Contrasts would be seen but must not attract attention.
- Class III Objective: Partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Contrasts would be seen but remain subordinate to the existing landscape character.
- Class IV Objective: 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.

3.1.10.2. Current Conditions and Trends

The FCPA consists of public, State, and private lands in Sheridan, Campbell, and Johnson counties in northeastern Wyoming. The FCPA lies in the PRB with the Big Horn Mountains to the west and the Black Hills to the east. The area consists of open grasslands, low rolling hills, and rugged slopes scattered throughout mostly unobstructed views for many miles. Most of the area is covered with dryland vegetation consisting of grasses, sagebrush, juniper shrubs, and deeply carved arroyos. The entire area is classified as VRM Class III with the exception of the WSA which is classified as VRM Class I.

Sensitive Observers

The WSA and surrounding BLM surface is the core of the FCPA, and is nearly landlocked by private property, requiring landowner permission to cross the private property to access public lands. At the present time, wells are limited to the perimeter of the FCPA and do not dominate the interior landscape. Wells are readily visible from public roads along the edges of the FCPA. Views from interior roads are substantially natural in character.

Scenic Byways

There are no scenic byways in the FCPA; however, two scenic byways are 70 miles west of the FCPA located in the Bighorn National Forest. The Bighorn Scenic Byway is on U.S. Route 14 and the Cloud Peak Skyway is on U.S. Route 16 west of Buffalo, Wyoming. The nearest average daily traffic counts are south of the FCPA upon Interstate 90 in Johnson County or upon Route 16 in Gillette; both counts are more than 20 miles away from the project area. Route 16 passes within 5 miles of the FCPA by the Campbell and Sheridan county border; it is a low-volume route (Wyoming Department of Transportation [WDOT] 2006).

Temporary Visitors

Visitation is severely limited because the FCPA is nearly landlocked by private ownership. The majority of the hunting is conducted through hired outfitters because of the private property limitations, but late in the elk season a few of the landowners allow hunters to access the FCPA without a guide. Based on hunting licenses and harvest in the area, hunter recreation is estimated at 202 visitor days per year. According to the BFO, it is estimated the area has about 100 days of rancher use per year and about 1,000 days of energy company employee use per year. Total visitation is approximately 1,329 persons per year.

3.1.11. Fuels and Fire

3.1.11.1. Regional Setting and Regulatory Framework

The number and size of fires in the PRB varies from year to year and is primarily weather-dependent. Long periods of drought and strong winds can lead to numerous and large fires. Most wildfires in the region are caused by lightning with occasional fires resulting from human-related sources (e.g., campfires or fireworks).

Wildfires are managed in all areas of the BFO. Suppression priority is given to fires in or threatening higher-value resources including WSAs and to keeping fires from spreading onto private, State, or other Federal lands. The highest priority in fuels and fire management is protecting human life (BLM 2001a).

The BFO RMP stipulates that prescribed burns will be conducted in the BFO to support vegetation and wildlife habitat objectives. Fire is used as a management tool to improve range forage production and wildlife habitat, and reduce hazardous fuel buildup (BLM 2001a).

From 1985 to 1994, 79 fires burned a total of 4,023.3 acres of the BFO. The average number of fires per year was 7.9, with an average of 402.3 acres burned (BLM 2001a). Five fires occurred within the FCPA during the period of 1980 to 2003 (BLM 2004c). While lightening strikes account for most unplanned fires human related ignitions from trains, automobiles, and campfires also occur.

The Fortification Creek WSA decadal burn target is used as an indicator of effective fuel and fire management. Approximately 2,000 acres are proposed in the FCPA for prescribed burns per decade (BLM 1998c). The primary objective of prescribed burning in the area is to reduce juniper encroachment into sagebrush communities.

To date, no prescribed burns have been implemented within the Fortification Creek WSA. However, from 2004 to 2007, more than 2,600 acres have burned elsewhere in the FCPA during prescribed burns.

3.1.11.2. Current Conditions and Trends

The Fortification Creek WSA is part of the Wilderness Study Areas Fire Management Unit (FMU) and is classified as Fire Regime 3 and Condition Class 2. Fire regimes describe periodicity and pattern of naturally occurring fires in a particular area or vegetative type. Land in Fire Regime 3 burns every 35 to 100-plus years and has mixed severities. Fire Regime Condition Class is a classification system that describes the amount of departure from the natural (historic) state of an area or landscape to present condition. Areas classified as Condition Class 2 have fire regimes that have a moderate departure from the historical range of variability. Fire behavior, effects, and other associated disturbances are moderately departed, with composition and structure of vegetation somewhat altered. The risk of losing key ecosystem components from the occurrence of fire is moderate in Condition Class 2 (BLM 2004c).

Lightning-caused fires account for 100 percent of all unplanned ignitions in the WSA. Across the FMU (which includes the North Fork and Gardner Mountain WSAs), fire behavior is generally moderate with low rates of spread. Shading from vegetation seems to keep fire on the ground, even during drought years. However, the fuels could support crown runs given the right conditions (BLM 2004c).

Current heavy fuels in the FCPA consist mainly of Rocky Mountain juniper, with scattered ponderosa pine on ridgetops. Fuel loads in the area are considered high over historic conditions due to increasing juniper and historic fire suppression.

The Fortification Creek WSA consists largely of sagebrush shrubland, mixed grassland, and juniper woodlands. The WSA is being managed to protect or enhance wilderness values and has a fire management plan in effect that specifies that all fire will be suppressed. Priority is given to keeping fires from spreading onto adjacent private or state lands. Restrictions or prohibitions on the use of heavy equipment and other minimal impact suppression techniques are to be followed (BLM 1998c).

Current fuel and fire management in the area is outlined in the BLM 2001 RMP, the Fire Management Implementation Plan for the BLM-Administered Public Lands in the State of Wyoming (BLM 1998c), and the BLM Eastern Wyoming Zone Fire Management Plan (BLM 2004c).

Current management direction states that prescribed fire would be used in the WSA and adjacent lands primarily to maintain or improve watershed conditions, wildlife habitat, and livestock forage. Approximately 2,000 acres are proposed for prescribed burns per decade (BLM 1998c). However, no mechanical or chemical fuels treatments are allowed in the WSA FMU (BLM 2004c).

Under current management, unwanted wildfires will be suppressed, the use of some types of suppression equipment will be restricted in some areas, and fire and suppression damage will be rehabilitated. Heavy equipment (dozers) is restricted from being used for wildfire suppression in WSAs. Helispot construction is also prohibited in the WSAs and specific restrictions on retardant use for wildfire suppression apply (BLM 2001a).

Firelines that are constructed with heavy equipment or on steep slopes outside of the WSA will be rehabilitated to prevent or control erosion. Rehabilitation includes, but is not limited to, water barring and reseeding (BLM 2001a).

Recent fire records indicate fires are becoming larger and more frequent in the area. This periodicity and intensity of wildfires is attributed to past fire suppression, increased vegetation density (particularly juniper), and climate changes. The increase may also be due to improved fire reporting and recording systems. However, some fires on BLM lands were, and probably still are, not reported properly (BLM 2004c).

Across the region, historic wildland fire suppression has resulted in reduced fire frequency and may be causing shifts in the vegetation present in the FCPA in favor of juniper and older sagebrush classes (BLM 2003a).

3.2 Resource Uses

3.2.1. Rangeland Resources

3.2.1.1. Regional Setting

The majority of lands in the FCPA are used for livestock grazing. BLM manages grazing on its lands through a system of grazing leases and allotments. Grazing allotments are made up of BLM lands intermingled with and grazed in conjunction with private (deeded) properties that are owned or leased by the BLM grazing lessee. BLM permitted grazing allotments are classified by

how many animal unit months (AUMs) are provided by the acreage and amount of forage available in the allotment. AUMs are defined as the amount of forage required to sustain one cow and calf for one month (BLM 2003a).

Grazing lessees and other interested parties are consulted and cooperated with when implementing various grazing management practices and other actions including vegetation and land treatments, water developments, and fence building. BLM policy stipulates that priority be given to management actions that are developed through activity plans such as Allotment Management Plans (AMPs) and Coordinated Resource Management Plans (CRMPs) (BLM 2001b).

The BFO RMP (BLM 2001a) stipulates that reservoirs, wells, troughs, and pipelines will be constructed to provide water in dry areas and to disperse grazing use. The grazing lessee or other cooperator is required to maintain water in all troughs located on public land during the frost-free period (April through October) for wildlife.

BLM requires land use activities within allotment areas to comply with the Wyoming Standards for Healthy Public Rangelands (BLM 1995a) in cooperation with the State of Wyoming. These guideline BMPs are also used to avoid and mitigate impacts and conflicts among resources and land uses for surface-disturbing activities on BLM-administered lands in Wyoming.

Livestock grazing is considered a compatible use with CBNG development. Livestock management in the BFO is conducted in accordance with the BFO RMP (BLM 2001a) and has not been modified in response to increasing CBNG development in the area.

The goal for rangeland management is sustaining viable populations and a diversity of native plant and animal species appropriate to the habitat that could support threatened, endangered, species of special concern, or sensitive species to be maintained or enhanced. Indicators include the following:

- Noxious weeds;
- Species diversity;
- Vegetative cover;
- Plant composition (age class and structure);
- Soil stability; and
- Population trends.

3.2.1.2. Current Conditions and Trends

There are currently 17 allotments leased in the FCPA as shown on Figure 3-11. Rangeland health assessments have not been completed on all of the allotments in the area. However, the several allotments that have been assessed have all been found to be meeting the Wyoming Standards for Healthy Public Rangelands (BLM 1995a). BLM has requirements in place for lessees to construct fences that will minimally impede wildlife movement (BLM Handbook H-1741-1; BLM 1989b).

Water wells in the FCPA principally support livestock use, but the Fortification Creek elk herd also uses livestock watering troughs as water sources. Livestock and elk in the FCPA may also compete for forage under certain conditions. The species have an average 55 percent dietary

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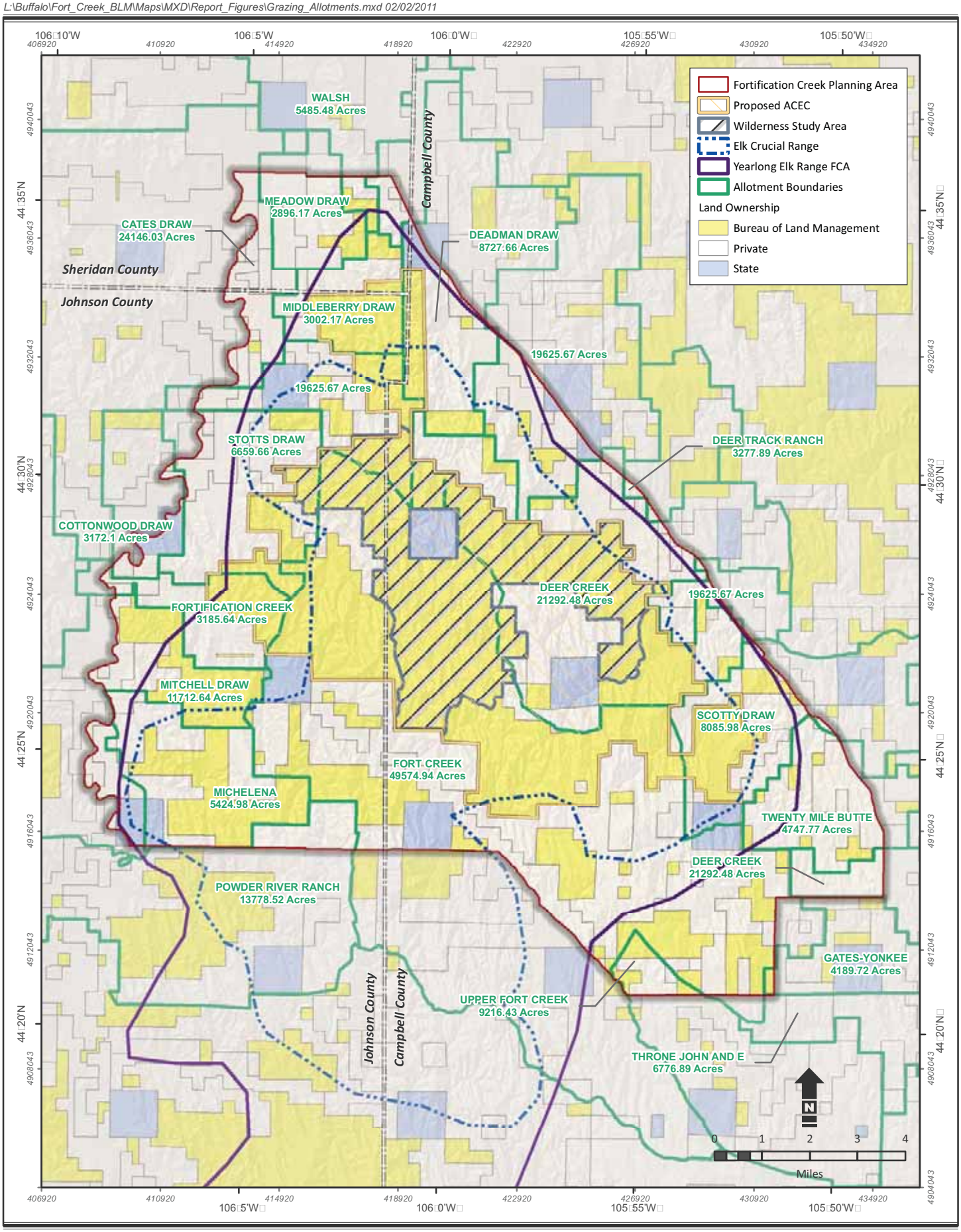

Source:
Boundaries/Lease Properties - Bureau of land Management 2009

Figure 3-11

Grazing Allotments in the Fortification Creek Planning Area

Campbell, Johnson, and Sheridan Counties, Wyoming

overlap, which varies with the season (Hanson and Reid 1975). Forage competition may be greatest in the winter, when the elk are seeking suitable winter range with residual grasses from the previous growing season. If livestock have already grazed these areas during the previous summer, the residual forage may not be enough to sustain both species.

Grazing levels are likely to remain consistent in the FCPA; however, increased CBNG development is impacting livestock grazing. CBNG construction activities can temporarily require the removal of allotment fencing, although all fencing is required to be repaired upon construction completion. Livestock may also be curious about CBNG structures or use structures for scratching posts or shade. Additionally, increased vehicle traffic can disturb or kill livestock.

The largest influences of increasing CBNG development on livestock are water availability and distribution, forage loss, and delayed reclamation. CBNG discharged water is increasing the availability of surface water in the FCPA. Riparian vegetation and the availability of water in an otherwise dry landscape tend to attract livestock. Livestock spend more time grazing in riparian ecosystems than in adjacent uplands and may become more concentrated in CBNG areas (BLM 2003a). In some cases, CBNG discharged water may be high in selenium. Concentrations of selenium do not limit the use of water for stock watering; however, certain vegetation could become toxic to livestock through the uptake of selenium (BLM 2003a).

3.2.2. Recreation

BLM lands provide open space for a variety of dispersed outdoor recreation opportunities, as well as developed facilities to help meet the demand for site-oriented recreation. Private sector recreation opportunities generally consist of guiding services and facilities.

3.2.2.1. Regional Setting and Regulatory Framework

BLM lands within the FCPA are available for dispersed recreational land uses; however, there are no developed recreational facilities. The location of the Fortification Creek WSA is shown on Figure 1-2. Hunting is the main recreational activity in the FCPA. Off-road vehicles are not allowed in the WSA. There is no direct public access to the Fortification Creek WSA; access into the WSA is through private landowner permission or by a long circuitous off-trail route on public lands.

Laws and regulations that address recreation include the following:

- The specific terms and conditions authorizing Special Recreation Permits (SRPs) that are issued for commercial or organized events; and
- Cooperative agreements between the WGFD and BLM that provide for enforcement of hunting regulations.

Recreation indicators include the number of visitor or recreation days and hunter days. The number of visitor or recreation days was approximately 202 for the 2008 hunting year (WGFD 2009a). With the exception of elk hunting, recreation opportunities are severely limited within the FCPA by the lack of public access. Therefore, only elk hunting statistics are being used to evaluate recreation use. Table 3-11 lists the numbers of active hunters or hunting licenses, total harvest, percent hunter success, and number of hunter days for resident and nonresident hunters for elk in the FCPA (WGFD 2009). Deer hunting statistics for the FCPA are not available because the hunt unit is much larger than the FCPA.

Table 3-11 FCPA Hunting for 2008				
Type of Permit	**Active Licenses/Hunters**	**Total Harvest**	**Percent Hunter Success**	**Hunter Days**
Elk Hunt Unit #2				
Resident	63	55	87.3%	177
Nonresident	6	5	83.3%	25
Total	**69**	**60**	**87.09**	**202**

3.2.2.2. Current Conditions and Trends

The WGFD manages big-game populations in big-game management units and in hunt areas. The FCPA and elk yearlong range are within hunting unit #2. Deer hunting is the most common form of hunting in the FCPA. The majority of hunters do not enter the WSA because of the restricted vehicle access and most hunters remain on private land or on BLM lands outside the WSA that are accessible to vehicles. Several ranches in the area have outfitters or pay-for-access hunting operations.

3.2.3. Transportation

BLM is responsible for ensuring that new roads on Federal lands meet the criteria for design and construction as specified in BLM Manual Section 9113 – Roads (BLM 1985b). Additionally, BLM may designate road usage for all BLM roads.

3.2.3.1. Regional Setting and Regulatory Framework

The existing public road network, BLM roads, and other access roads in the FCPA are shown on Figure 3-12. Interstate Highways 25 and 90 and Highway Routes 14 and 16 also provide access.

There are approximately 299 miles of roads and routes in the FCPA. As shown on Figure 3-12, the primary access roads in the FCPA are Echeta Road and Fortification Creek Road. The Upper Powder River Road is on the western side of the river with no bridge access to the Fortification Creek area. Many private roads associated with fluid mineral development and ranches also provide access to the FCPA.

Regulations and guidelines for transportation management include the following:

- The Transportation Safety Act of 1974 and subsequent Hazardous Materials Transportation Act amendments of 1976, and 1990 amendments (49 United States Code; U.S.C. 1801 et seq.), and associated regulations (49 CFR 171-173, 177, 383, 392, 395, and 397); and
- Executive Order 11644, "Use of Off-Road Vehicles on Public Lands." The purpose of this order is "to establish policies and provide for procedures that will ensure that the use of off-road vehicles on public lands will be controlled and directed so as to protect the resources of

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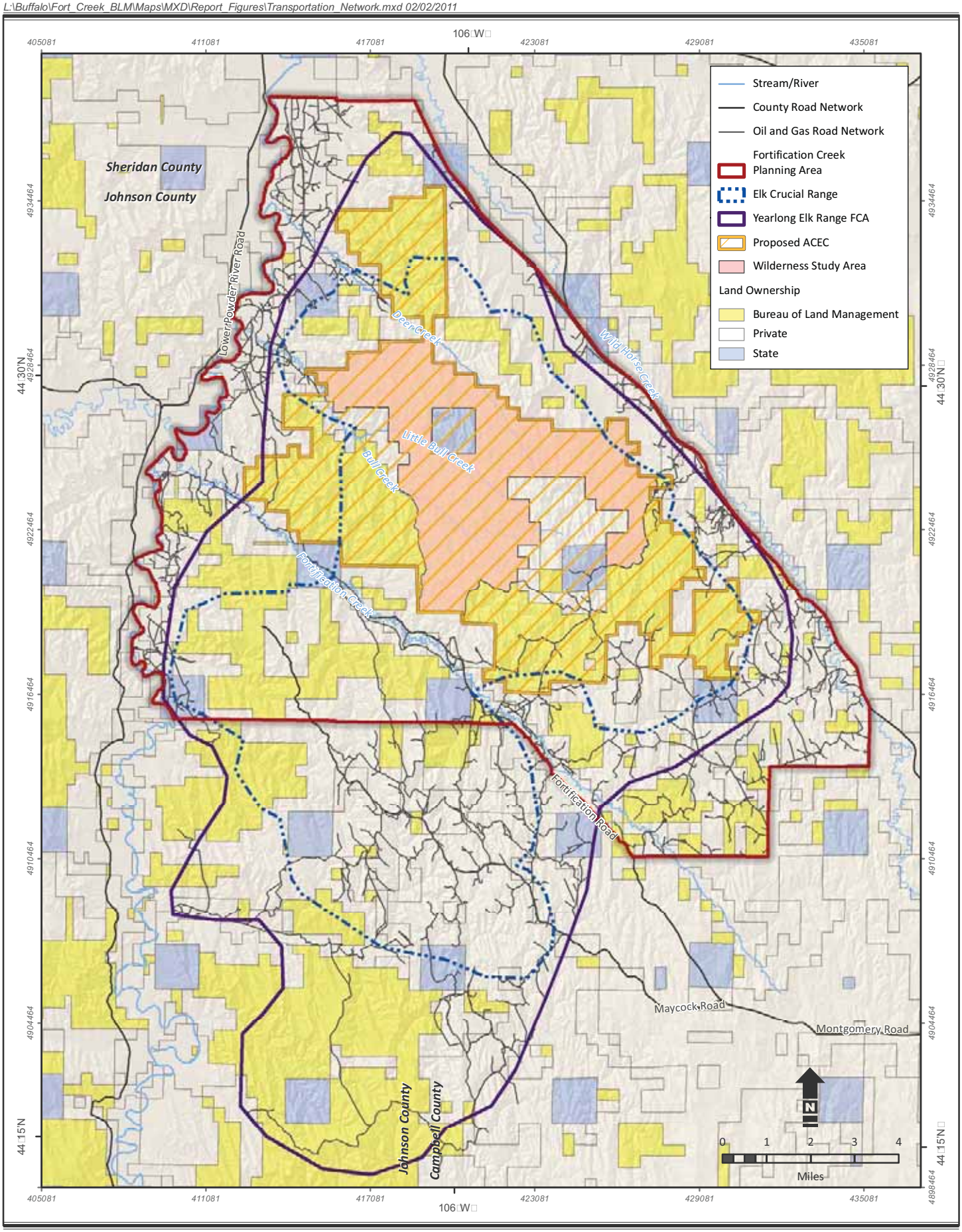

Source:
Topography - United States Geological Survey 2005
Hydrography - National Hydrography Dataset 2003

Figure 3-12

Planning Area Transportation Network

Campbell, Johnson, and Sheridan Counties, Wyoming

those lands, to promote the safety of all users of those lands, and to minimize conflicts among various uses of those lands."

3.2.3.2. Current Conditions and Trends

There are approximately 9 miles of primitive roads in the Fortification Creek WSA that have reclaimed naturally. As shown on Figure 3-12, road density increases to the south, with more primary and secondary roads.

The number of roads is increasing due to CBNG development, especially in the southern and eastern portions of the FCPA.

3.2.4. Lands and Realty

3.2.4.1. Regional Setting and Regulatory Framework

The FCPA encompasses BLM surface and subsurface, State surface and subsurface, and private surface and subsurface lands. Land ownership is summarized in Table 3-12 and surface ownership is shown on Figure 1-2. Most of the land in the FCPA is used for grazing on both private land and Federal leases.

Table 3-12 Land Ownership in the FCPA

Ownership	Acres	Percentage of the FCPA
BLM Surface	42,755	42%
State Surface	5,324	5%
Private Surface	52,576	52%
BLM Mineral Estate	79,362	65%
State Mineral Estate	5,234	4%
Private Mineral Estate	36,569	30%

Most of the BLM land in the FCPA is used for livestock grazing in accordance with permitted grazing allotments. Land outside the FCPA WSA has been leased for oil and gas development. Oil and gas leases are not issued within the WSA.

Land tenure decisions must conform to the following regulations and policies:

- 43 CFR 2400, Lands for retention, proposed disposal, or acquisition (based on acquisition criteria identified in the land use plan; FLPMA Section 205[b]; Oregon Natural Resources Council, 78; and Interior Board of Land Appeals [IBLA] 124 [1983]) – Lands are to be retained under Federal ownership, unless it is determined that disposal of a particular parcel will serve the national interest (FLPMA Section 102[a][1]). Land use plans should avoid prescribing the method of disposal, acquisition, or property interest to be acquired.
- FLPMA – Acquisitions – Section 205; Exchanges – Section 206; Permits for temporary use, such as filming – Section 302; rights-of-way (ROWs) – Section 501 – ROWs for facilities

and systems for the impoundment, storage, transportation, or distribution of water; pipelines for other uses; systems for generation, transmission, and distribution of electric energy; systems for transmission or reception of radio, television, telephone, telegraph, and other electronic signals; roads; railroads; airways; livestock driveways; etc.

- 43 CFR 2300, Land management guidelines regarding withdrawal areas.
- Section 7 of the Taylor Grazing Act of 1934, as amended (43 U.S.C. 315[f]), Land Classifications.
- 43 CFR 2740, 2912, 2911, and 2920, Land Use Authorizations – These regulations describe where and under what circumstances authorizations for use, occupancy, and development (such as major leases and land use permits) may be granted.

3.2.4.2. Current Conditions and Trends

The oil and gas lease for the State-owned land within the WSA has expired and Wyoming has indicated it will not re-issue the lease in the near future. The previous lessee did not develop the lease because it could not be accessed without crossing the WSA. Development within the WSA requires a BLM ROW. Several other State parcels are present in the FCPA and these are under development.

Approximately 42,775 acres of the surface ownership in the FCPA are Federal, 5,324 acres are State, and 52,576 acres are private. Existing BLM oil and gas leases within the FCPA contain various restrictions, stipulations, or Conditions of Approval (COAs) regarding surface disturbance, surface occupancy, and limitations on surface use. Increasing CBNG development in the FCPA is causing conflicts between grazing, quality of life, and recreational uses.

3.2.5. Fluid Minerals

3.2.5.1. Regional Setting

Three types of fluid minerals are present in the FCPA: conventional natural gas, oil, and CBNG. Natural gas and oil production are declining in the FCPA and the PRB in general, while CBNG exploration and production are increasing rapidly.

Wyoming's annual oil production peaked at 160 million barrels in the early 1970s and has been in decline since (Wyoming Oil and Gas Conservation Commission [WOGCC] 1998). Three hundred and thirty-six fields were producing nearly 25 million barrels of oil and 60 MMCF of conventional natural gas in Wyoming in 2000 (WOGCC 2001). Production in the PRB comes from upper and lower Cretaceous sediments and from upper Paleozoic sediments in the northeastern part of the basin (Lageson and Spearing 1991).

It is estimated that approximately 14.264 trillion cubic feet (tcf) of CBNG may be recoverable from the coal beds in the Wyoming portion of the PRB (USGS 2004). CBNG in the PRB is almost entirely methane (CH_4) and nitrogen (N). A large percentage of the CBNG escapes to the surface or migrates into nearby rocks during the coalification process. Some of the gas is trapped and stored in coal beds in one of the following four ways:

- As free gas in tiny pores or fractures within the coal;
- As dissolved gas in water within the coal;
- As adsorbed gas on coal surfaces; or

- As absorbed gas within coal molecules (Debruin et al. 2001).

Future CBNG production in the entire PRB area was estimated by BLM using 28 tcf as the recoverable gas reserve. Estimated recovery in the Wyoming portion of the PRB is 25 tcf. Three reasonably foreseeable development scenarios (high, moderate, and low) were calculated based on different average well recoveries. Recoverable reserves and average well recoveries are from the PRB Oil and Gas FEIS (BLM 2003a). A separate Reasonably Foreseeable Development scenario was not developed for the FCPA and therefore the number of wells and recovery are estimates for the purpose of the NEPA analysis. These recoveries, for existing and projected new wells, are shown in Table 3-13.

Table 3-13 Estimated Number of Existing and New CBNG Wells – Powder River Basin

Scenario	Number of Wells 2010	Number of Wells 2020
High – 0.50 bcf	80,000	139,000
Moderate – 0.35 bcf	50,000	81,000
Low – 0.20 bcf	38,000	57,000

bcf = billion cubic feet

Estimated recoveries for existing and new wells, by county, are shown in Table 3-14.

Table 3-14 Total Estimated Recoverable Resources (tcf)

County	Low	Moderate	High
Campbell	3.9	5.0	6.2
Johnson	3.4	4.4	5.4
Sheridan	1.5	1.9	2.4
Total	8.8	11.3	14.0

Cumulative CBNG production, from 1981 to the end of December 2007 was 1.9 billion cubic feet (bcf) in Campbell County, 0.4 bcf in Johnson County, and 0.3 bcf in Sheridan County (WOGCC 2008).

A complete description of the methodology used to calculate the number of potential CBNG wells is included in the Reasonably Foreseeable Development Scenario (BLM 2001d).

FCPA-specific estimates by CBNG industry sources indicate that 2.62 tcf of natural gas is present in the FCPA and 1.755 tcf is recoverable (Gene R. George and Associates 2007).

3.2.5.2. Current Conditions and Trends

The location of current natural gas, oil, and CBNG wells is shown on Figure 3-13. The number of potential new wells and related facilities in the FCPA was estimated by assuming an 80-acre

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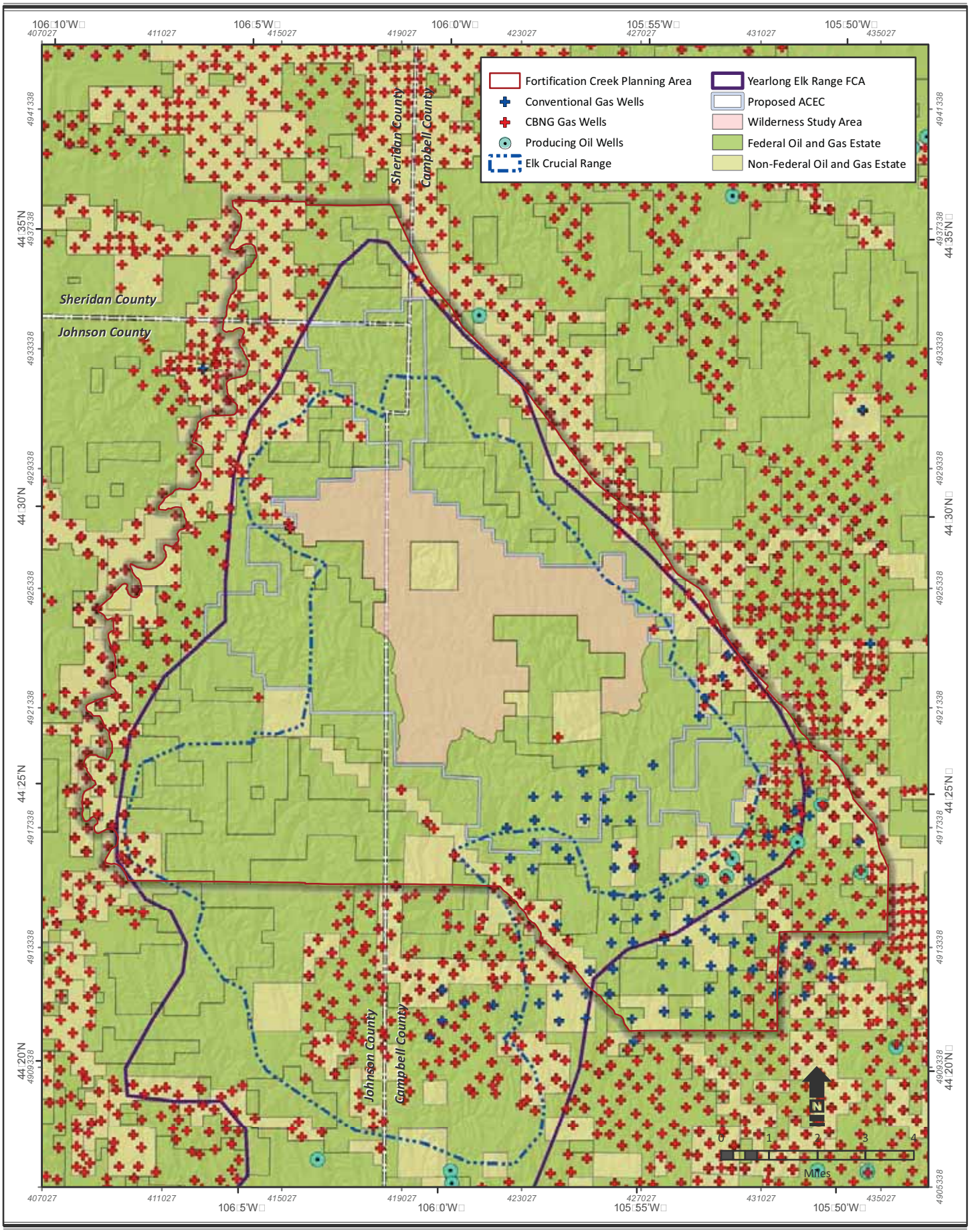

Source:
Mineral Estate/Boundaries - Bureau of land Management 2009
Topography - United States Geological Survey 2005
Wells - Wyoming Oil and Gas Conservation Commission 2010

Figure 3-13

Location of Current Natural Gas, Oil and CBNG Wells

Campbell, Johnson, and Sheridan Counties, Wyoming

spacing pattern (eight pads per square mile) on Federal mineral estate where development is allowed and on non-Federal land (BLM 2003a).

There are 480 wells in the FCPA. These wells include exploration and production wells for CBNG, conventional gas, and oil. Well locations and Federal mineral estate are shown on Figure 3-13. There are approximately 94 CBNG wells and 55 conventional gas wells on Federal mineral estate, with an additional 303 CBNG, 184 conventional gas, and five oil wells on non-Federal mineral estate in the FCPA. The power line network that supports current well production is shown on Figure 3-14.

The number of producing oil and conventional gas wells in the FCPA has decreased since the 1980s. This trend could reverse depending on the price of oil and gas. New oil and gas wells are expected to be permitted at a relatively constant rate through 2010. CBNG development is increasing in and around the FCPA. There are approximately 206 CBNG wells in active APDs proposed for the FCPA (WOGCC 2010b).

3.3 Special Designations

The FLPMA directs BLM to consider and evaluate lands for a number of special designations during the land use planning process. In general, lands are eligible for these designations based on the presence of particular values and qualities through several different types of processes and management frameworks. Current and potential special designations in the FCPA include ACECs and WSAs.

The FCPA contains two special areas: Fortification Creek WSA (which is encompassed by the larger FCPA) and a proposed ACEC, which incorporates the WSA boundaries. These areas are shown on Figure 1-2. There was also a citizen's proposal to expand the boundaries of the WSA, but it is not consistent with BLM policy to do so.

The BLM BFO identified special resource values in the FCPA when it delineated the area in the Buffalo Resource Area (BRA) Oil and Gas Environmental Assessment (EA) (BLM 1980) and the BRA Oil and Gas Surface Protection Plan (BLM 1982). The BRA RMP (BLM 1985a) incorporated decisions and management actions regarding the FCPA from both of these documents. Important resources identified by BLM in the 12,185-acre Fortification Creek WSA include an isolated elk herd and its habitat; high visual quality; steep slopes with erosive soils; and cultural, historic, and paleontological values (BLM 2007b). These values were also identified for the entire FCPA.

Management objectives specific to the FCPA are to allow orderly development of mineral resources while protecting wildlife habitat and subwatershed areas and maintaining wilderness values. Two seasonal timing limitations are applied in this area: one in the elk crucial parturition range and one in the crucial winter range.

3.3.1. Areas of Critical Environmental Concern

3.3.1.1. Regional Setting and Regulatory Framework

The FCPA contains two special areas: the Fortification Creek WSA, which is encompassed by the larger FCPA, and a proposed ACEC that incorporates the WSA boundaries. There was also a citizen's proposal to expand the boundaries of the WSA. These areas are shown on Figure 1-2.

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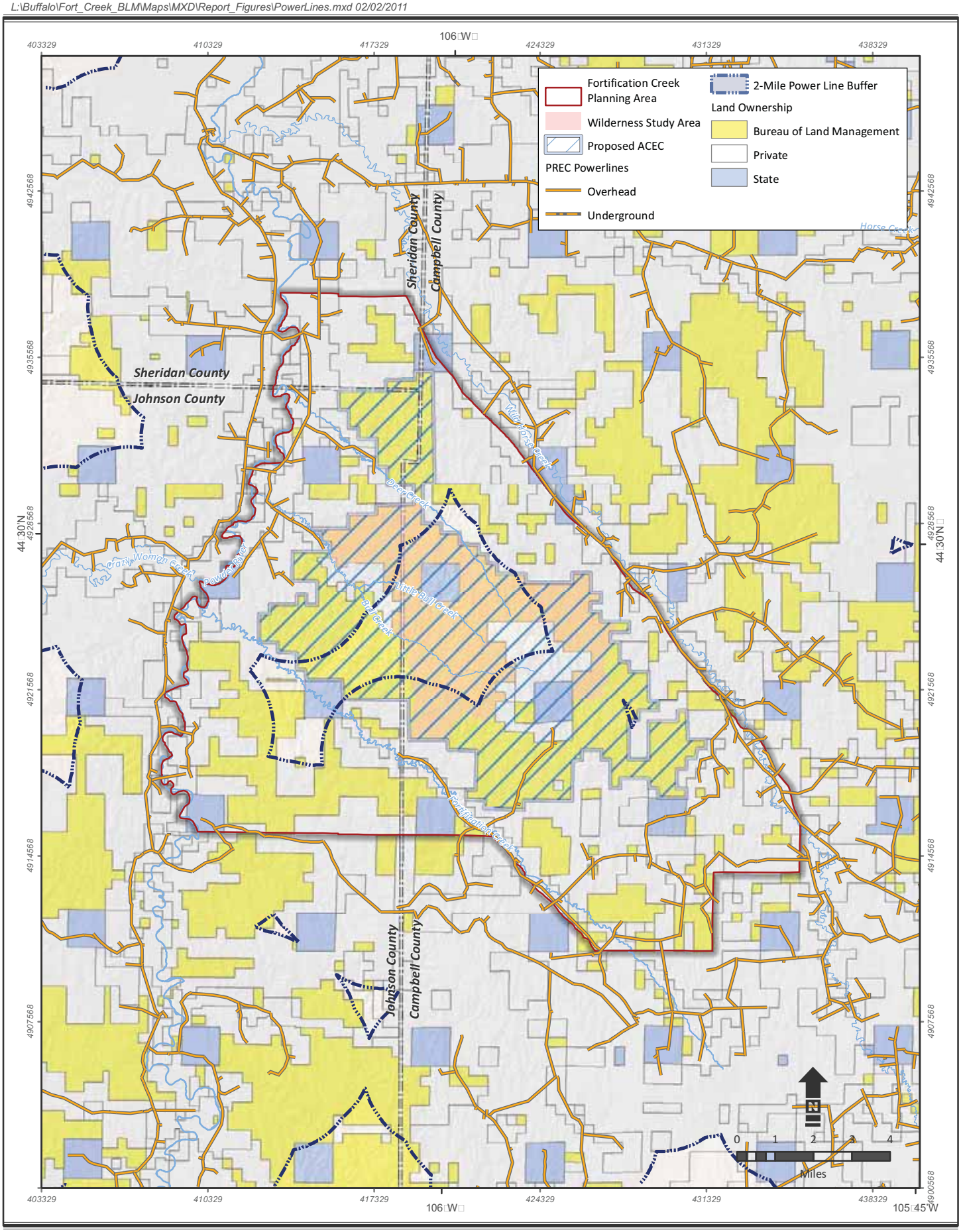


Source:
Boundaries - Bureau of land Management 2009
Topography - United States Geological Survey 2005
Powerlines - PREC 2009

Figure 3-14

Existing Power Lines

Fortification Creek Planning Area

3.3.1.2. Current Conditions and Trends

Portions of the FCPA, including the WSA, were proposed for ACEC designation during scoping for the PRB O&G FEIS (BLM 2003a). BLM verified that the area "meets the relevance criteria for scenic value and wildlife. It also meets the importance criteria for local significant qualities; has circumstances that make it fragile and unique (isolated elk herd and minimal impacts from man); and has been recognized as warranting protection to satisfy national priority concerns." A final decision on whether to designate an ACEC in this area was deferred (BLM 2003a).

3.3.2. Wilderness Study Areas

3.3.2.1. Regional Setting and Regulatory Framework

Wilderness provides undeveloped Federal land in a natural condition without permanent improvements or human habitation, which has outstanding opportunities for solitude or a primitive and/or unconfined-type of recreation. In addition, a wilderness must consist of at least 5,000 acres of land or be of sufficient size to make its preservation and use practical. Wilderness may also contain ecological; geological; or other features of scientific, educational, scenic, and/or historical value. The original wilderness inventory of BLM public lands was performed pursuant to Sections 201 and 603 of FLPMA, beginning in 1978. This process involved evaluating public lands to determine and locate areas containing wilderness characteristics that meet the criteria established in the Wilderness Act. Areas identified as WSAs are managed under the Interim Management Policy until they are designated as wilderness or until they are released by Congress.

The BLM BFO identified special resource values in the FCPA when it delineated the area in the BRA Oil and Gas EA (BLM 1980) and the BRA Oil and Gas Surface Protection Plan (BLM 1982). The BRA RMP (BLM 1985a) incorporated decisions and management actions regarding the FCPA from both of these documents. Important resources identified by BLM in the 12,419-acre Fortification Creek WSA include an isolated elk herd and its habitat; high visual quality; steep slopes with erosive soils; and cultural, historic, and paleontological values (BLM 2007b).

Management objectives specific to the FCPA are to allow orderly development of mineral resources while protecting wildlife habitat and subwatershed areas and maintaining wilderness values. However, development is not allowed in the WSA.

3.3.2.2. Current Conditions and Trends

All of the Federal oil and gas minerals leased in the FCPA are outside the WSA. The oil and gas lease for the State-owned land within the WSA has expired and Wyoming has indicated it will not re-issue the lease in the near future.

The Fortification Creek WSA is currently used for big-game wildlife habitat. There is no public access to the area because it is surrounded by private property. Private landowners surrounding the WSA have allowed limited public access into the area for elk hunting to help control the elk herd. However, illegal trespassing during recent hunting seasons and the increasing spotlight on CBNG development in the area has caused some landowners to further restrict hunting access across their properties.

As part of the continuing development of the CBNG resources in the PRB, development is now being proposed in the leased areas of the FCPA including adjacent to the WSA. Seven PODs have been proposed by six different companies, which include 158 proposed CBNG wells along with the installation of associated facilities. These PODs have been delayed because of concern over impacts to the resident Fortification Creek elk herd and various planning issues.

There is also a growing interest in hunting within the WSA.

3.4 Socioeconomics and Environmental Justice

The FCPA is located in portions of Campbell, Johnson, and Sheridan counties in northeastern Wyoming. These three counties could experience socioeconomic impacts from BLM management actions in the FCPA. The FCPA comprises 2 percent of the land area in Campbell County, 2 percent in Johnson County, and 0.2 percent in Sheridan County. Private land comprises approximately one-third of the FCPA and includes mostly ranches; there are no municipalities within the FCPA.

3.4.1. Economic

3.4.1.1. Regional Setting and Regulatory Framework

The indicators for the economic impact analysis are consistent with those used in the PRB O&G FEIS (BLM 2003a), and include the following:

- Population;
- Employment;
- Personal income; and
- Public finance.

Other indicators considered include housing, property values, and community and government services.

3.4.1.2. Current Conditions and Trends

The population for Campbell, Johnson, and Sheridan counties is shown in Table 3-15. Between 2000 and 2006, population in Campbell County grew 9 percent and population in Johnson County grew by approximately 10 percent.

Table 3-15 Population Estimates

Location	1990	2000	2006
Campbell County	29,370	33,698	38,480
Johnson County	6,145	7,075	7,820
Sheridan County	23,562	26,560	27,482
State of Wyoming	453,588	493,782	512,757

Source: Headwaters Economics, 2009, a,b,c,d

The unemployment rate in Campbell County was 2.0 percent, in Johnson County it was 2.5 percent, and in Sheridan County it was 3 percent (WY DOE 2008). Wages and employment by sector are presented in Tables 3-16, 3-17, and 3-18. In Campbell County, almost one-third of total jobs were in the high-paying mining sector, which includes oil and gas. Other important employment sectors include trade, transport, and utilities; local government; and construction. It should be noted that tourism wages were less than one-quarter of mining wages. More recent data from the WY EAD (2009) shows that, state-wide, most industries saw declines in employment.

Table 3-16 Campbell County Wages and Employment in 2006

Sector	Employment	% of Total	Average Annual Wages
Mining (Oil and Gas)	7,673	30%	$69,051
Agriculture, Forestry, Hunting	50	0%	$34,883
Construction	2,903	11%	$45,193
Manufacturing	620	2%	$51,768
Trade, Transport, Utilities	4,648	18%	$41,158
Information	218	1%	$28,291
Financial Activities	647	3%	$37,969
Professional/Business Services	1,742	7%	$43,987
Education and Health Services	784	3%	$42,259
Leisure and Hospitality	1,917	7%	$12,511
Other Services	791	3%	$36,262
Federal Government	86	0%	$52,590
State Government	160	1%	$41,950
Local Government	3,372	13%	$39,587
Total	**25,611**	**100%**	**$47,795**

Source: Headwaters Economics, 2009 a, d

In Johnson and Sheridan counties, the average wage is approximately one-half of that in Campbell County. This is because wages in all sectors are lower and there are a higher proportion of jobs in the lower-paying construction, trade, tourism, and local government sectors.

Table 3-17 Johnson County Wages and Employment in 2006

Sector	Employment	% of Total	Average Annual Wages
Mining (Oil and Gas)	279	8%	$45,800

Table 3-17 Johnson County Wages and Employment in 2006			
Sector	**Employment**	**% of Total**	**Average Annual Wages**
Agriculture, Forestry, Hunting	53	2%	$20,899
Construction	400	12%	$41,170
Manufacturing	83	2%	$20,302
Trade, Transport, Utilities	541	16%	$21,670
Information	43	1%	$25,115
Financial Activities	150	4%	$33,208
Professional/Business Services	148	4%	$29,370
Education and Health Services	145	4%	$26,985
Leisure and Hospitality	474	14%	$12,195
Other Services	129	4%	$18,743
Federal Government	131	4%	$49,526
State Government	101	3%	$37,632
Local Government	668	20%	$37,281
Total	**3,344**	**100%**	**$30,336**
Source: Headwaters Economics, 2009b,d			

Table 3-18 Sheridan County Wages and Employment in 2006			
Sector	**Employment**	**% of Total**	**Average Annual Wages**
Mining (Oil and Gas)	474	4%	$66,333
Agriculture, Forestry, Hunting	280	2%	$25,614
Construction	1,276	10%	$31,485
Manufacturing	365	3%	$34,645
Trade, Transport, Utilities	2,390	19%	$29,587
Information	175	1%	$35,381
Financial Activities	577	4%	$35,323
Professional/Business Services	879	7%	$37,067
Education and Health Services	1,505	12%	$29,070
Leisure and Hospitality	1,594	12%	$12,954
Other Services	447	3%	$19,231
Federal Government	611	5%	$64,076

Table 3-18 Sheridan County Wages and Employment in 2006			
Sector	**Employment**	**% of Total**	**Average Annual Wages**
State Government	351	3%	$39,371
Local Government	1,944	15%	$35,957
Total	**12,847**	**100%**	**$32,416**
Source: Headwaters Economics 2007a, b			

Total personal income grew in all three counties between 2001 and 2006 (Headwaters Economics 2009b, c, d). In Campbell County in 2006, total personal income amounted to $1.6 billion. More than three-quarters of this amount was from wage and salary disbursements. In Johnson County in 2006, total personal income was $282 million and about half of this income was from non-labor sources. Total personal income in Sheridan County in 2006 amounted to $1.2 billion and like Johnson County almost half of this income was from non-labor sources.

Government revenues in Wyoming are highly dependent on the minerals industry (coal, other solid energy, non-energy minerals and fluid minerals that include conventional gas, CBNG, and oil). In 2005, approximately two-thirds of state and local government revenues came directly from mineral industries (WY EAD 2007b). All three counties have realized increased county revenues from CBNG development. This revenue is used to fund county services such as schools, roads, and social services. Between 1996 and 2002, Campbell County's assessed valuation for natural gas increased thirty-fold. During the same time, Johnson County's natural gas valuation nearly quadrupled. The estimated assessed valuation for Campbell County in 2007/2008 rose by almost 7 percent, from $4.3 billion to approximately $4.6 billion (Campbell County 2007a). In 2005, minerals composed over 85 percent of the total assessed valuation in Campbell County. This indicates that government revenues and associated social services are highly sensitive to changes in natural gas production and prices.

In addition to property taxes, counties receive payments in lieu of taxes (PILT) from the Federal government to help make up for "lost" revenue that counties would normally collect through property taxes (if the land were privately held). Federal land ownership in Campbell County is 13 percent, in Johnson County 31 percent, and in Sheridan County 27 percent. Between 2002 and 2007 PILT payments in Campbell County increased from $366,000 to $390,000. In 2007 Johnson County received about $577,943; up from $462,000 in 2002. In Sheridan County, PILT payments in 2007 amounted to almost $0.6 million (Wyoming Extension 2008 a, b, c).

Although Wyoming's economy outperformed the U.S. economy in 2005 and 2006, it is vulnerable to sudden downturns because of its dependence on natural resource demand. High prices for oil and natural gas have buoyed Wyoming's economy and accelerated job and earnings growth in 2005 and 2006. The recent economic downturn resulted in a reduction of state wide revenue by approximately $10 million. Economic forecasts for Wyoming predict continued but slower growth in the near future. Campbell, Johnson, and Sheridan counties will likely follow this trend.

Future population estimates for Wyoming and Campbell, Johnson, and Sheridan counties are listed in Table 3-19. Both Campbell and Johnson counties are forecasted to experience twice the average population growth of Wyoming between 2005 and 2020.

Table 3-19 Population Estimates

Location	2010	2015	2020
Campbell County	43,090	47,650	52,630
Gillette	26,062	28,820	31,832
Wright	1,671	1,847	2,041
Johnson County	8,780	9,540	10,350
Buffalo	4,877	5,299	5,749
Kaycee	310	337	365
Sheridan County	28,800	29,700	30,700
Sheridan	17,100	17,700	18,300
Clearmont	120	130	130
State of Wyoming	540,000	559,200	579,100

Source: Headwaters Economics, 2007a, b

Economic forecasts for Wyoming report that the State's tight labor market and high wages for energy-related jobs will support strong wage and income growth. Over the long term, however, Wyoming's low economic diversity and high dependence on the energy sector will be a limiting factor for future growth, particularly if energy prices drop lower and faster than expected. Because of the larger proportion of baby boomers and lack of metropolitan areas in the state, Wyoming could experience a population that is aging faster than the national average. Therefore, the tight labor market in the State is expected to continue or tighten as the boomer cohort begins to retire around 2010 (WY EAD 2007a).

3.4.2. Social

3.4.2.1. Regional Setting and Regulatory Framework

Social impacts can be difficult to measure because there are no direct indicators for measuring changes to quality of life. Furthermore, defining quality of life is highly personal and can change over time. It is important, however, to recognize that despite the difficulty in measuring social impacts, there are social changes occurring in the FCPA that could be caused in part by management actions on BLM lands. For example, there is a noticeable shift in Campbell and Johnson counties from a rural-agricultural lifestyle to rural-industrial lifestyle as more land is converted from traditional agriculture (farm and ranchland) to CBNG or other energy resource

development land use. Landowners could sense that they do not have control over the land use decisions because of split estate ownership. The subsurface mineral owner can make the decision to recover the minerals based on market conditions and the surface owner must comply with that decision. The accelerating rate of mineral development in the FCPA can result in landowners feeling vulnerable and that their quality of life could degrade as they watch their traditional way of life disappear.

In addition, mineral development can increase the value of undisturbed landscapes in the region. For instance, the WSA could increase in value as significant tracts of this ecosystem are developed. The large stretches of the sagebrush shrubland landscape that are not crossed by roads or covered with tanks, pumps, and other equipment are becoming rare in the area. Therefore, tracts of land that are protected from development are gaining value because they offer a unique viewshed and isolated recreation opportunities as well as "existence value" for people that do not live in the area but value the existence of wide-open spaces.

The social indicators used to measure social impacts are based on the rate of change in Campbell, Johnson, and Sheridan counties and include:

- Rate of change in population;
- Rate of change in household income; and
- Rate of change in land use (acres converted from traditional agriculture to other uses).

These indicators are designed to quantitatively illustrate the rate of change for key factors that influence social stability and structure in the counties.

3.4.2.2. Current Conditions and Trends

Current social conditions in Campbell and Johnson counties are best summarized by the counties in their descriptions of their culture and place:

> "The history, custom, and culture of the people of Johnson County have, in part, shaped the type and location of land uses within Johnson County. The expansion of agriculture and development of other natural resources also led to the formation of various small communities in Johnson County. Today, employment and income in Johnson County are primarily generated from several economic sectors including agriculture, oil, gas and mineral exploration and development, tourism, retail trade, and, government." (Johnson County 2005)

> "The culture of Campbell County is tied to the land. A love for this land often grows on the visitor to Campbell County, like the passion for the land experienced by the people who own and work it. With ownership comes the duty of stewardship of the land. 'If we take care of the land, the land will take care of us' has often been quoted by old-timers within the county" (Campbell County 2007b)

The community structure in Campbell and Johnson counties is best summarized in the description included in Campbell County's Land Use Plan (Campbell County 2007b):

> "Historically, in the agricultural community, many family farm and ranch operations have been retained in the same family for generations. A heritage of values, traditions, and ethics are passed on as well and likewise in the coal mining, oil production, and CBNG communities. Campbell County has a wealth of community pride and spirit. The pride and

culture of the agricultural community is displayed in the numerous rodeos, brandings, and the county fair held each year. In the same manner, the pride and culture of the mineral extraction communities are displayed in several trade fairs for the oil and gas production industries and numerous tours of the area coal mines.

The communities of Campbell County are generally in harmony with each other. Each economic community understands the importance of the others to the whole of Campbell County. It is well understood that what impacts one community impacts the whole community. Other cultural traits of Campbell County are cohesiveness, family, sticking to traditions, values, and ethics of doing what is right and what works."

The major trend affecting social structure and stability in the FCPA is the shift from traditional agriculture as an economic base and primary land use to mineral development and extraction including coal and CBNG. As noted in the Campbell County Land Use Plan, the balance between these two industries is the key to social stability:

"The multiple use of State and Federal land for agriculture, mineral development and extraction, wildlife habitat, and recreation helps sustain the social stability of Campbell County. Production agriculture has been the mainstay for the economy and social structure and will remain so even as the energy industry fluctuates with the markets and declines as energy resources are used up. These major industries are all interfaced in that they are dependent on the land and the resources it contains. The impacts affecting one industry often affect the other industries. These industries are subject to the decisions and actions of Federal and State agencies. Therefore, it is very important that these industry communities within the community of Campbell County have representation through the local county government in the planning, decisions, and actions of Federal and State agencies that affect the use and management of the land surface and the subsurface resources." (Campbell County 2007b)

A quantitative measure of these trends is illustrated in Table 3-20, which shows the average rate of change in population and personal income by decade from 1980 and forecasted through 2020 in Campbell, Johnson, and Sheridan counties. These same measures are shown for the State of Wyoming for comparison. Johnson and Campbell counties have experienced population growth at a rate at least twice the state average since 1990 and this trend is expected to continue through 2020. Over the past several decades, population in Sheridan County has been growing slowly and steadily with a projected annual county compound growth rate of just under 1 percent per year (Sheridan County 2008).

Table 3-20 Social Indicators – Average Rate of Change of Population and Personal Income by Decade

Location	1970-1980	1980-1990	1990-2000	2000-2010	2010-2020
Campbell County					
Population	93%	17%	16%	27%	22%
Personal Income	688%	52%	71%	n/a	n/a
Johnson County					
Population	20%	-9%	15%	24%	18%
	225%	58%	69%	n/a	n/a

Table 3-20 Social Indicators – Average Rate of Change of Population and Personal Income by Decade					
Location	**1970-1980**	**1980-1990**	**1990-2000**	**2000-2010**	**2010-2020**
Personal Income					
Sheridan County					
Population	41%	-6%	11%	8%	5%
Personal Income	292%	48%	42%	n/a	n/a
State of Wyoming					
Population	42%	-4%	9%	9%	7%
Personal Income	326%	47%	72%	n/a	n/a
Source: BEA 2000 and WY EAD 2006a.					

The Johnson County Land Use Plan also found that the increase in population is due in large part to in-migration from other states. The Plan notes that about one-quarter of all persons living in Buffalo, Wyoming in April 2000 lived in a different state in 1995 (Johnson County 2005). An additional 8 percent had previously lived in another county in Wyoming. Using driver's license data, the Plan researchers found that during the 2000 to 2002 period, 732 persons exchanged an existing driver's license from another state for a new Wyoming driver's license and about 20 percent were 56 years or older.

The shift in land use is reflected in the amount of agricultural land and the size of farms. Agricultural land comprises more than half of the surface area of Wyoming and 94 percent of the private land. In 2002, 84 percent of land in Campbell County and 81 percent of land in Johnson County were in use as farms or ranches (Campbell County 2007b, USDA 2002). The Campbell County Land Use Plan notes livestock production was the leading industry prior to mineral development. Between 1997 and 2002, there was shift away from traditional management emphasis on agricultural production to a more non-traditional emphasis such as amenity and lifestyle (Foulke, Coupal, and Taylor 2005). This is illustrated by the shift from medium-sized farms to smaller farms. For example, between 1997 and 2002, the total number of farms stayed about the same in Campbell and Johnson counties. However, the number of farms sized 220 to 259 acres fell by half, and farms sized 70 to 99 acres doubled (USDA 2002). Forecasts for land conversion in Wyoming estimate that 2.6 million acres of ranchland could be converted to residential development by 2020 (Taylor 2003). These land use trends indicate that the wide-open vistas and large tracts of open rangeland will likely become scarcer in the future in the three counties. In Sheridan County, 62 percent of the land area is dedicated to agricultural use (Sheridan County 2008). However, about two-thirds of the population of Sheridan County lives in incorporated areas, primarily the City of Sheridan.

All three counties in the FCPA have enacted land use plans with the goal to balance development to preserve the rural character of the region and maintain economic diversity. The boom-bust cycle of economic development has been experienced throughout the region's history and is expected to continue as either the price or production of energy resources is reduced. As noted in the economic forecast section, Wyoming is especially vulnerable to boom-bust economic cycles because of the high concentration of jobs and income tied to the energy industry. The social

impacts related to boom-bust cycles are the sudden need for housing, infrastructure, and social services caused by peak in-migration during the boom and the oversupply of these same services after the bust. Additionally, rapid in-migration can cause social instability by changing the racial, economic, and cultural profile of the communities.

Campbell and Johnson counties have been experiencing rapid in-migration, population growth, and land use change since 1990 and this trend is expected to continue into the foreseeable future. Both counties have been investing some of the increased revenues from the energy boom into expanding services and diversifying their economies. However, like the State of Wyoming, they are both vulnerable because of the relatively small population and lack of metropolitan areas and opportunities for economic and social diversity.

Agriculture has traditionally balanced the boom-bust cycles in Wyoming. Currently, tourism and amenity migration are also offering some diversity and balance to energy development in Campbell, Johnson, and Sheridan counties. However, tourism and amenity migration could be jeopardized by the industrial development related to the energy boom. While it has not been measured, tourists and retirees could prefer to visit or move to places with less developed landscapes. This trend points to the need for preserving some areas in the FCPA for remote recreation and undeveloped landscapes to maintain some diversity and balance as a hedge against an energy resource downturn.

3.4.3. Environmental Justice

Environmental justice in minority and low-income populations identifies and addresses those potential human health and environmental effects of BLM management actions that could disproportionately affect these vulnerable populations. The environmental justice assessment completed for the PRB O&G FEIS (BLM 2003a) covers the potential actions. There are unlikely to be any significant environmental justice impacts associated with the proposed actions because there are no significant minorities or low-income populations in the area.

In 2000, Campbell County's population was 96 percent white by race, Johnson County's population was 97 percent white by race, and Sheridan County's was 96 percent white by race (Headwaters Economics 2007 a, b, and c). This reflects the racial profile of Wyoming which was 92 percent white by race in 2000. The closest Indian reservation or other significant concentration of minority population is the Crow Reservation in Montana.

In 2004, the overall poverty rate in Wyoming was 10.3 percent and the poverty rate for children (persons aged 0 to 17 years) was 13.7 percent (WY EAD 2006a). In Campbell County the overall poverty rate in 2004 was 7.9 percent, and in children, 9.4 percent. In Johnson County, the overall poverty rate was 8.7 percent and 11.5 percent in children. In Sheridan County, the overall poverty rate in 2005 was 9.1 percent and in children, 14.2 percent. These same trends are reflected in median household income. In 2004, median household income in Wyoming was $43,800. In Campbell County, median household income was $60,800 in 2004; in Johnson County, it was $42,300; and in Sheridan County, it was $40,200 (WY EAD 2006a).

4.0 ENVIRONMENTAL CONSEQUENCES

4.1 Introduction

This chapter describes and compares the environmental consequences that may result from implementing the three alternatives presented in Chapter 2. The purpose of this chapter is to present the analyses of the alternative management actions and to disclose the potential impacts of the Federal action on resources within the Fortification Creek Planning Area (FCPA) and surrounding area. The Federal action is the Bureau of Land Management's (BLM's) selection of an alternative that will guide the management of the FCPA. The human environment is considered to include both the human environment (natural, cultural, and socioeconomic) resources and BLM multiple-use land management programs or resource uses (e.g., lands and realty, wilderness, recreation, and energy and minerals).

The potential consequences or impacts of each alternative are addressed in the same order of resource topics as was presented in Chapter 3 (i.e., Resources, Resource Uses, Special Designations, and Socioeconomics and Environmental Justice). This parallel organization will allow readers to compare existing resource conditions (Chapter 3) with potential impacts (Chapter 4) for the same resource(s). The impact analysis of environmental consequences emphasizes key planning issues (see Chapter 1) raised during the scoping process, rather than all possible consequences.

Potential impacts for a particular resource or resource use are discussed primarily in terms of the direct physical change and the indirect consequences of change resulting from the specific management of that resource or resource use under a particular alternative. In addition, discussion is included for impacts from other management on a specific resource or resource use resulting from:

- The anticipated level of coal bed natural gas (CBNG) development;
- Elk and special status species management; and
- Management of other resources that may impact the particular resource or resource use under discussion.

The two exceptions to this organization occur in the discussion of Air Quality (Section 4.3.1) and Socioeconomics and Environmental Justice (Section 4.6). In the case of Air Quality, the impact analysis for CBNG development was conducted for the highest level of potential air quality impacts of the alternatives. Therefore, one analysis covers Alternatives I, II, and III and is based on the alternative with the most development. The Environmental Justice analysis is not dependent on fluid minerals or wildlife management actions; therefore, the analysis covers all alternatives.

As discussed in Chapter 2, it is important to remember that the actions described under each alternative would not necessarily be permitted by the adoption of any alternative as a result of the planning process. For example, although new CBNG development may be allowed under some of the alternatives, actual development would only occur after any proposed well locations, road and/or pipeline alignments, and/or other facilities/infrastructure have gone through a permitting process and further National Environmental Policy Act (NEPA) analysis. Furthermore, while the assumptions associated with the alternatives represent reasonable projections of what could occur, it is impossible to predict with certainty the precise location of potential development or a

structure, or the precise outcome of any of the alternatives, because of the large number of variables involved.

4.1.1. Analytical Assumptions

The analysis of alternatives describes how each alternative could affect baseline conditions of individual resources in the FCPA. Impacts are typically described by topic, such as surface disturbance, and other resources or resource uses. If a particular allowable use or management action is not discussed for a particular resource, then no impacts are expected or the anticipated impact is considered extremely small or highly unlikely to occur.

4.1.2. Types of Effects

When applicable, definitions of the following types of impacts are included in the evaluation of reasonably expected environmental consequences (speculative impacts are not addressed), including:

- Direct/Indirect Impacts: In general, direct impacts result from activities authorized by BLM and generally occur at the same time and place as the management activity or action causing the impact. For example, for the action of building a road, a direct adverse impact is surface disturbance. Surface disturbance is the impact (the effect) of heavy equipment (the cause) removing existing vegetation as it grades the proposed road location. Indirect impacts often occur at some distance or time from the action. In the above example, an indirect impact could occur days after the surface is disturbed, as well as some distance from the disturbance. Heavy precipitation following the removal of vegetation and/or disturbance of the ground surface could erode soil and transport sediment into streams. The impact on stream water quality is considered an indirect adverse impact.
- Onsite/Offsite Impacts: Onsite impacts occur within the FCPA. Offsite impacts occur outside the FCPA, but result from an action taken within the FCPA. The degree to which land uses, management actions, and environmental changes under the alternatives would affect other lands depends on the absolute and relative amount of onsite changes, the causal linkage between onsite changes and offsite consequences, and the relationship between changes resulting from the alternative and those that would occur without the alternative.
- Short- or Long-Term Impacts: When applicable, the short-term or long-term aspects of impacts are described. Short-term disturbance (pipelines, off-pad disturbance) occurs during or after the activity or action and for this Proposed Resource Management Plan Amendment/ Environmental Assessment (PRMPA/EA), will be called initial disturbance. While reclamation starts immediately after the disturbance to stabilize the area, revegetation may occur within five years; however, vegetation structure, function, and diversity would not return to pre-disturbance status for decades. Long-term impacts last beyond the construction phase, generally beyond the first two years (roads, well pads).
- Cumulative Impacts: Cumulative impacts result from the interaction of impacts of the alternative along with impacts resulting independently from unrelated non-Federal actions and activities. Cumulative impacts may include private lands within and adjacent to the FCPA (i.e., CBNG development of non-Federal minerals), as well as both private and public lands outside the FCPA. Additionally, cumulative impacts are not necessarily limited to the types of actions and activities affecting BLM lands in the FCPA.

4.1.2.1. Cumulative Impacts

The Council on Environmental Quality (CEQ) regulations state that the cumulative impact analysis should include the anticipated impacts to the environment resulting from "the incremental impacts of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over time." (40 Code of Federal Regulations [CFR] 1508.7)

Impacts of the proposed action and alternatives presented in this PRMPA/EA are assessed for cumulative impacts with other actions conducted in the region. Unless otherwise specified, the region of influence for each resource in the cumulative analysis is the same as the area defined in Chapter 3. This analysis considers the effects of the management actions considered under each of the alternatives when combined with the effects of other past, present, and future actions in the affected region.

Cumulative actions include CBNG development actions and other proposed land actions and use of those lands, and other reasonably foreseeable future actions. In the Powder River Basin (PRB) these activities include ranching, coal mining, and CBNG and conventional oil and gas development. These activities affect similar elements of the environment in that they remove surface vegetation, reduce native species and habitat, may introduce invasive species, cause sedimentation to surface water bodies, deplete groundwater aquifers, and introduce hazardous materials to lands and waters.

CBNG development in the FCPA may have an adverse cumulative effect on one or more elements of the environment when combined with other activities in the region. Most significant of these activities is CBNG and conventional oil and gas development on surrounding Federal, State, and private lands.

Quantification of cumulative impacts is difficult for the resources, land uses, and management actions due to:

- Uncertainties regarding the location, scale, and/or rate of changes on BLM lands in the FCPA resulting from the alternatives; and
- Uncertainties about the location, scale, and rate of changes on private lands in, adjacent to, or near the FCPA that would occur irrespective of the alternative.

All of the impacts associated with the implementation of any of the alternatives would be in addition to ongoing existing impacts occurring on Federal lands in the FCPA, private lands within the FCPA, and both public and private lands adjacent to, or near, the FCPA. Even where an estimate of cumulative impacts resulting from offsite causes is available (e.g., the number of CBNG wells in the PRB), it is not known how much long-term surface disturbance would result, to what degree adverse impacts would be avoided or mitigated, or how the impacts would affect other resource values and land uses (e.g., hunting, visual quality, livestock grazing). Therefore, the descriptions of cumulative impacts for the individual resources addressed in Sections 4.3 through 4.6 are necessarily qualitative.

The boundaries used to define impact sources and levels differ by resource. For example:

- For wide-ranging wildlife, such as elk, the cumulative impact area may include offsite habitats that are used by onsite populations and that are subject to impacts from development in the offsite areas; and
- For surface water quality, the cumulative impact area may be one or more watersheds, including all pollutant sources that affect the same water quality parameters potentially impacted by the implemented alternative.

Although these are only examples, they illustrate that cumulative impact boundaries may not only differ considerably among resources, but that the boundaries may be either natural or artificial.

4.2 Methods and Assumptions

The timing and specific location of project-specific actions that could affect resource values are not defined. Moreover, the relationship between cause (future actions) and effect (impact on resources) is not always known or quantifiable. For these reasons, the analysis of alternatives is both qualitative and quantitative and is based on a series of assumptions. The methods and assumptions listed below, and for each resource in the following sections, are presented to provide a basis for the conclusions reached. Assumptions common to all alternatives and all resources are listed below, whereas assumptions unique to specific resources and resource uses are listed under the appropriate resource section:

- All alternatives are implemented in compliance with standard practices, best management practices (BMPs), guidelines for surface-disturbing activities, and applicable laws, standards, policies, and implementation plans, as well as with all BLM polices and regulations.
- An oil and gas lease (including CBNG) grants the lessee the “right and privilege to drill for, mine, extract, remove, and dispose of all oil and gas deposits” in the leased lands, subject to the terms and conditions incorporated in the lease (BLM Form 3100-11, Lease for Oil and Gas). The Secretary of the Interior has the authority and responsibility to protect the environment within Federal oil and gas leases; therefore, restrictions are imposed on the lease terms.
- Provisions in leases that expressly provide BLM the authority to deny or restrict development, in whole or in part, depend on an opinion provided by the U.S. Fish and Wildlife Service (USFWS) regarding impacts to endangered or threatened species or to habitats of plants and animals that are listed or proposed for listing. If the USFWS concludes that the development likely would jeopardize the continued existence of any endangered or threatened plant or animal species, then the development may be denied in whole or in part.
- Although not defined as a surface-disturbing activity, concentrated livestock and wild ungulate grazing, off-road vehicle use, and fire may remove vegetation and expose the soil surface leading to increased erosion.
- Comparison of impacts among resources is intended to provide an impartial assessment to inform the decision maker and the public. The impact analysis does not imply or assign a value or numerical ranking to impacts. Actions resulting in adverse impacts to one resource may impart a beneficial impact to other resources.
- Key planning issues identified in Chapter 1 provide the focus for the scope of impact analyses in this chapter.

- In general, adverse impacts described in this chapter are considered important if they result from, or relate to:

  The key planning issues described in Chapter 1;

  Context and/or intensity of impacts suggesting potential impacts to public health and safety;

  A potential for violating legal standards, laws, and/or protective status of resources; and/or

  Potential impacts to unique resources.
- The comparison of individual alternatives is qualitative, relative to Alternative I (the No Action Alternative), and based on professional judgment and consideration of the context and intensity of allowable uses and management actions anticipated to impact resources and resource uses.
- Analysis of environmental consequences considered the extent of projected surface disturbance and associated development from BLM actions.
- Analysis of environmental consequences focuses on the anticipated incremental and meaningful impact of management actions and the allowable uses proposed for each alternative. The impact of past and present actions is encompassed within the description of existing conditions in Chapter 3, Affected Environment.
- Split estate lands (e.g., Federal mineral/private surface) will be treated the same as BLM surface lands.
- An 80-acre well spacing, excluding non-Federal minerals and the Wilderness Study Area (WSA).
- Well pads, roads, and ancillary facility disturbances calculated from an 80-acre well spacing, excluding non-Federal minerals and the WSA.
- All BLM BMPs and other BLM mitigation measures and conditions will be conducted on private surface lands overlying Federal mineral estate in the same manner as BLM surface lands.
- Because special status species presence is very limited, only restrictions and limitations for elk (and no other special status species) will be considered in this analysis, unless otherwise noted.

4.2.1. General Levels of Impacts

To reduce the necessarily complex impact analysis process to readily understandable terms, the following subsections use a qualitative approach for summarizing impacts to specific resources, management actions, and uses. For some resources the impacts are defined more quantitatively, while others remain as general levels of impact. In terms of duration, impacts may be initial and related to the construction phase of the project (generally less than two years) or long-term (greater than two years).

4.2.2. Impact Analysis Components

The starting point for analysis of the alternatives is the Analysis of the Management Situation (AMS; BLM 2008a) and the Reasonably Foreseeable Development (RFD) scenario (BLM 2001d) for CBNG development in the FCPA. Because the Powder River Basin Oil and Gas Final Environmental Impact Statement (PRB O&G FEIS; BLM 2003a) and RFD addresses CBNG development for the entire PRB, BLM developed separate estimates for the much smaller FCPA.

For this analysis, well estimates were calculated from existing and projected roads. The 80-acre blocks were counted if at least 50 percent of the block was Federal mineral estate and could be reached from the road network. Ancillary facilities and disturbance associated with each alternative were calculated using estimates identified in the PRB O&G FEIS (BLM 2003a). The estimated number of well locations and ancillary facilities allows BLM to calculate projected disturbance, which is used throughout the impact analysis. The estimates in Table 4-1 are not intended to define the specific numbers and locations of wells (multiple wells may be drilled at a single location each targeting a different coal seam) needed to develop the CBNG resource. Instead, they allow flexibility during resource development while providing sufficient specificity to support the impact analysis and the alternative selection processes.

The estimated number of wells, well pads, roads, ancillary facilities, and associated disturbance are shown in Table 4-1. Assumptions for the disturbance calculations are included in Appendix E.

4.2.3. Protective Stipulations and Other Restrictions on Surface Use

The RFD does not incorporate all of the land management direction and multiple-use considerations that BLM must take into account as part of its responsibilities under the Federal Land Policy and Management Act (FLPMA). Therefore, in developing the alternatives, assumptions in the RFD were subjected to various “screens” or “filters” representing restrictions designed to protect specific resource values and meet BLM’s multiple-use and sustainability mandates. Protection of specific resources is accomplished by a combination of management actions and the surface use stipulations described in Section 2.2 and in lease terms and conditions. These include:

- Restrictions on slopes greater than 25 percent and highly erosive soils.
- Restrictions to protect fragile watersheds.
- TL (Timing Limitations) – BLM may allow specified activities within the area, and at a proposed location, but not during certain sensitive seasons. Examples include raptor nesting areas, bald eagle winter roosting areas, and big game crucial winter range. It is important to note that TL restrictions can apply to areas with standard restrictions and limitations.

Note that on split estate lands (i.e., Federal minerals but private surface) the TL restrictions would be applied only as stipulations for activities related to mineral exploration and development, such as drilling for oil and gas. This is because the Federal mineral estate creates a nexus by which BLM may regulate aspects of these activities that occur on the surface as well as the subsurface. BLM does not regulate or manage other types of activities on split estate lands (e.g., grazing, recreation, utilities rights-of-way [ROWs], etc.).

Table 4-1 Estimated New Wells, Facilities, and Disturbance – Fortification Creek Planning Area

	Projected New Wells and Facilities			Estimated Initial Disturbance (acres)			Estimated Long-Term Disturbance (acres)		
	Alternative I	**Alternative II**	**Alternative III (Proposed Action)**	**Alternative I**	**Alternative II**	**Alternative III (Proposed Action)**	**Alternative I**	**Alternative II**	**Alternative III (Proposed Action)**
Number of Wells	726	487	483						
Miles of New Roads									
Improved	125	71	54	727	411	313	363	206	156
Two-track	54	30	23	311	176	134	156	88	67
Total	**179**	**101**	**77**	**1,038**	**587**	**447**	**519**	**294**	**223**
Miles of Pipeline									
3-inch pipe	260	175	173	625	419	416	0	0	0
12-inch pipe	98	66	65	598	401	398	0	0	0
Steel Pipe	26	18	17	316	212	210	0	0	0
Overhead Electric (miles)	9.3	2.5	1.6	33	9	6	5	1	1
Compressors and Facilities									
Booster units	20	13	13						
Reciprocating units	6	4	4						
Booster stations	3	2	2	7	5	5	1	1	1

Table 4-1 Estimated New Wells, Facilities, and Disturbance – Fortification Creek Planning Area

	Projected New Wells and Facilities			Estimated Initial Disturbance (acres)			Estimated Long-Term Disturbance (acres)		
	Alternative I	Alternative II	Alternative III (Proposed Action)	Alternative I	Alternative II	Alternative III (Proposed Action)	Alternative I	Alternative II	Alternative III (Proposed Action)
Reciprocating stations	1	1	1	6	4	4	1	1	1
Central Metering Facilities	72	48	48	14	10	10	7	5	5
Water Facilities	108	73	72	390	262	260	390	262	260
Total Disturbance				**3,536**	**2,249**	**2,092**	**1,141**	**709**	**635**

In addition to the restrictions and limitations on surface uses and management activities outlined above, BLM may require specific BMPs to mitigate environmental effects. BMPs are found in Appendix F and examples include the required use of the following:

- Culverts at stream crossings;
- Special road design or dust suppression techniques to reduce impacts from aerial deposition of particulates on nearby streams and vegetation;
- Biodegradable erosion-control fabrics to ensure soil stability and enhance revegetation;
- Fences to exclude livestock from sensitive habitats; and
- Specialized revegetation using only native species and possibly requiring that woody plants (trees and shrubs) be included in the seed mix or planted as containerized stock ("tubelings").

These measures, and the protective stipulations cited above, would be applied not just to CBNG development and grazing, but also as appropriate to recreation, aquatic and riparian habitat enhancements, prescribed fires, and construction or routine maintenance in ROWs and easements.

4.3 Resources and Resource Uses

The following impact analysis includes evaluation of all resources and resources uses. Wildlife and fluid minerals are the resources or resource uses that would receive the most impact in the FCPA; therefore each is discussed in relation to each resource or resource use, as well as for each alternative. This arrangement may result in some repetition where management actions are similar for all alternatives; however, it allows a better understanding of the impact of important management actions across all resources and resource uses. A summary of impacts is also provided for each resource or resource use. Each resource is discussed in the same order as it was presented in Chapter 3.

4.3.1. Air Quality

In the case of air quality, the impact analysis for CBNG development was conducted in terms of the highest level of potential air quality impacts of the action alternatives (although not at "worst-case" scenario levels). Therefore, one analysis covers Alternatives I, II, and III and is based on the alternative with the most development.

Proposed Alternatives

The number of proposed facilities and estimates of disturbance considered in the PRMPA/EA are presented in Table 4-1. A comparison of these alternatives, using Alternative I as the baseline case, will yield the following information:

- Alternative I, the No Action Alternative, includes approximately 179 miles of new roads and 3,536 acres of short-term disturbance. Alternative I has the most wells, pipelines, and facilities.
- Alternative II includes approximately 101 miles of new roads and 2,249 acres of short-term disturbance. Alternative II has fewer wells, pipelines, and facilities than Alternative I.
- Alternative III, the Proposed Action, includes 77 miles of new roads and 2,092 acres of short-term disturbance. However, the Proposed Action includes fewer wells, pipelines, and facilities than Alternative I.

Air Quality Impacts

The proposed disturbance in Table 4-1 for the FCPA will result in air quality impacts because of the following sources and operations:

- Continuous air emissions for the operation of the temporary diesel generators (typically one for every six wells for two years) and from the combustion of fuel by booster and reciprocating compressors. Compressor emissions will continue for the life of the wells in the FCPA.
- Continuous emissions because of fugitive road dust and tailpipe emissions from motorized vehicles in the FCPA required to service the wells, booster and reciprocating compressors, temporary generators, and water management facilities.
- Temporary air emissions because of construction and transportation in the FCPA. These emissions will consist of fugitive particulate due to wind erosion, and land disturbance activities and tailpipe emissions from motorized vehicles during the construction process.

Gas Compression Station Emissions

The air emissions from the gas compression stations will be due to the combustion of diesel fuel in the operation of the booster units and reciprocating units as presented in each alternative in Table 4-1.

The operational and emission assumptions are presented in Table 4-2 for the booster units and in Table 4-3 for the reciprocating units. The emissions factors for these units were obtained from U.S. Environmental Protection Agency (EPA) AP-42 (EPA 2004) and Table 4-4 presents a summary of criteria pollutant emissions and formaldehyde for each alternative.

Transportation Emissions for Final Configuration

As previously stated, the transportation emissions for the operational configuration for each alternative are based on tailpipe emissions and roadway fugitive particulate for diesel trucks that will be utilized in the maintenance and servicing of the wells and facilities. These emissions are presented in Table 4-5 and Table 4-6 on a per-well basis, and are summarized for each alternative in Table 4-7 on an annual basis. These emissions are based on the use of light diesel trucks and the conservative assumption that an average of 250 miles per year (based on 5 miles per well once a week for 50 weeks) of travel will be required.

Table 4-2 Well Booster Unit Emissions Calculations – FCPA				
Gas Compression Booster Unit				
Fuel Combustion Source				
Engine design (hp/hr)	350			
Operating Parameters				
Operated:	24 hours/day	7 days/wk	365 days/yr	
Operating hours:	8,760			
Engine rating:	6,601	Btu/hp-		

Table 4-2 Well Booster Unit Emissions Calculations – FCPA				
Gas Compression Booster Unit				
		hour		
Capacity (%):	100	(while operating)		
Annual load (%):	Winter:	25	Spring:	25
	Summer:	25	Fall:	25
Potential Fuel Combustion for the Year for Unit				
Heat content:	152,000	Btu/gal		
Hourly heat input rate:	2.31	MMBtu/hr		
Annual fuel consumption:	133,129	gal/yr		

Table 4-2 Well Booster Unit Emissions Calculations – FCPA				
Gas Compression Booster Unit				
Emissions Data	**Emissions Factor[1] (lb/MMBtu)**	**Emissions (lb/hr)**	**Emissions (tpy)**	**Method of Determination**
NO_X	4.41	10.19	44.62	AP-42
CO	0.95	2.19	9.61	AP-42
SO_2	0.29	0.67	2.93	AP-42
PM_{10} including condensable	0.31	0.72	3.14	AP-42
$PM_{2.5}$ including condensable	0.31	0.72	3.14	AP-42
VOC	0.35	0.81	3.54	AP-42
Formaldehyde	0.07	0.16	0.71	AP-42

[1] Based on emissions factor for uncontrolled diesel engine, taken from AP-42 Table 3.3-1 (EPA 2004)

Key:
hp/hr = Horsepower per hour
Btu/hp-hour = British thermal units per horsepower-hour
MMBtu/hr = Million British thermal units
gal/yr = Gallons per year
lb/MMBtu = Pounds per million British thermal units
lb/hr = Pounds per hours
tpy = Tons per year
NOx = Oxides of nitrogen
CO = Carbon monoxide
SO_2 = Sulfur dioxide
PM_{10} = Particulate matter of 10 microns or less
$PM_{2.5}$ = Particulate matter of 2.5 microns or less
VOCs = Volatile organic compounds

Table 4-3 Well Reciprocating Unit Emissions Calculations – FCPA				
Gas Compression Reciprocating Unit Emission Calculations				
Fuel Combustion Source				
Engine design (hp/hr):	1,650			
Operating Parameters				

Table 4-3 Well Reciprocating Unit Emissions Calculations – FCPA				
Gas Compression Reciprocating Unit Emission Calculations				
Operated:	24 hours/day	7 days/wk	365 days/year	
Operating hours:	8,760			
Engine rating:	6,601	Btu/hp-hr		
Capacity (%):	100	(while operating)		
Annual load (%):	Winter:	25	Spring:	25
	Summer:	25	Fall:	25
Potential Fuel Combustion for the Year for Unit				
Heat content:	152,000	Btu/gallon		
Hourly heat input rate:	10.89	MMBtu/hr		
Volume of gas combusted:	627,608	gal/yr		

Table 4-3 Well Reciprocating Units Emissions Calculations – FCPA				
Gas Compression Reciprocating Unit Emission Calculation				
Emission Data	**Emission Factor[1] (lb/MMBtu)**	**Emissions (lb/hr)**	**Emissions (tpy)**	**Method of Determination**
NO_X	4.41	48.02	210.35	AP-42
CO	0.95	10.35	45.31	AP-42
SO_2	0.29	3.16	13.83	AP-42
PM_{10} including condensable	0.31	3.38	14.79	AP-42
$PM_{2.5}$ including condensable	0.31	3.38	14.79	AP-42
VOCs	0.35	3.81	16.69	AP-42
Formaldehyde	0.07	0.76	3.34	AP-42

[1] Based on emissions factor for uncontrolled diesel engine, taken from AP-42 Table 3.3-1 (EPA 2004)

Table 4-4 Comparison of Air Quality Impacts Due to Booster Units and Reciprocating Units for Gas Wells

Pollutants	Alternative I			Alternative II			Alternative III (Proposed Action)		
	Booster Units (tpy)	Reciprocating Units (tpy)	Total	Booster Units (tpy)	Reciprocating Units (tpy)	Total	Booster Units (tpy)	Reciprocating Units (tpy)	Total
NO_X	825.8	1,167.66	1,993.46	536.77	778.44	1,315.21	536.77	778.44	1,315.21
CO	64.2	90.72	154.92	41.73	60.48	102.21	41.73	60.48	102.21
VOC	23.88	33.78	57.66	15.52	22.52	38.04	15.52	22.52	38.04
PM_{10}	2	2.838	4.84	1.3	1.89	3.192	1.30	1.89	3.19
SO_2	0.12	0.168	0.29	0.08	0.11	0.19	0.08	0.11	0.19
Formaldehyde	10.68	15.12	25.80	6.94	10.08	17.02	6.94	10.08	17.02

Table 4-5 Tailpipe Emissions Due to Motorized Vehicles for Gas Well Service and Maintenance				
Pollutant	**Emission [1] Factor (g/mi)**	**Average Speed (mph)**	**Average miles traveled/year/well (mi/yr)**	**Average Emissions per well (tpy)**
CO	14.74	20	250	0.00406
NO_X	11.44	20	250	0.00315
SO_2 [2]	0.32	20	250	0.00009
VOC	5.69	20	250	0.00157

Assumptions:
1 AP-42 (EPA 2004), Table 2.7.1 "Volume II Mobile Sources" For heavy-duty diesel-engine powered trucks, high altitude, 20 miles per hour, "aged" with 50,000 miles, 1997+ model.
2 The SO_2 emission factor is calculated assuming 10 mpg fuel consumption, with 0.05% sulfur content of #2 diesel fuel, and fuel density of 7.08 pounds per gallon (lb/gal).

Table 4-6 PM Emissions Due to Roadway Traffic for Gas Well Service and Maintenance				
Pollutant	**Emission[1] Factor (lb/VMT)**	**Vehicle Miles Traveled (VMT/well/yr)**	**Uncontrolled Emissions (lb/well/yr)**	**Controlled Emissions (lb/well/yr)**
PM_{10}	1.87	250	467.5	233.75
$PM_{2.5}$	0.29	250	72.5	36.25

Assumptions:
1 Haul trucks weight range is 28,000-80,000 pounds (lb). Average weight of 54,000 lbs used for calculations.
2 AP-42 (EPA 2004), Table 13.2.2-1, "Typical Silt Content Values of Surface Material on Industrial and Rural Unpaved Roads."
3 AP-42 (EPA 2004), Table 11.9-3, "Typical Values for Correction Factors Applicable to the Predictive Emission Factor Equations."
4 Controlled Emissions based on use of water and 50% efficiency.
5 AP-42 (EPA 2004), Table 13.2.2 "Unpaved Roads." Equations 1a and 1b.
6 Calculated as lb/VMT x VMT/well x control efficiency.
Key:
VMT = Vehicle miles traveled

Table 4-7 Summary of Roadway Emissions			
	Emission Rate (tpy)		
Pollutant	**Alternative I**	**Alternative II**	**Alternative III (Proposed Action)**
CO	2.95	1.98	1.88
NO_X	2.29	1.54	1.46
SO_2	0.06	0.04	0.04
VOCs	1.14	0.76	0.72
PM_{10}	84.85	56.92	54.25

Table 4-7 Summary of Roadway Emissions			
Emission Rate (tpy)			
Pollutant	**Alternative I**	**Alternative II**	**Alternative III (Proposed Action)**
$PM_{2.5}$	13.16	8.83	8.41
tpy = tons per year Assumptions: Alternative 1 = 726 wells Alternative 2 = 487 wells Alternative 3 = 483 wells			

Construction Emissions

The construction emissions for the planning alternatives are presented in Tables 4-8 and 4-9. Table 4-8 includes the emissions due to the installation of wells, pads, pipelines, and roadways, while Table 4-9 includes the emissions from the construction of facilities. The emission factors for these tables were obtained from the Draft Canyons of the Ancients National Monument Resource Management Plan and Draft Environmental Impact Statement (BLM 2007c). These emission factors are based on a per-well basis and are probably conservative for this project. The construction emissions are considered temporary, however, and all of the construction will not occur in a given year; therefore, the emissions may be spread over an extended time period.

Summary of Air Quality Impacts

Based on the previous discussion and the summary of emissions for each operational alternative, the following conclusions can be made:

- During the operational phase, well gas compression units are the greatest source of criteria pollutant emissions except for particulate. In the case of particulate, roadway sources result in the highest emission rate.
- A comparison of all alternatives shows that Alternative I provides the highest emission rate of all the alternatives; therefore, Alternatives II and III would result in an improvement in air quality.
- A comparison of the construction air emissions in Tables 4-8 and 4-9 for each alternative shows that Alternative I results in the highest emission rate for all criteria pollutants. Although the emissions in Table 4-8 appear high, they will occur only for a short time; therefore, the annual impact may be appreciably less.

Finally, it can be concluded that based on the emission data and the existing air quality, Alternatives II and III should result in moderately improved air quality and no expected violations of National Ambient Air Quality Standards (NAAQS); however, it should be noted that this conclusion is based on an emission inventory and is not substantiated by detailed air quality modeling.

Table 4-8 Well/Pipeline/Roadway Construction Emissions							
Pollutant	Emission Factor[1] (ton/well)	Alternative I		Alternative II		Alternative III (Proposed Action)	
		Number of wells	Tons	Number of wells	Tons	Number of wells	Tons
NO_X	10.2	726	7,405.20	487	4,967.40	483	4,926.60
CO	2.43	726	1,764.18	487	1,183.41	483	1,173.69
SO_2	0.68	726	493.68	487	331.16	483	328.44
PM_{10}	1.34	726	972.84	487	652.58	483	647.22
$PM_{2.5}$	0.81	726	588.06	487	394.47	483	391.23
VOCs	2.00	726	1,452.00	487	974.00	483	966.00

[1] Emission factors were obtained from Appendix J of the Draft Canyons of the Ancients National Monument Resource Management Plan and Environmental Impact Statement (BLM 2007c)

Table 4-9 Facilities Construction Emissions							
Pollutant	Emission Factor[1] (ton/facility)	Alternative I		Alternative II		Alternative III (Proposed Action)	
		Number of Facilities[2]	Tons	Number of Facilities[2]	Tons	Number of Facilities[2]	Tons
NO_X	0.64	210	134.4	141	90.24	140	89.6
CO	0.23	210	48.3	141	32.43	140	32.2
SO_2	0.07	210	14.7	141	9.87	140	9.8
PM_{10}	3.68	210	772.8	141	518.88	140	515.2
$PM_{2.5}$	0.44	210	92.4	141	62.04	140	61.6
VOCs	0.06	210	12.6	141	8.46	140	8.4

[1] Emission factors obtained from Appendix J of the Draft Canyons of the Ancients National Monument Resource Management Plan and Environmental Impact Statement (BLM 2007c).
[2] Sum of Booster Stations, Reciprocating Stations, Central Metering Facilities and Water Facilities

Cumulative Impacts

Cumulative impacts to air resources were evaluated for the entire PRB, including the FCPA, in the PRB O&G FEIS (BLM 2003a). Because the FCPA is small (100,655 acres) in comparison to the PRB (8 million acres) (approximately 1.3 percent), cumulative impacts from all three FCPA alternatives would be very small in comparison to the PRB impacts. Cumulative impacts to air resources described in the PRB O&G FEIS (BLM 2003a) indicate that there would be exceedances of nitrogen dioxide (NO_2) and particulate matter of 10 microns or less (PM_{10}) at the Northern Cheyenne Reservation. However, because the FCPA is south of the reservation and prevailing winds in the FCPA are from the southwest, it is unlikely that CBNG development would contribute substantially to these exceedances.

Cumulative impacts from CBNG development to the FCPA would include air resource impacts from CBNG development on non-Federal mineral estate (33,490 acres) within the FCPA and on both Federal and non-Federal mineral estate outside of the FCPA. Regional haze could increase in and near the FCPA and result in a change in visibility.

CBNG development in the FCPA and surrounding area may impact air quality and visibility as the result of substances being released into the atmosphere. The increase in the number of CBNG facilities, especially near county roads, will decrease the visual quality in the area. Dust, precipitated by an increase in traffic, is already a nuisance along county roads.

4.3.2. Soil Resources

The goal for soil resources management in the FCPA is to maintain, improve, or restore soil health and productivity, and to prevent or minimize soil erosion and compaction while supporting a multiple-use management objective. Soil management objectives will ensure that adequate soil protection is consistent with the resource capabilities and objectives for other resources/uses within the 100,655-acre FCPA. Management actions related to this goal that are common to all alternatives include:

- Management actions on BLM lands would be consistent with achieving or maintaining the Standards for Healthy Rangelands (BLM 1995a) and Guidelines for Livestock Grazing Management for Public Lands Administered by BLM in the State of Wyoming (BLM 1997).
- BLM would use county soil survey information to predict soil behavior, limitations, or suitability for a given activity or action.
- Prior to authorizing any surface-disturbing activity, BLM would evaluate the activity and, if necessary, apply mitigation measures, relocate the activity to a more suitable soil type, or deny the action.
- Surface-disturbing activities would be subject to an onsite evaluation to develop mitigation, if necessary, apply BMPs, and plan for reclamation. Site-specific measures would be developed for soils susceptible to erosion (e.g., water and wind), high sodium and salt content soils, soils with sparse vegetative cover, droughty soils, and/or shallow soils.
- Areas would be avoided where the erosion potential cannot be effectively controlled or mitigated, and reclamation treatments to BLM standards would likely be unsuccessful.

Evaluation Criteria

Assumptions not included in Section 4.2 but used in analyzing impacts to soil resources include the following:

- Approximately 34 percent (33,694 acres) of lands in the FCPA have slopes greater than 25 percent.
- Soils with high erosion potential (84,377 acres) are also present throughout the FCPA.
- Approximately 59 percent (59,343 acres) of lands within the FCPA have poor reclamation suitability.

Environmental consequences and alternative comparisons associated with CBNG development within the FCPA are based on an analysis of the most current data available and the best

professional judgment of the preparers. The following terms and definitions will be used to describe the anticipated impacts to soil resources for each of the alternatives, including:

- *Negligible* – The effect on soil resources is barely detectable. Less than 1 percent of the resource.
- *Minor* – The effect on soil resources is slight but detectable, and there would be small changes. Resource indicator thresholds are potentially exceeded, but on a short-term or highly localized basis. This could include surface disturbance that would affect approximately 1 to 5 percent of the FCPA soil resource.
- *Moderate* – The effect on soil resources is readily apparent, and there would be a measurable change that could result in a long-term or permanent change to the resource. Some resource indicator thresholds are exceeded. This could include surface disturbance that would affect 5 to 10 percent of the FCPA soil resource.
- *Major* – The effect on soil resources is large, and there would be a highly noticeable, long-term or permanent measurable change. Resource indicator thresholds are clearly exceeded. This could include surface disturbance that would impact more than 10 percent of the resource.

Alternative Analysis

Effects to the soil resource are primarily associated with the installation of roads, fluid minerals development of well pads and ancillary facilities, pipelines, water-handling facilities, and overhead and buried electric lines. Soil impacts result from the clearing of vegetation through excavation, stockpiling, compaction, and redistribution of soils during construction and reclamation operations, the retention or discharge of produced CBNG water, and vehicle traffic rutting and creation of road dust. The following alternative analysis considers direct and indirect impacts, as well as short-term and long-term impacts, to soil resources area wide.

The effects to soils resulting from well pad, access roads and pipeline construction include:

- Mixing of horizons – occurs where construction on roads, pipelines or other activities take place. Mixing may result in removal or relocation of organic matter and nutrients to depths where they would be unavailable for vegetative use. Soils that are more susceptible to wind and water erosion may be moved to the surface. Soil structure may be destroyed, which may impact infiltration rates. Less desirable inorganic compounds such as carbonates, salts, or weathered materials may be relocated and have a negative impact on revegetation. Soil horizon mixing may change the ecological integrity of the site and the recommended seed mix.
- Loss of soil vegetation cover, biologic crusts, organic matter, and productivity.
- Soil erosion would also affect soil health and productivity. Erosion rates are site specific and are dependent on soil, climate, topography, and cover.
- Soil compaction – the collapse of soil pores results in decreased infiltration and increased erosion potential. Factors affecting compaction include soil texture, moisture, organic matter, clay content and type, pressure exerted, and volume of vehicle traffic or machinery.
- Modification of hill slope hydrology.

These impacts, singly or in combination, would increase the potential for valuable soil loss due to increased water and wind erosion, invasive plant establishment, and increased sedimentation and salt loads to the watershed system.

Impacts to soil resources may differ in extent and severity, depending on specific management actions proposed under each alternative for different resource uses. The following sections describe the impacts under each alternative resulting from the management of soil resources, as well as those anticipated to result from the management actions proposed for wildlife and special status species and fluid minerals.

Alternative I (No Action Alternative)

Soil Resources Management

Alternative I, the No Action Alternative, would continue current management goals and objectives, including standard lease terms and conditions. Surface disturbance or occupancy would be prohibited on slopes greater than 25 percent and on highly erodible soils from March 1 through June 15.

Limited development may be authorized on highly erosive soils and slopes greater than 25 percent under the following conditions:

- Surface disturbance will not be authorized on slopes greater than 35 percent.
- Only linear features (roads, pipelines, electric lines, etc.) will be considered.
- An engineered reclamation plan acceptable to the authorized officer must be submitted with the project proposal.

Under the No Action Alternative, management actions could allow for the development of approximately 726 CBNG wells within the FCPA. Most leases include a stipulation or notice regarding development on slopes greater than 25 percent (Appendix G). The number of wells was determined from modeling potential road access and restricting road access to areas with less than a 25 percent slope.

Based on a disturbance estimate of 0.7 acre per well pad, the management action would thus allow approximately 508 acres of localized initial soil impacts within the FCPA (Table 4-1). If reclamation of the temporary impacts is successful, approximately 218 acres (0.3 acres per well) of localized permanent soil resource impacts within the FCPA would be realized with well pad establishment.

The development of CBNG ancillary facilities associated with 726 projected wells would include three booster stations, one reciprocating station, 72 metering stations, and associated pipelines. Based on an estimated initial and long-term disturbance area of approximately 2 acres per booster station, 5 acres per reciprocating station, and 0.2 acres per every 10 wells for metering facilities, approximately 27 acres of impacts are projected.

Anticipated impacts associated with the installation of either water or natural gas pipelines on soil resources within the FCPA would be dependent upon the type/size of pipe installed. Estimated disturbance areas were determined based on a 20-foot-wide corridor for 3-inch pipe; a 50-foot-wide corridor for 12-inch poly pipe; and a 100-foot-wide corridor for 12-inch steel pipe. Based on the corridor widths listed, approximately 625 acres (260 miles) of initial soil impacts would be realized for 3-inch pipe; 598 acres (98 miles) of initial soil impacts would be realized

for 12-inch poly pipe; and 316 acres (26 miles) of initial soil impacts would be realized for 12-inch steel pipe.

Management actions associated with Alternative I would allow approximately 179 miles of new roads within the FCPA. Based on a 48-foot-wide initial disturbance area, impacts to the soil resource would be approximately 1,038 acres. Long-term road impacts were determined based on a 24-foot-wide road width for the 179 miles listed above. It is anticipated that permanent road impacts to soil resources would be approximately 519 acres.

Under this alternative there would be approximately 9.3 miles of overhead power lines on non-Federal surface (no overhead electric lines on BLM surface lands). Underground utilities would be buried in road corridors and would not increase the amount of disturbance. The estimated buffer width of these roads follows Table 4-1.

Management actions under Alternative I could also allow the development of approximately 108 new CBNG water-handling facilities. Based on an estimated water impoundment area of 3.6 acres, the permanent soil resource impact would be approximately 390. Additional information on water treatment impacts is found in Section 4.3.3, Water Resources.

Approximately 34 percent (33,694 acres) of lands in the FCPA have slopes greater than 25 percent. Soils associated with steep landforms are highly susceptible to wind and water erosion. Soil resource management under this alternative would result in minor adverse initial impacts to soil resources because development of CBNG facilities will temporarily remove the existing vegetative cover on approximately 3,536 acres (3.5 percent) of the FCPA allowing for increased wind and water erosion, and soil compaction, as well as increasing the potential for sediment migration into perennial stream courses.

Limited development may be authorized on highly erosive soils and slopes greater than 25 percent under the following conditions:

- Surface disturbance will not be authorized on slopes greater than 35 percent.
- Only linear features (roads, pipelines, electric lines, etc.) will be considered.
- An engineered reclamation plan acceptable to the authorized officer must be submitted with the project proposal.

Impacts from these exceptions are expected to be minor.

Soil resource management actions associated with Alternative I would result in minor permanent impacts to soil resources on approximately 1,141 acres (1.1 percent) of the FCPA because projected CBNG well pad and ancillary facilities development will permanently alter the soil profile through compaction, alteration, changes to the soil chemistry from produced water storage, and soil loss (e.g., airborne dust, wind, and water).

Wildlife and Special Status Species Resources Management

Under this alternative, wildlife resources management, including specific elk management actions, provides TLs in elk habitat and for special status species. Because the TLs for elk and special status species are temporary, no impacts are anticipated. TLs may delay soil disturbance but will not prevent it.

Fluid Minerals Management

The BLM goal for CBNG management is to facilitate the extraction of CBNG and minimize the effects to the landscape that would impact the resource values in the FCPA. Management objectives are to identify stipulations, Conditions of Approval (COAs), and BMPs for exploration, development, production, and reclamation to ensure that activities would not impact other resource values in the FCPA.

Management actions specific to Alternative I include an unrestricted development pace and no geographic restrictions on ancillary and water management facilities. In addition, management actions for CBNG development would include an increase of 179 miles of roads and 9.3 miles of overhead power lines. The No Action Alternative would result in minor adverse impacts to 1,038 acres of soil resources caused by road disturbance. Additional adverse impacts to soil resources from fluid minerals management are discussed in the Soil Resources Management section above.

Alternative II

Soil Resources Management

Alternative II would not allow any exceptions to the restriction on surface slopes greater than 25 percent, badlands, rock outcrop, slopes susceptible to mass failure, and soil with a severe erosion hazard.

Under this alternative, management actions would allow the development of approximately 487 CBNG well pads within the FCPA. Based on a disturbance estimate of 0.7 acre (initial) and 0.3 acre (long-term) per well pad, the management action would allow approximately 341 acres of localized initial soil impacts within the FCPA. If reclamation of the temporary impacts were successful, approximately 146 acres of localized permanent soil resource impacts within the FCPA would be realized with well pad establishment. Approximately 101 miles of new roads would be installed.

The development of CBNG ancillary facilities associated with 487 projected well pads would include three booster stations, one reciprocating station, 48 metering stations, and associated pipelines. Based on an estimated initial and long-term disturbance area of approximately 2 acres per booster station, 5 acres per reciprocating station, and 0.2 acre per every 10 wells for meter stations, approximately 19 acres of impacts are projected.

Anticipated impacts associated with the installation of either water or natural gas pipelines to soil resources within the FCPA would be dependent upon the type/size of pipe installed. Estimated disturbance areas were determined based on a 20-foot-wide corridor for 3-inch pipe; a 50-foot-wide corridor for 12-inch poly pipe; and a 100-foot-wide corridor for 12-inch steel pipe. Based on the corridor widths listed, approximately 419 acres (175 miles) of initial soil impacts would be realized for 3-inch pipe; 401 acres (66 miles) of initial soil impacts would be realized for 12-inch poly pipe; and 212 acres (18 miles) of temporary soil impacts would be realized for 12-inch steel pipe.

Additionally, 2.5 miles of overhead electric lines would be necessary to serve the CBNG infrastructure. Based on an estimated soil resources disturbance of 3.6 acres per mile (initial) and 0.3 acres per well pad (long-term), the initial and long-term impacts to soil resources would be approximately 9 acres and 1 acre, respectively.

Management actions associated with Alternative II would allow for an increase of the existing road infrastructure with a threshold of a 50 percent loss in elk security habitat in the yearlong range and 25 percent loss in non-overlapping crucial ranges, and no loss in the overlapping crucial ranges. Based on the security habitat constraint, approximately 101 miles of new roads (71 miles of improved roads, and 30 miles of two-track roads) would be allowed within the FCPA. Impacts to soil resources, based on a 48-foot-wide temporary disturbance area, would be approximately 587 acres. It is estimated that long-term road impacts to soil resources would be approximately 294 acres.

Management actions under Alternative II would also allow the development of approximately 73 new CBNG water-handling facilities. Based on an estimated water impoundment area of 0.3 acres per well, the permanent soil resource impact would be approximately 262 acres. Additional information on water treatment impacts is found in Section 4.3.3, Water Resources.

Approximately 34 percent of the soil resources within the FCPA are located on slopes that are greater than 25 percent. Soils associated with steep landforms are highly susceptible to wind and water erosion. Under Alternative II, soil resource management would result in minor, adverse impacts to the FCPA soils because CBNG facilities would temporarily remove the existing vegetative cover on approximately 2,249 acres (2.2 percent) of the FCPA, allowing for increased wind and water erosion, soil compaction, as well as increasing the potential for sediment migration into perennial stream courses.

Soil resource management actions associated with Alternative II would result in minor permanent impacts to soil resources on approximately 709 acres (0.7 percent) of the FCPA because development of the projected CBNG well pads and ancillary facilities will permanently change the soil profile through compaction, alteration, changes to the soil chemistry from produced water storage and soil loss (e.g., airborne dust, wind, and water).

Wildlife and Special Status Species Resources Management

Under this alternative, wildlife resources management, including specific elk management actions, provides TLs in elk habitat and for special status species. Livestock grazing could be deferred post-reclamation prior to proceeding with the next development phase area. Well metering and all Plan of Development (POD) monitoring and maintenance activities would be allowed based on an approved activity management plan. However, BLM assumes the following visitation schedule: three well visits per week for the initial six months; two well visits per month after the initial six months of production and continuing for 4.5 years; and return to three well visits per week for duration of well life. Provisions would be made for emergencies including any unforeseen circumstance or combination of circumstances that creates a dangerous situation that threatens human health, safety, or the environment if repair/remedial actions are delayed until BLM approval can be obtained.

Alternative II would result in minor beneficial impacts to soil resources because the site visitation restriction would result in less road erosion, and the restriction of facilities outside of the elk crucial winter and parturition ranges would result in less erosion in sensitive areas. Additionally, deferring livestock grazing would allow time for vegetation establishment thereby reducing erosion.

Fluid Minerals Management

Management actions specific to Alternative II include restrictions and limitations for wildlife values and erosive soils. These limitations include TLs for elk and special status species.

Additional management actions specific to Alternative II include a tri-phased approach to CBNG development. One year of successful interim reclamation would be required prior to proceeding to the next development area. Ancillary and water management facilities for CBNG development would be located outside of the elk crucial ranges. Well metering and POD visitations would be allowed based on an approved activity management plan. Under Alternative II, overhead power lines would be allowed in the FCPA along road corridors and drainages. The buffer width of these roads follows information presented in Table 4-1 and it is assumed that all buried pipelines would be included within road buffers. Impacts would be minor and beneficial because the site visitation limits would result in less road erosion, the restriction of facilities to outside of the crucial ranges would result in less erosion in sensitive areas, and deferring livestock grazing would allow time for vegetation establishment.

Additional adverse impacts to soil resources from fluid minerals management are discussed in the Soil Resources Management section above.

Alternative III – Proposed Action

Soil Resources Management

Alternative III, the performance-based alternative, would restrict surface disturbance on slopes greater than 25 percent, badlands, rock outcrop, slopes susceptible to mass failure, and soil with a severe erosion hazard. There could be exceptions to this restriction if the operator proposed an acceptable disturbance and reclamation plan with their POD when required by BLM. The disturbance and reclamation plan would take into account the performance-based standards for soil reclamation (Appendix B) and the operator would be required to meet these performance-based standards for soil reclamation for three years. An example of disturbance and reclamation plan components could include geotechnical analysis and geomorphic analysis of soils to identify slope failure potential.

Initial exception criteria include the following:

- Surface disturbance will not be authorized on slopes greater than 35 percent.
- Only linear features (roads, pipelines, electric lines, etc.) will be considered.
- An engineered reclamation plan acceptable to the authorized officer must be submitted with the project proposal.
- On slopes from 25 to 30 percent, a maximum of 0.5 acre (21,780 sq. ft.) total disturbance would be allowed per feature.
- On slopes from 30 to 35 percent, a maximum of 0.25 acres (10,890 sq. ft.) total disturbance would be allowed per feature.

Requests for exceptions will be considered consistent with Instruction Memorandum No. 2008-032 (BLM 2007d), with determinations based on site-specific mitigation proposed and the potential to achieve reclamation standards. The criteria identified above are a starting point and are subject to change through the adaptive management process.

Management actions could allow for the development of approximately 483 CBNG well pads within the FCPA. Based on a disturbance estimate of 0.7 acre (initial) and 0.3 acre (long-term) per well pad, the management action would allow approximately 338 acres of localized initial soil impacts within the FCPA. If reclamation of the temporary impacts were successful, approximately 145 acres of localized long-term soil resource impacts within the FCPA would be realized with well pad establishment.

The development of CBNG ancillary facilities associated with the 483 projected well pads would include two booster stations, one reciprocating station, 48 metering stations, and pipelines. Based on an estimated disturbance area of approximately 2 acres per booster station, 5 acres per reciprocating station, and 0.2 acre per every 10 wells for meter stations, approximately 19 acres of impacts are projected.

Anticipated impacts associated with the installation of either water or natural gas pipelines to soil resources within the FCPA would be dependent upon the type/size of pipe installed. Estimated disturbance areas were determined based on a 20-foot-wide corridor for 3-inch pipe; 50-foot-wide corridor for 12-inch poly pipe; and a 100-foot-wide corridor for 12-inch steel pipe. Based on the corridor widths listed, approximately 416 acres (173 miles) of initial soil impacts would be realized for 3-inch pipe; 398 acres (65 miles) of initial soil impacts would be realized for 12-inch poly pipe; and 210 acres (17 miles) of temporary soil impacts would be realized for 12-inch steel pipe.

Management actions associated with the Proposed Action would allow for an increase of the existing road infrastructure with a threshold of a 20 percent loss in elk security habitat. Based on the security habitat constraint, approximately 77 miles of new roads (54 miles of improved roads, and 23 miles of two-track roads) would be allowed within the FCPA. These estimates do not take into account successful performance-based reclamation, which could increase the number of roads and wells. Impacts to the soil resource, based on a 48-foot-wide temporary disturbance area, would be approximately 447 acres. It is estimated that long-term road impacts to the soil resource would be approximately 223 acres.

Overhead power lines would occupy approximately 1.6 miles. Based on an estimated initial disturbance to the soil resource of 3.6 acres per mile and an estimated long-term disturbance to the soil resource of 0.5 acre per well pad, the initial and long-term impacts to the soil resource would be approximately 6 acres and 1 acre, respectively.

Management actions under the Proposed Action could also allow the development of approximately 72 new CBNG water-handling facilities. Based on an estimated water impoundment area of 3.6 acres, the permanent soil resource impact would be approximately 260 acres. Additional information on water treatment impacts is found in Section 4.3.3, Water Resources.

Approximately 34 percent of the soil resources within the FCPA are located on slopes that are greater than 25 percent, and 84 percent of the soil resources are highly susceptible to wind and water erosion. Soil resource management under the Proposed Action would result in minor initial impacts to soil resources because development of CBNG facilities would remove the existing vegetative cover on approximately 2,092 acres (2.1 percent) of the FCPA, allowing for increased wind and water erosion as well as increasing the potential for sediment migration into perennial stream courses.

Soils with slopes less than 25 percent, but with severe erosion potential, will be addressed in the disturbance and reclamation plan.

Soil resource management actions associated with the Proposed Action would result in minor, permanent impacts to soil resources on approximately 635 acres (0.6 percent) of the FCPA because CBNG well pads and ancillary facilities will permanently change the soil profile through compaction, alteration, changes to the soil chemistry from produced water storage, and soil loss (e.g., airborne dust, wind, and water).

Wildlife and Special Status Species Resources Management

Under this alternative, wildlife resources management, including specific elk management actions, provides TLs in elk crucial winter and parturition (calving) ranges. Livestock grazing management should be a component of the disturbance and reclamation plan. Grazing could be deferred (post-reclamation) prior to proceeding to the next development area. Water management facilities, well metering, and all POD monitoring and maintenance activities would meet performance-based standards as described in Appendix B.

The Proposed Action would result in minor, beneficial impacts to soil resources because adherence to performance-based standards for site visitation and the location of ancillary facilities would result in less erosion.

Fluid Minerals Management

Management actions specific to the Proposed Action include a performance-based approach to CBNG development. Ancillary and water management facilities, well metering, and POD visitations would meet performance-based standards (Appendix B). Under the Proposed Action, 1.6 miles of overhead power lines would be along road corridors. Underground power lines would be allowed along road corridors and would not result in any additional disturbance. The buffer width of these roads follows information presented in Table 4-1 and it is assumed that all power lines would be included within this buffer. There could be approximately 77 miles of new roads. Impacts would be minor and beneficial because the adherence to performance-based standards the location of ancillary facilities would result in less soil erosion.

Additional impacts to soil resources from fluid minerals management are discussed in the Soil Resources Management section above.

Summary

The summary of impacts to soil resources is shown in Table 4-10.

Table 4-10 Summary of Impacts to Soil Resources

Land Use or Management Action	Alternative I (No Action)	Alternative II	Alternative III Proposed Action
Soil Resources Management	Minor (-) 1,141 acres permanent disturbance	Minor (-) 709 acres permanent disturbance	Minor (-) 635 acres permanent disturbance
Wildlife and Special Status	No Impact	Minor (+)	Minor (+)

Table 4-10 Summary of Impacts to Soil Resources			
Land Use or Management Action	**Alternative I (No Action)**	**Alternative II**	**Alternative III Proposed Action**
Species Resources Management		Facilities outside crucial ranges on less sensitive soils	Performance-based standards will reduce soil impacts
Fluid Minerals Management	Minor (-) 726 new wells, 179 miles of new roads	Minor (-) 487 new wells, 101 miles of new roads	Minor (-) 483 new wells, 77 miles of new roads

Cumulative Impacts

Cumulative impacts to soil resources were evaluated for the entire PRB, including the FCPA in the PRB O&G FEIS (BLM 2003a). Because the FCPA is small (100,655 acres) in comparison to the PRB (8 million acres) (approximately 1.3 percent), cumulative impacts from all three FCPA alternatives would be very small in comparison to the PRB impacts. The maximum amount of soil disturbance for any of the alternatives would be 3,536 acres in the FCPA, which is approximately 2 percent of the disturbance predicted for the entire PRB (BLM 2003a).

Under all alternatives wells, roads, utilities, water treatment facilities, and ancillary facilities will be managed on slopes greater than 25 percent to protect highly erosive soils and reduce runoff into streams and the Powder River. These actions may increase development on gentler slopes and closer to stream channels. The proximity of CBNG development to drainages could affect downstream and offsite surface water from erosion.

4.3.3. Water Resources

The primary goal for water resource management in the FCPA is to maintain or improve surface and groundwater quality throughout eight subwatershed areas associated with the PRB.

Water resources management actions will be consistent with existing uses and account for anticipated users as they relate to all applicable State and Federal water quality standards for all watershed areas. Additional goals provide for the availability to facilitate all authorized uses and to minimize harmful consequences caused by erosion and uncontrolled surface runoff from BLM-administered land.

Water management objectives will ensure that current Wyoming Department of Environmental Quality (WDEQ) water discharge standards are maintained within the eight subwatershed areas of the FCPA. Management actions related to this goal and common to all alternatives include the following:

- The rights to water-related projects on public lands will be filed with the Wyoming State Engineer's Office (WSEO) in order to obtain valid water rights approval.
- A WDEQ Wyoming Pollutant Discharge Elimination System (WYPDES) permit will be necessary for all water discharge.
- Discharge points will be located in areas that will minimize erosion and impacts to the receiving channel, existing improvements, and downstream users.

- Discharge points will be located in stable, low-gradient drainage systems and below active headcuts, when possible. If discharge is located above a headcut, mitigation measures will be required by the BLM Authorized Officer on a site-specific basis. Some mitigation measures may require a certified engineering design.
- All discharge points will require the installation of energy dissipation measures.
- Discharge points, regardless of WYPDES status or previous use, may not be authorized by BLM. Sites may be moved or otherwise mitigated by the BLM Authorized Officer during onsite inspections where sensitive resource habitat issues exist.
- Cumulative produced water discharges from CBNG developments must not exceed the naturally occurring two-year peak flow in any reach of the receiving channel.
- Discharge points will not be located in playas or enclosed basins unless it can be demonstrated that they will not result in adverse habitat impacts. Discharges into valley bottoms that have no defined bed and bank (low-flow channel) will generally not be allowed; however, the BLM Authorized Officer may allow such discharges after inspection on a site-by-site basis.
- Channel crossings will be designed to minimize disturbance to the channel bed, to the extent practical. Pipelines and access road crossings within floodplains or that run parallel to a drainage channel will be avoided. Channel crossings by access road and pipelines will be constructed perpendicular to water flow. Pipelines will be buried to a depth of at least 48 inches below the channel bottom. Culverts may be installed, at appropriate locations, to provide a suitable crossing at washes or streams as specified by BLM Manual 9112 – Bridges and Major Culverts, and BLM Manual 9113 – Roads. At a minimum, all channel crossing structures will be designed to accommodate a 25-year storm event or other capacities as directed by BLM.
- Low water crossings will be constructed perpendicular to channel flow and in such a manner that it will prevent the blockage or restriction of water flows within the channel. All excavated material will be stockpiled adjacent to the water body and outside any associated wetland habitats for later use in restoration.
- Produced CBNG water quality may require operators to increase the amount of storage during downstream irrigation months. For non-irrigation months, additional surface discharges may be considered if the operator has sufficient assimilative capacity credits, or if treated to monthly Powder River water quality standards.
- The operator will be required to provide a reclamation bond for produced CBNG water impoundments over Federal minerals in an amount specified by a qualified professional engineer. Proof of submission for the bond amount will be submitted prior to the approval of a POD. The POD and reclamation bond will require approval by a BLM Authorized Officer prior to commencing construction activities.
- The operator will supply a copy of the completed and approved SW-3, SW-4, or SW-CBNG permit(s) to BLM as they are issued by the WSEO for produced CBNG water impoundments.
- The operator will supply a copy of the complete and approved Chapter 3 – Permit to Construct - Water Management Facilities to BLM as they are issued by the WDEQ.

Effects to water resources associated with CBNG development include increased produced water discharge, groundwater drawdown, and increased sedimentation from new roads, wells, and ancillary facilities, pipelines, water-handling facilities, and power lines.

Impacts that could result from surface disturbance include reduction of vegetative cover, soil compaction, and increased erosion and sedimentation. These erosion-related impacts could include changes in surface and groundwater chemistry, in meeting water quality standards, and changes in the quantity and distribution of surface flows or retention areas, and aquifer drawdown.

Water Discharge

Many different techniques may be used for discharge of produced water. Two common techniques in the FCPA are impoundments and pipelines to transport waters outside the planning area. Impoundments would be developed in bottomlands along the Powder River, Fortification Creek, and tributaries. Off-channel impoundments would be used on flat terraces.

Development of impoundments leads to water leakage, which may result in changes to vegetation from existing range grasses, sagebrush, and juniper to more mesic species such as sedges (*Carex* sp.), foxtail barley (*Hordeum jubatum*), and, in places, cattails (*Typha* sp.). Saltcedar (*Tamarix* sp.) has a toehold in the FCPA, and expansion of mesic habitats allows for further invasion by this species. Generally, the area of disturbance is twice the size of the impoundment.

The discharge to channels, although treated if needed as required by WDEQ, would result in increased sedimentation and increased flows. To date, 53 million gallons per day of produced waters have been permitted for discharge. There are no monitoring requirements for the amount of discharge. Increased discharge of CBNG produced water to perennial and intermittent stream channels could result in impacts to stream morphology and biology.

Stream channels tend to undergo a consistent series of adjustments over time to accommodate changes or alterations to “driving” forces, such as an increase in flow frequency (Rosgen 1996). Although the actual impacts cannot be predicted for each channel because they depend on stream-specific factors including slope, depth, and soil composition of that channel, changes to the structure and function of stream channels converted from ephemeral to perennial would be expected to occur and are described below.

Analyses of hydraulic geometry from gauged sites indicate that ephemeral streams normally have greater channel widths for the same discharges than perennial streams of the same type. This is primarily due to greater rates of bank erosion resulting from significant differences in flow duration and magnitude, combined with poor vegetation cover, shallow rooting depth, and low root density – which is characteristic of arid regions such as the FCPA (Rosgen 1996). For ephemeral streams, the active channel capacity is usually indicative of higher return flow events, such as the 10-year flood (Simons and Senturk 1992). Based on the amount of CBNG produced water being discharged in relation to the channel’s existing capacity, some channels may be able to accommodate the increased flow volumes with relatively slight or gradual changes to the stream structure.

In addition, stream structure would be further stabilized by the establishment of riparian and in-channel vegetation. One study of wastewater discharge on the channel morphology of four arid ephemeral streams found that the colonization of part of the active channel by vegetation

increased flow resistance as well as bank and bed stability, and limited sediment availability from bars and other sediment stores along the channel. This significantly decreased the active channel width and in some cases the established vegetation covered the entire active channel and halted the transport of bed material downstream. During low- and medium-sized flood events, sediment bars remained stable; extreme events destroyed the vegetation and activated the bars (Hassan 2001).

Given the high water erosion potential of the majority of soils in the FCPA, and prior to or without the establishment of riparian vegetation, if CBNG discharges exceed the existing channel capacity, the following changes would be expected to occur:

- Accelerated bank erosion, resulting in an increased width/depth ratio of the channel and increased sediment supply;
- Establishment of a bi-modal particle size distribution (with bed load aggregated into two particle-size groups); and
- Increased bar deposition and channel aggradation downstream (Rosgen 1996).

Additionally, the depositional features and morphology of these stream beds would likely transition from those characteristic of ephemeral channels in the area (scour holes, crescent scour, "tool marks," incipient rib-and-furrow) to those of perennial streams (pool/riffle complexes) (Picard and High 1973, Rosgen 1996).

Studies have also shown that as mean discharge increases, channel width, depth, and average current velocity also increase (Ritter 2006). If these channels collectively begin downcutting, this could result in a lowering of the base level and an over-steepening of all tributaries to the Powder River (Rosgen 1996).

4.3.3.1. Evaluation Criteria

Assumptions used in analyzing impacts to the water resources include the following:

- BLM estimated water production within the FCPA to be greater than 79 million barrels per year (mby; BLM 2003a). Based on this modeling and a complete FCPA buildout, it was estimated that approximately 70 percent (55.3 mby) of produced CBNG water would be directly discharged into existing ephemeral drainages, and 25 percent (19.75 mby) of produced CBNG water would be retained through development of water impoundments. The remaining 5 percent (3.95 mby) of produced CBNG water may be lost through evaporation or infiltration.
- Groundwater discharge data compiled by the WDEQ and BLM in 2008 identified 23 current CBNG permit holders within the FCPA. Of these, 18 CBNG permit holders have reported the number of existing groundwater wells permitted and their associated flow rates. Table 4-11 presents a summary of these data. These data indicate 75 percent (35.51 million gallons per day [mgd]) of produced groundwater is permitted for discharge into drainage channels. In addition, approximately 25 percent (12.1 mgd) of the data indicates produced groundwater is permitted for impoundment by either on-channel reservoirs or in full-containment structures. Figure 4-1 shows discharge locations within the FCPA held by permit holders in 2008. Any additional discharge flows within the currently permitted outfall locations may exceed the naturally occurring, two-year peak flow for the receiving channels' specific reach.

Table 4-11 Fortification Creek Planning Area CBNG 2008 Groundwater Wells and Flow Rates[1]

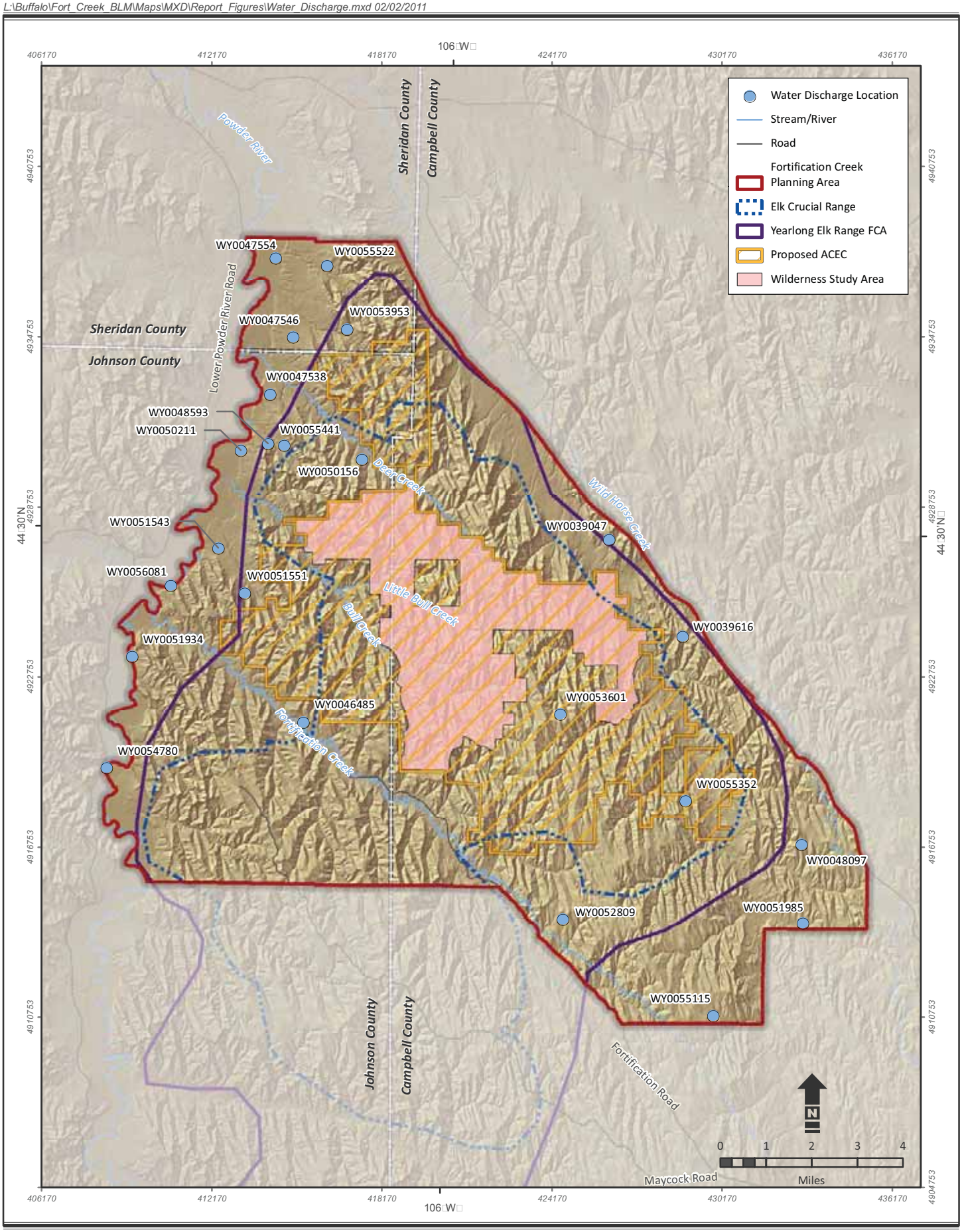
Permit Number	Number of Groundwater Wells	Groundwater Well Flow Rate (mgd)	Drainage Channel Discharge Point (discharge type)[2]
WY0039616	180	4.16	(2 OCR/1A)
WY0046485	111	2.01	(2 OCR/1A)
WY0047538	32	0.1	(2 OCR/1A)
WY0047546	24	0.52	(2 OCR/1B)
WY0047554	36	0.52	(2 OCR/1B/1A)
WY0048097	33	1.01	(2 OCR)
WY0048593	48	0.32	(1A/1B)
WY0050156	58	0.13	(2 OCR)
WY0050211	33	0.32	(1A/1B)
WY0051985	624	16.16	(2 DD)
WY0052809	122	1.55	(2 OCR/2 DD)
WY0053601	26	0.55	(1B)
WY0053953	10	0.25	(2 OCR)
WY0054780	184	13.9	(2 DD)
WY0055115	22	0.934	(2 OCR)
WY0055352	45	0.878	(2 OCR)
WY0055441	7	0.35	(2 OCR)
WY0056081	212	3.9	(2 DD)

[1] Well and Flow Rate table summarized from WDEQ and BLM 2008 permit holder data.
[2] Discharge Types defined as: 2 OCR = Option 2 on-channel reservoirs; 2 DD = Option 2 discharge; 1B = Option 1B full containment-class 4; 1A = Option 1A full containment-class 3.

Environmental consequences and alternative comparisons associated with CBNG development within the FCPA are based on an analysis of the most current data available and the best professional judgment of the preparers. The following terms and definitions will be used to describe the anticipated impacts to water resources for each of the alternatives:

- *Negligible* – The effect on water resources is barely detectable; less than 1 percent of the resource is affected. This could include a 1 percent increase in discharge rates, drawdown, or exceedance of a water quality parameter.
- *Minor* – The effect on water resources is slight but detectable; there would be a small change in the resource. This could include impacts on 1 to 10 percent of the resource, including a 10 percent increase in discharge rates, drawdown, or exceedance of a water quality parameter.

L:\Buffalo\Fort_Creek_BLM\Maps\MXD\Report_Figures\Water_Discharge.mxd 02/02/2011



Source:
Topography - United States Geological Survey 2005
Hydrography - National Hydrography Dataset 2003

Figure 4-1

Water Discharge Points

Campbell, Johnson, and Sheridan Counties, Wyoming

- *Moderate* – The effect on water resources is readily apparent; there would be a measurable change in the resource. This could include impacts between 10 and 30 percent of the resource including a 10 to 30 percent increase in discharge rates, drawdown, or exceedance of a water quality parameter.
- *Major* – The effect on water resources is large; there would be a highly noticeable, long-term, or permanent measurable change in the resource. This could include impacts to more than 30 percent of the resource. This could also include a 30 percent or greater increase in discharge rates, drawdown, or exceedance of a water quality parameter.

4.3.3.2. Alternative Analysis

Impacts to water resources may differ in extent and severity, depending on specific management actions proposed under each alternative for different resource uses. The following sections describe the anticipated impacts under each alternative resulting from the management of the water resource, as well as those expected to result from the management actions proposed for Wildlife and Special Status Species, Fluid Minerals, and Soils.

Alternative I (No Action Alternative)

Water Resources Management

Alternative I water resources management would include WYPDES permits for the discharge of CBNG produced water with water quality requirements but not water quantity requirements. WDEQ has permitted approximately 48 mgd for 1,807 wells, 75 percent of which (36 mgd) is permitted for discharge. within the FCPA. This includes all Federal and non-federal CBNG wells. Current discharge is estimated at 1.8 mgd (16.2 mby) and current storage is estimated at 0.6 mgd (4 mby).

Under this alternative there is the potential for approximately 726 new wells in the FCPA. It is anticipated that 75 percent of these wells would discharge produced water directly into drainage channels. This could include the Powder River, Mickleberry Creek, Deer Creek, Bull Creek, Fortification Creek, and/or Wild Horse Creek. With an average discharge of approximately 3.1 gallons per minute per well, an increase of 726 wells would result in an additional 2.4 mgd (0.1 mby) of produced water directly discharged into FCPA channels. This increase would have a major impact on stream channels. Intermittent streams would become perennial and could support non-native fish species. Vegetation would change significantly in and adjacent to streams; wetlands would be generated. Additionally, and perhaps most important, the increase in water discharge to streams would change the morphology of the stream channels and increase sediment transport downstream. Anticipated impacts to ephemeral streams would include an increase in bank erosion, changes to stream depth and width ratios, increased sediment supply, increased stream velocity, and increased bar deposition and channel aggradation downstream. In-channel vegetation would increase, which could serve to stabilize the channel. The magnitude of this impact cannot be specified at this time because the results would depend on stream-specific factors including slope, depth, and soil composition. While water discharge would be temporary, the changes to stream morphology could be long term.

Changes to water chemistry, while possible, may be mitigated due to WYPDES discharge limits.

Twenty-five percent, or 0.8 mgd, of produced CBNG water would be discharged to surface impoundments. This increase of discharged water in surface impoundments would impact soils and vegetation in the surrounding area, resulting in wetlands and invasive weeds.

Drawdown from 726 new wells would have a major impact on aquifers in the FCPA. Drawdown from six wells in the FCPA was measured by the Wyoming State Geological Survey (WSGS). These data indicate a range of drawdown from 8.4 feet to almost 200 feet per well. Drawdown in these wells is in response to gas head pressure and is highest during initial production (WSGS 2009). Free-flowing wells in the Fort Union Formation would likely lose their water. Free-flowing wells in the Wasatch Formation could lose water; however, this would depend on their connection to CBNG coal seams and cannot be quantified at this time (WSGS 2009). Results of groundwater modeling for the PRB O&G FEIS (BLM 2003a) indicated that drawdown of 200 to 400 feet would be generally expected. Drawdown would be mitigated by recharge; however, recharge would lag drawdown by an average of four years and the rate cannot be estimated at this time.

Additionally, water resources management under the No Action Alternative would result in minor, adverse impacts to water resources because of increased sediment loading within drainage channels through degradation of existing drainage networks from roadways and other ancillary facility development. Existing surface and groundwater chemistry could be altered to unacceptable/unusable levels and perennial water sources within the elk ranges could be eliminated.

Wildlife and Special Status Species Resources Management

Under this alternative, wildlife resources management TLs in elk crucial ranges would provide only a temporary benefit and, therefore, would not have any impact on water resources. Additional wildlife management actions, such as water facility locations, are further discussed in Fluid Minerals Management.

Fluid Minerals Management

The BLM goal for CBNG management is to facilitate the extraction of CBNG and minimize the effects to the landscape that would impact the resource values in the FCPA. Management objectives are to identify stipulations, COAs, and BMPs for exploration, development, production, and reclamation to ensure that activities would not impact other resource values in the FCPA.

Management actions specific to Alternative I include an unrestricted development pace and no elk-related restrictions on ancillary and water management facilities. Under Alternative I, there would be approximately 9.3 miles of overhead power lines within the FCPA and an increase of approximately 179 miles of roads. The buffer width of these roads follows information presented in Table 4-1 and it is assumed that all underground power lines would be included within this buffer. These actions would result in minor, temporary impacts to water resources because installation of underground utilities, roads, and ancillary facilities would temporarily disturb drainage channel profiles and increase channel sedimentation. Development would alter the existing vegetative cover along existing drainage channels, increase erosion and sediment loading within drainage channels, alter existing surface and groundwater chemistry and potentially eliminate perennial water sources within the elk ranges.

Additional adverse impacts to water resources from fluid minerals management are discussed under the Water Resources Management section above.

Other Resources Management

Soil Resources Management

Approximately 33,694 acres (34 percent) of the soil resources within the FCPA are located on slopes that are greater than 25 percent. Soils associated with steep landforms are highly susceptible to wind and water erosion. Under this alternative, surface disturbance would be restricted on slopes greater than 25 percent, or on highly erodible soils. Standard lease terms, stipulations, and notices apply, and there may be exceptions to this restriction.

Soil resource management under the No Action Alternative would result in minor initial adverse impacts to the watershed resource because projected development of CBNG facilities will temporarily remove the existing vegetative cover on approximately 3,536 acres (3.5 percent) of the FCPA allowing for increased wind and water erosion, soil compaction, as well as increasing the potential for sediment migration into drainage courses.

Soil resource management actions associated with Alternative I would result in minor, adverse long-term impacts to the watershed resource because projected CBNG well pad and ancillary facilities development on approximately 1,141 acres (1.1 percent) of the FCPA will result in permanent alteration of the soil profile through compaction, changes to the soil/groundwater chemistry at produced water storage facilities, and increased soil loss through airborne dust, wind, and water erosion.

Alternative II

Water Resources Management

Alternative II water resources management would include WYPDES permits for the discharge of CBNG produced water with water quality requirements but not water quantity requirements. WDEQ has permitted approximately 48 mgd for 1,807 wells, 75 percent of which (36 mgd) is permitted for discharge within the FCPA. This includes all Federal and non-federal CBNG wells. Current discharge is estimated at 1.8 mgd (16.2 mby) and current storage is estimated at 0.6 mgd (4 mby). No additional discharge will be authorized from Federal projects directly into ephemeral and intermittent channels.

Under this alternative, there is the potential for approximately 487 new wells in the FCPA. It is anticipated that 75 percent of these wells would discharge produced water directly into drainage channels. This could include the Powder River, Mickleberry Creek, Deer Creek, Bull Creek, Fortification Creek, and/or Wild Horse Creek. Under Alternative II, discharge points would likely be moved to private surface off the Federal leases, piped outside the FCPA, or injected. With an average discharge of approximately 3.1 gallons per minute per well, an increase of 487 wells would result in an additional 1.6 mgd (0.05 mby) of produced water directly discharged into FCPA channels. This increase would have a major impact on stream channels. Intermittent streams would become perennial and could support non-native fish species. Vegetation would change significantly in and adjacent to streams; wetlands would be generated. Additionally, and perhaps most importantly, the increase in water discharge to streams would change the morphology of the stream channels and increase sediment transport downstream.

Anticipated impacts to ephemeral streams would include an increase in bank erosion, changes to stream depth and width ratios, increased sediment supply, increased stream velocity, and increased bar deposition and channel aggradation downstream. In channel vegetation would increase, which could serve to stabilize the channel. This impact cannot be specified at this time

because the results would depend on stream-specific factors including slope, depth, and soil composition. While water discharge would be temporary, the changes to stream morphology could be long-term.

Changes to water chemistry, while possible may be mitigated because of WYPDES discharge limits. Downstream monitoring of CBNG discharge will enable future impact assessment and an adaptive management approach, if necessary.

Twenty-five percent, or 0.5 mgd, of produced CBNG water would be discharged to surface impoundments. This increase of discharged water in surface impoundments would impact soils and vegetation in the surrounding area, resulting in wetlands and invasive weeds.

Drawdown from 487 new wells could have a major impact on aquifers in the FCPA. Drawdown from six wells in the FCPA was measured by the WSGS. These data indicate a range of drawdown from 8.4 feet to almost 200 feet per well. Drawdown in these wells is in response to gas head pressure and is highest during initial production (WSGS 2009). Free-flowing wells in the Fort Union Formation would likely lose their water. Free-flowing wells in the Wasatch Formation could lose water; however, this would depend on their connection to CBNG coal seams and cannot be quantified at this time (WSGS 2009). Results of groundwater modeling for the PRB O&G FEIS (BLM 2003a) indicated that drawdown of 200 to 400 feet would be generally expected. Drawdown would be mitigated by recharge; however, recharge would lag drawdown by an average of four years and the rate cannot be estimated at this time.

Water resource management under this alternative would result in minor, adverse impacts to water resources because of increased sediment loading within drainage channels through degradation of existing drainage networks from roadways and other ancillary facility development. Additionally, existing surface and groundwater chemistry could be altered to unacceptable/unusable levels and perennial water sources within the elk ranges could be eliminated.

Wildlife and Special Status Species Resources Management

Alternative II Wildlife and Special Status Species Resources Management would result in minor, beneficial impacts to watershed resources. Disturbance would be minimized, livestock grazing could be deferred after reclamation allowing time for vegetative cover establishment, and produced water management facilities would be constructed outside the crucial ranges where the topographic relief is less, resulting in decreased sediment loading and channel degradation.

Fluid Minerals Management

Management actions specific to Alternative II include a phased development approach, summer water sources provided by CBNG projects, and restrictions on ancillary and water management facilities in the elk crucial winter and parturition ranges. Under Alternative II, overhead power lines would be allowed. Construction of ancillary facilities, along with power lines and roads, would temporarily disturb drainage channel profiles and potentially increase channel sedimentation. Development would alter the existing vegetative cover along existing drainage channels, increase erosion and sediment loading within drainage channels, alter existing surface and groundwater chemistry, and potentially eliminate perennial water sources within the elk ranges.

Additional adverse impacts to water resources from fluid minerals management are discussed under the Water Resources Management section above.

Other Resources Management

Soil Resource Management

Under Alternative II, there would be no surface-disturbing activities on slopes greater than 25 percent, soils with a severe erosion hazard, badlands, rock outcrop, or slopes susceptible to mass failure. There would be no exceptions to these restrictions.

Soils management under this alternative would result in minor adverse initial impacts to the FCPA water resources because, although CBNG facilities would temporarily remove the existing vegetative cover on approximately 2,249 acres (2.2 percent) of the FCPA allowing for a temporary increase of wind and water erosion and increasing the potential for sediment migration into perennial drainage channels, disturbance would be restricted to slopes less than 25 percent, thereby reducing potential erosion into streams.

Soil resource management actions associated with Alternative II would result in minor adverse long-term impacts to the watershed resource because projected CBNG well pad and ancillary facilities development on approximately 709 acres (0.7 percent) of the FCPA will result in permanent alteration of the soil profile through compaction, changes to the soil/groundwater chemistry at produced water storage facilities, and increased soil loss through airborne dust, wind, and water erosion. Impacts to the watershed resource would be realized because CBNG facilities would remove the existing vegetative cover within the FCPA allowing for increased degradation of the existing drainage channels through airborne dust, wind, and water erosion.

Alternative III – Proposed Action

Water Resources Management

Proposed Action water resources management would include requirements for WYPDES permits for the discharge of CBNG produced water with water quality requirements but not water quantity requirements. WDEQ has permitted approximately 48 mgd for 1,807 wells, 75 percent of which (36 mgd) is permitted for discharge within the FCPA. This includes all Federal and non-federal CBNG wells. Current discharge is estimated at 1.8 mgd (16.2 mby) and current storage is estimated at 0.6 mgd (4 mby).

Under this alternative, there is the potential for approximately 483 new wells in the FCPA. It is anticipated that 75 percent of these wells would discharge produced water directly into drainage channels. This could include the Powder River, Mickleberry Creek, Deer Creek, Bull Creek, Fortification Creek, and/or Wild Horse Creek. Under Alternative III, discharge points would likely be moved to private surface off the Federal leases, piped outside the FCPA, or injected. With an average discharge of approximately 3.1 gallons per minute per well, an increase of 483 wells would result in an additional 1.5 mgd (0.05 mby) of produced water directly discharged into FCPA channels. This increase would have a major impact on stream channels. Intermittent streams would become perennial and could support non-native fish species. Vegetation would change significantly in and adjacent to streams; wetlands would be generated. Additionally, and perhaps most importantly, the increase in water discharge to streams would change the morphology of the stream channels and increase sediment transport downstream.

Anticipated impacts to ephemeral streams would include an increase in bank erosion, changes to stream depth and width ratios, increased sediment supply, increased stream velocity, and increased bar deposition and channel aggradation downstream. In channel vegetation would increase, which could serve to stabilize the channel. This impact cannot be specified at this time

because the results would depend on stream-specific factors including slope, depth, and soil composition. While water discharge would be temporary, the changes to stream morphology could be long term.

Drawdown from 483 new wells could have a major impact on aquifers in the FCPA and a moderate impact overall. Drawdown from six wells in the FCPA was measured by the WSGS. These data indicate a range of drawdown from 8.4 feet to almost 200 feet per well. Drawdown in these wells is in response to gas head pressure and is highest during initial production (WSGS 2009). Free-flowing wells in the Fort Union Formation would likely lose their water. Free-flowing wells in the Wasatch Formation could lose water; however, this would depend on their connection to CBNG coal seams and cannot be quantified at this time (WSGS 2009). Results of groundwater modeling for the PRB O&G FEIS (BLM 2003a) indicated that drawdown of 200 to 400 feet would be generally expected. Drawdown would be mitigated by recharge; however, recharge would lag drawdown by an average of four years and the rate cannot be estimated at this time.

Additionally, water resources management under the Proposed Action would result in minor adverse impacts to water resources because of increased sediment loading within drainage channels through degradation of existing drainage networks from roadways and other ancillary facility development. Overall, development would alter the existing vegetative cover within and adjacent to impoundments, increase erosion and sediment loading within drainage channels, alter existing surface and groundwater chemistry, and potentially eliminate perennial water sources within the elk ranges and result in major changes to water resources.

Wildlife and Special Status Species Resources Management

Proposed Action Wildlife and Special Status Species Resources management would result in minor, beneficial impacts to watershed resources because livestock grazing may be deferred and allow time for vegetative cover establishment. Produced water management facilities would be constructed based on performance objectives. Elk performance-based objectives would have little effect on water resources unless operators choose to place water management facilities outside the elk crucial ranges and security habitat which tends to be in rough topography. Locating facilities in areas of less topographic relief would decrease sediment loading and channel degradation.

Fluid Minerals Management

Management actions specific to the Proposed Action include a performance-based development approach. The operator's water management strategy must meet the performance-based Elk and Reclamation (Appendix B) standards. The location and number of ancillary and water management facilities will be based on performance standards. Operators may need geotechnical analysis and design, geomorphological analysis, and alternative water management facility siting to achieve the performance standards.

Under the Proposed Action, overhead power lines would be allowed on BLM surface. The buffer width of power lines and roads follows the Table 4-1 data and it is assumed that all underground power lines would be included within this buffer. Summer water sources would be provided by CBNG projects. There would be up to a 20 percent decrease in elk security habitat with approximately 2,092 acres of associated disturbance. The increased roads would result in minor adverse impacts because of additional erosion potential. Construction of ancillary facilities,

along with power lines and roads would temporarily disturb drainage channel profiles and potentially increase channel sedimentation. Development would alter the existing vegetative cover along existing drainage channels and within and adjacent to impoundments, increase erosion and sediment loading within drainage channels, alter existing surface and groundwater chemistry, and potentially eliminate perennial water sources within the elk ranges.

Performance objectives related to reclamation would benefit water resources by encouraging development in areas with greater reclamation potential and by accelerating reclamation, thereby reducing the duration and extent of water related impacts.

Additional adverse impacts to water resources from fluid minerals management are discussed under the Water Resources Management section above.

Other Resources Management

Soil Resources

Under the Proposed Action, BLM management actions would restrict surface disturbance on slopes greater than 25 percent, soils with severe erosion hazard, badlands, rock outcrop, or slopes susceptible to mass failure. There would be exceptions to these restrictions with an approved BLM disturbance and reclamation plan.

Approximately 34 percent of the soil resources within the FCPA are located on slopes that are greater than 25 percent. Soils associated with steep landforms are highly susceptible to wind and water erosion. Soil resource management under the Proposed Action would result in minor adverse initial impacts to water resources because development of CBNG facilities would remove the existing vegetative cover on approximately 2,092 acres (2.1 percent) of the FCPA allowing for increased wind and water erosion as well as increasing the potential for sediment migration into drainage channels.

Management actions associated with Proposed Action soil resources management would result in negligible, long-term impacts to water resources on approximately 635 acres (0.6 percent) of the FCPA. CBNG well pads and ancillary facilities will permanently alter the soil profile through compaction, which minimizes infiltration rates, changes the soil/groundwater chemistry from produced water storage, and increases soil loss into the drainage network through airborne dust, wind, and water erosion.

Summary

The summary of impacts to water resources is shown in Table 4-12.

Table 4-12 Summary of Impacts to Water Resources

Land Use or Management Action	Alternative I (No Action)	Alternative II	Alternative III (Proposed Action)
Water Resources Management	Major (-) Discharge to ephemeral channels, 3.2 mgd produced water Drawdown from 726	Major (-) Discharge to ephemeral channels, 2.2 mgd produced water Drawdown from 487	Major (-) Discharge to ephemeral channels, 2.1 mgd produced water Drawdown from 483

Table 4-12 Summary of Impacts to Water Resources			
Land Use or Management Action	**Alternative I (No Action)**	**Alternative II**	**Alternative III (Proposed Action)**
	wells	wells	wells
Wildlife and Special Status Species Resources Management	No Impact	Minor (+) Water facilities outside elk crucial range	Minor (+) Water facilities based on performance standards
Fluid Minerals Management	Minor (-) 179 miles of new road	Minor (-) 101 miles of new road	Minor (-) 77 miles of new road
Other Resource Management Soil Resources	Minor (-) 3,536 acres (3.5%) soil disturbance	Minor (-) 2,249 acres (2.2%) soil disturbance	Minor (-) 2,092 acres (2.1%) soil disturbance

4.3.3.3. Cumulative Impacts

Cumulative impacts to water resources were evaluated for the entire PRB, including the FCPA in the PRB O&G FEIS (BLM 2003a). The FCPA is in the Upper Powder River subbasin, which was predicted to produce 1.2 million acre-feet of water from CBNG development (BLM 2003a). CBNG development in the FCPA is expected to produce between 2 mgd (3.2 acre-feet) and 3.2 mgd (10 acre-feet) of water assuming two years of produced water. Produced water from any alternative in the FCPA is approximately 3 percent of the total produced water predicted for the PRB.

Groundwater in the FCPA will be subjected to drawdown, which is predicted to recover within 25 feet of pre-operational conditions within 25 years. Full recovery would likely take tens to hundreds of years (BLM 2003a). Seventy-five percent of the produced water estimate for the FCPA is permitted for discharge to drainages. Cumulative impacts from this discharge could result in changes to water chemistry and increased sediment loading to the Powder River and Wild Horse Creek.

4.3.4. Vegetation Resources

Management goals for vegetation resources within the FCPA are (1) maintain or improve the diversity of plant communities to support livestock needs, wildlife habitat, watershed protection, and acceptable visual resources; and (2) reduce the spread of noxious weeds. Most management actions related to these goals are common to all alternatives and include:

- Management actions affecting vegetation will be designed to meet overall resource management objectives and will be consistent with policy to protect or improve biodiversity and water quality.
- In cooperation with county weed and pest districts, cooperative integrated weed control programs are being implemented on public land in conjunction with control work on adjoining deeded and State lands.

- Weed educational material will be reviewed during pre-construction onsite meetings with operators, subcontractors, and landowners and will be attached to approved applications for permit to drill (APDs) and PODs (PRB O&G ROD, BLM 2003c).
- The operator will be responsible for prevention and control of noxious weeds and weeds of concern on all areas of surface disturbance associated with the project (well locations, roads, water management facilities, etc.). Use of pesticides will comply with the applicable Federal and State laws. Pesticides will be used only in accordance with their registered uses and within limitations imposed by the Secretary of the Interior. Prior to the use of pesticides on public land, the holder will obtain from the BLM Authorized Officer written approval of a plan showing the type and quantity of material to be used, pest(s) to be controlled, method of application, location of container storage and disposal, and any other information deemed necessary by the BLM Authorized Officer for such use.
- Authorized livestock grazing use will not be increased.
- Moist soils near wetlands, streams, lakes, or springs in the project area will be promptly revegetated if construction activities impact the vegetation in these areas. Revegetation will be designed to avoid the establishment of noxious weeds.
- Operators in areas with identified weed infestations or suitable Ute ladies'- tresses orchid habitat will be required to submit an integrated pest management plan prior to APD approval. Mitigation will be determined on a site-specific basis and may include measures such as spraying herbicides prior to entering areas and washing vehicles before leaving infested areas. Infestation areas of noxious weeds have been identified throughout the county weed and pest districts and information is available at the Buffalo BLM Buffalo Field Office (BFO) office.

The following alternative analysis considers adverse and beneficial impacts as well as direct and indirect impacts to vegetation resources.

4.3.4.1. Evaluation Criteria

The degree of both beneficial and adverse estimated impacts to vegetation resources is described using categories that are defined in both quantitative terms (surface disturbance area) when such analyses are possible, and in more qualitative terms (visibility, duration, and in the context of Wyoming Standards for Healthy Public Rangelands) when there are no quantitative parameters available for analysis. These categories include the following:

- *None* – No physical disruption of the resource. Effects are unlikely to be detectable. No impairment of the resource value in terms of Wyoming Standards for Healthy Public Rangelands (BLM 1995a).
- *Negligible* – Physical disruption to less than 1 percent of the resource. Effects may be detectable but of short duration (would last no more than one growing season) and not of concern to the general public. Unlikely to impair the resource value in terms of Wyoming Standards for Healthy Public Rangelands (BLM 1995a).
- *Minor* – Physical disruption to less than 5 percent of the resource. Effects would be detectable but temporary (would last no more than 2 years) and unlikely to be of concern to the general public. Likely to cause some impairment of the resource value in terms of Wyoming Standards for Healthy Public Rangelands (BLM 1995a).

- *Moderate* – Physical disruption of 6 to 15 percent of the resource. Effects would be readily visible and maybe of concern to the general public. Effects may increase over time or be long-term to permanent. May cause substantial impairment of the resource value in terms of Wyoming Standards for Healthy Public Rangelands (BLM 1995a).
- *Major* – Physical disruption to more than 15 percent of the resource. Effects would be highly visible and of concern to the general public. Effects likely to increase over time and be long term or permanent. Likely to cause substantial impairment of the resource value in terms of Wyoming Standards for Healthy Public Rangelands (BLM 1995a).

4.3.4.2. Alternative Analysis

Direct adverse impacts to upland vegetation are considered to include disruption or removal of rooted vegetation resulting in a reduction in areas of native vegetation; reduction of total numbers of plant species (species richness) within an area; and/or reduction or loss of total area, diversity, structure, or function of wildlife habitat. Impacts to vegetation resources may differ in extent and severity, depending on specific management actions proposed under each alternative for different resource uses.

A number of indirect impacts to vegetation resources are also a potential result of proposed management actions. Potential indirect impacts include disruption or reduction of pollinator populations; loss of habitat suitable for colonization due to surface disturbance; introduction of noxious weeds by various vectors or conditions that enhance the spread of weeds; and general loss of habitat due to surface occupancy, surface compaction, or trampling. Upgradient physical disruption can result in sedimentation into occupied habitat and/or potential habitat. Failed reclamation or mitigation may also cause indirect impacts to these resources. Most indirect impacts are assumed to result from direct impacts in proportion to the relative amount of surface disturbance. Restricting surface disturbing activities during wildlife TLs postpones vegetation loss, and promotes timely reclamation and revegetation and the return of wildlife.

The estimated extent of ground-disturbing activities associated with fluid minerals management to each vegetation type, by alternative, as shown on Table 4-13, is as follows:

- The linear extent of associated roads was calculated based on location and length estimated in Section 4.3.5, Fish and Wildlife Resources. Because both would result in direct impacts to vegetation resources, this number includes existing roads that would be used for each alternative as well as anticipated new roads. These were overlain on vegetation type boundaries and the proportion of the total road lengths (existing and new roads) was estimated for each vegetation type.
- The estimated buffer width of these roads follows Table 4-1. It was assumed that all pipelines and overhead power lines would be included within this buffer.
- The proportion of the total road disturbance area within each vegetation type was applied to the total estimated disturbance area for all other associated structures and facilities, as shown in Table 4-13. These include well pads, overhead electric, compressor, metering, and water facilities.

Table 4-13 Estimated Area of Direct Surface Disturbance to Vegetation Resources				
Vegetation Class	**Total Area (acres) Percentage of FCPA**	**Estimated Impacts (acres)**		
		Alternative I	**Alternative II**	**Alternative III (Proposed Action)**
Agricultural	99.7 (0.1%)	3	2	2
Woodland	1,737.2 (1.7%)	58	37	35
Herbaceous Rangeland	66,848.7 (66.4%)	2,346	1,492	1,388
Rock-Bare Soil	1,514.5 (1.5%)	51	33	30
Shrubland	30,451.5 (30.3%)	1,078	685	637
Total Vegetation Resources	**100,652 (100%)**	**3,536**	**2,249**	**2,092**

Note: Water not included in acreage.
Disturbance estimates are based on new roads as "improved roads" with a width of 48 feet.

The following sections describe the impacts under each alternative resulting from the management of vegetation resources (including noxious weed management), as well as those anticipated to result from the management actions proposed for wildlife, special status species, fluid mineral management, and other resource management, including soil resources and special designations.

Alternative I (No Action Alternative)

Vegetation Resources Management

Alternative I, the No Action Alternative, would continue the current management goals and objectives summarized above. Most of the specific management actions are common to all alternatives, including direction to design all vegetation management to meet these objectives. A number of management actions specifically address undertaking actions that would result in some control of existing noxious weed populations and would limit the spread of noxious weeds. As is currently practiced, livestock management would be allowed within oil and gas projects. Several allotments have been assessed and determined to meet Wyoming Standards for Healthy Public Rangelands (BLM 1995a); however, the condition of other allotments is not known. Management actions under Alternative I, including weed control and revegetation, are expected to result in beneficial impacts. Weed control actions would result in some control of existing weed populations and limit the further spread of noxious weeds. Revegetation would be planned and implemented to prevent noxious weed proliferation and spread. Overall, the results of these actions would be considered minor in terms of visibility and duration of impacts because weed populations continue to decrease in size, incipient populations are not allowed to spread, and native vegetation cover within the FCPA increases as a result.

Wildlife and Special Status Species Resources Management

Under this alternative, TLs for elk crucial habitats limit surface-disturbing activities during parts of the year. Prohibiting impacts to vegetation in elk crucial winter range between November 15 and April 30 and in crucial parturition range between May 1 and June 30 will result in better plant growth and less erosion during this time; however, the benefits are temporary and do not impact vegetation resources. Wildlife management actions related to CBNG development are discussed in Fluid Minerals Management.

Fluid Minerals Management

The BLM goal for CBNG management is to facilitate the extraction of CBNG and minimize effects to the landscape that would impact the resource values in the FCPA. Associated objectives are to identify stipulations, BMPs, and COAs for exploration, development, production, and reclamation to ensure that activities would not adversely affect resource values in the FCPA.

Current management actions for CBNG development under Alternative I include restrictions and limitations for wildlife values. Under Alternative I, no overhead power lines are allowed on BLM lands. These restrictions are reflected in the estimated surface disturbance impacts.

Development of CBNG under Alternative I would result in an estimated 3,536 acres of vegetation disturbance (1 percent of the total area; see Table 4-13). All vegetation types would experience less than 1 percent surface disturbance. It should be noted that revegetation may take approximately two years to reestablish some vegetation cover and vegetative structure, function, and diversity will likely take decades to restore to pre-disturbance conditions.

CBNG development results in produced water from well development, which is handled in either impoundments or discharge to channels. Development of impoundments can lead to localized water leakage, which would result in changes in vegetation from existing range grasses, sagebrush, and juniper to more mesic species such as sedges (*Carex* sp.), foxtail barley (*Hordeum jubatum*), and, in places, cattails (*Typha* sp.). Saltcedar and leafy spurge are noxious weed species with toeholds in the FCPA. Expansion of mesic habitats could allow for further invasion by these species. Recent studies (Sterns et al. 2005, Bergquist et al 2007) suggest that produced water could result in a decrease in species richness and an increase in salt-tolerant species because of the buildup of salts in soils. Under Alternative I, an estimated 390 acres will be disturbed as a result of water impoundments.

The discharge to channels, although treated if necessary as required by WDEQ, would likely have an adverse impact on aquatic habitats, including vegetation. Under this alternative there is the potential for approximately 726 new wells in the FCPA. It is anticipated that 75 percent of these wells would discharge produced water directly into drainage channels. These drainage channels could include the Powder River, Mickleberry Creek, Deer Creek, Bull Creek, Fortification Creek, and Wild Horse Creek. With an average discharge of approximately 3.1 gallons per minute per well, an increase of 726 wells would result in an additional 2.4 mgd (0.10 mby) of produced water directly discharged into FCPA channels. Increased flows and sedimentation could result in conversion of reaches of ephemeral drainages that currently support upland grassland vegetation to perennial stream habitat that supports riparian vegetation. The magnitude of this impact cannot be estimated at this time. Overall the adverse impacts to vegetation resources from these conversions would be minor. Although they would result in an

increase in wetland and riparian habitat, both limited in the FCPA, these vegetation types are temporary and dependent on continued CBNG discharge for their existence.

Other Resources Management

Soil Resources

Under this alternative, surface-disturbing activities may be restricted or excluded on slopes greater than 25 percent, badlands, rock outcrop, slopes susceptible to mass failure (erosive), and erosive soils. This would result in indirect minor beneficial impacts to any vegetation that occurs in these areas because erosion would be minimized on approximately 33,694 acres; however vegetation is sparse in these areas. In an effort to avoid erosive soils, development would be displaced to less erosive soils resulting in disproportionate vegetation loss on these soil types; however less erosive soils typically have higher reclamation potential so that over time the vegetation is expected to recover more quickly.

Special Designations

Special designations often indirectly benefit vegetation as a result of limiting surface-disturbing activities in this area. Under Alternative I, the WSA (approximately 12,419 acres) would continue to be managed to maintain wilderness characteristics and no development would be allowed. No Area of Critical Environmental Concern (ACEC) or Wildlife Habitat Management Areas (WHMAs) would be designated. Therefore, it is expected that with no area of special designation in addition to the WSA, impacts to vegetation resources would be considered negligibly beneficial.

Alternative II

Vegetation Resources Management

Under Alternative II, current management goals and objectives summarized above would be continued. Most of the specific management actions are common to all alternatives, including direction to design all vegetation management to meet these objectives. A number of management actions specifically address undertaking efforts that would result in some control of existing noxious weed populations and limit the spread of noxious weeds. Several allotments have been assessed and determined to meet Wyoming Standards for Healthy Public Rangelands (BLM 1995a); however, the condition of other allotments is not known. Management actions under Alternative II, including weed control and revegetation, are expected to result in beneficial impacts. Weed control through several actions would result in a potential reduction of noxious weeds through mitigation and prevention. Revegetation would be planned and implemented to prevent noxious weeds. Reclamation in problematic areas may be enhanced by the requirement to fence seeded areas. Overall, the results of these actions would be considered moderate in terms of visibility and duration of impacts, as weed populations continue to decrease in size, incipient populations are not allowed to spread and native vegetation cover within the FCPA increases as a result.

Wildlife and Special Status Species Resources Management

Current management actions for wildlife resources under Alternative II include restrictions and limitations for wildlife values including restrictions on loss of elk security habitat. Such actions indirectly benefit vegetation resources because they limit surface disturbance; however, these actions also lead to increased development outside the elk crucial ranges thereby increasing

impacts on lower elevation vegetation types such as agricultural. Deferment from livestock grazing in interim reclamation areas could be expected to result in more complete revegetation, contributing to minor, beneficial impacts to vegetation.

Fluid Minerals Management

The BLM goal for CBNG management is to facilitate the extraction of CBNG and minimize effects to the landscape that would impact the resource values in the FCPA. Associated objectives are to identify stipulations, BMPs, and COAs for exploration, development, production, and reclamation to ensure that activities would not adversely impact resource values in the FCPA. Continuing current management actions for CBNG development under Alternative II include restrictions and limitations for wildlife values. Overhead power lines could be constructed along road corridors and drainages. These restrictions are reflected in the estimated surface disturbance impacts.

Development of CBNG under Alternative II would result in an estimated 2,249 acres of surface disturbance (2.2 percent of the total area; Table 4-13) to vegetation, less than under Alternative I. All vegetation types would experience less 1 percent surface disturbance. This would result in minor adverse impacts to vegetation resources. It should be noted that while revegetation may take approximately two years to reestablish some vegetation cover, vegetative structure, function, and diversity will likely take decades to reestablish to pre-disturbance conditions.

CBNG development results in produced water from well development, which is handled in either impoundments or a discharge to channels. Development of impoundments can lead to localized water leakage, which in turn would result in changes in vegetation from existing range grasses, sagebrush, and juniper to more mesic species such as sedges, foxtail barley, and, in places, cattails. Saltcedar and leafy spurge are noxious weed species, with toeholds in the FCPA. Expansion of mesic habitats could allow for further invasion by these species. Recent studies (Sterns et al 2005 and Bergquist et al. 2007) suggest that produced water could result in a decrease in species richness and an increase in salt-tolerant species because of the buildup of salts in soils. Under Alternative II, an estimated 262 acres will be disturbed as a result of water impoundments.

Under this alternative there is the potential for approximately 487 new wells in the FCPA. It is anticipated that 75 percent of these wells would discharge produced water directly into drainage channels. This could include the Powder River, Mickleberry Creek, Deer Creek, Bull Creek, Fortification Creek, and Wild Horse Creek. With an average discharge of approximately 3.1 gallons per minute per well, an increase of 487 wells would result in an additional 1.6 mgd (0.05 mby) of produced water directly discharged into FCPA channels. Increased flows could result in conversion of reaches of ephemeral drainages that currently support upland grassland vegetation to perennial stream habitat that supports riparian vegetation. The magnitude of this impact cannot be estimated at this time. Overall the impacts to vegetation resources from these conversions would be minor in extent and adverse. Although they would result in an increase in wetland and riparian habitat, these vegetation types are temporary and dependent on continued CBNG discharge for their existence.

Other Resources Management

Soil Resources

Under this alternative, no surface disturbance would be allowed on slopes greater than 25 percent, badlands, rock outcrop, areas susceptible to mass failure, and erosive soil. There would be no exceptions to this restriction. This limitation of activities would indirectly result in minor beneficial impacts to any vegetation that occurs in these areas because erosion would be minimized on approximately 33,694 acres; however, much of this area is not vegetated. In an effort to avoid erosive soils, development would be displaced to less erosive soils resulting in disproportionate vegetation loss on these soil types; however less erosive soils typically have higher reclamation potential so that over time the vegetation is expected to recover.

Special Designations

Special designation areas often indirectly benefit vegetation as a result of limiting surface-disturbing activities in the area as well as potentially including protective or otherwise beneficial management prescriptions. As under all alternatives, the WSA (approximately 12,419 acres) would continue to be managed to maintain wilderness characteristics. Under Alternative II, an ACEC (approximately 33,757 acres) would be designated for elk parturition and crucial winter range. A WHMA for elk crucial ranges (approximately 52,069 acres) would also be designated. It is expected that these actions would result in minor beneficial impacts to vegetation resources because surface disturbance and erosion may be reduced.

Alternative III – Proposed Action

Vegetation Resources Management

Under the Proposed Action, current management goals and objectives summarized above would be continued. Most of the specific management actions are common to all alternatives, including direction to design all vegetation management to meet these objectives. A number of management actions specifically address undertaking efforts that would result in some control of existing noxious weed populations and limit the spread of noxious weeds. Management actions under the Proposed Action, including performance standards for weed control and revegetation, are expected to result in general beneficial impacts. Weed control would be planned and implemented to prevent and control noxious weeds. Under this alternative, livestock management on disturbed areas will be evaluated and may be modified to include such efforts as adjusting stocking rates/timing, fencing, and grazing deferment following reclamation. This action would result in minor beneficial impacts to vegetation resources because additional time would be allowed for revegetation of disturbed areas. Several allotments have been assessed and determined to meet standards Wyoming Standards for Healthy Public Rangelands (BLM 1995a); however, the condition of other allotments is not known. Overall, the results of these actions could be considered moderate in terms of the visibility and time period of these impacts.

Wildlife and Special Status Species Resources Management

Management actions for wildlife resources under the Proposed Action include restrictions and limitations for wildlife values such as retention of 80 percent of security habitat. Such actions indirectly benefit vegetation resources because they result in limitations to surface disturbance. Potential deferment of livestock grazing in interim reclamation areas could be expected to result in more complete revegetation, contributing to minor beneficial impacts to vegetation. While

revegetation may take approximately two years, vegetative structure, function, and diversity will likely take decades.

Fluid Minerals Management

The BLM goal for CBNG management is to facilitate the extraction of CBNG and minimize effects to the landscape that would impact the resource values in the FCPA. Associated objectives are to identify stipulations, BMPs, and COAs for exploration, development, production, and reclamation to ensure that activities would not adversely impact resource values in the FCPA. Continuing current management actions for CBNG development under the Proposed Action include restrictions and limitations for wildlife values. Development of CBNG under the Proposed Action would allow up to a 20 percent loss in elk security habitat from current conditions. These conditions and restrictions are reflected in the estimated surface disturbance impacts.

The Proposed Action would result in less surface disturbance than Alternative I; however actual surface disturbance would depend on operators meeting performance-based standards. It is estimated that approximately 2,092 acres of surface disturbance (2.0 percent of the total area; see Table 4-13) would result to vegetation resources. All vegetation types would experience less than 1 percent surface disturbance. This would result in minor, adverse impacts to vegetation resources. It should be noted that while revegetation may take approximately two years to reestablish some vegetation cover, vegetative structure, function, and diversity will likely take decades to reestablish to pre-disturbance conditions.

CBNG development results in produced water from well development, which is handled in impoundments. Development of impoundments can lead to localized water leakage that would result in changes in vegetation from existing range grasses, sagebrush, and juniper to more mesic species such as sedges, foxtail barley, and, in places, cattails. Saltcedar and leafy spurge are noxious weed species, with toeholds in the FCPA. Expansion of mesic habitats could allow for further invasion by these species. Recent studies (Sterns et al 2005 and Bergquist et al 2007) suggest that produced water could result in a decrease in species richness and an increase in salt-tolerant species because of the buildup of salts in soils. Under the Proposed Action, an estimated 260 acres will be disturbed as a result of water impoundments.

Alternative III would include WYPDES permits for the discharge of CBNG produced water with water quality requirements but not with water quantity requirements. CBNG discharge is currently permitted at approximately 48 mgd for 1,807 wells. Current discharge is estimated at 1.8 mgd (16.2 mby) and current storage is estimated at 0.6 mgd (4 mby). Under this alternative there is the potential for approximately 483 new wells in the FCPA and an additional 1.6 mgd of produced water discharged to channels. Overall the impacts to vegetation resources from these conversions would be minor in extent and adverse in that they would result in an increase in areas of wetland and riparian habitat.

Other Resources Management

Soil Resources

Under this alternative, surface-disturbing activities may be restricted or excluded on slopes greater than 25 percent, badlands, rock outcrop, slopes susceptible to mass failure, and erosive soil. There could be exceptions to this restriction if the operator submitted an acceptable disturbance and reclamation plan. The disturbance and reclamation plan would take into account

the performance-based standards for elk and reclamation (Appendix B) and the operator would be required to meet these performance-based standards for soil reclamation for three years. This would result in indirect minor beneficial impacts to any vegetation that occurs in these areas because erosion would be minimized on approximately 33,694 acres. In an effort to avoid erosive soils, development would be displaced to less erosive soils resulting in disproportionate vegetation loss on these soil types; however less erosive soils typically have higher reclamation potential so that over time the vegetation is expected to recover.

Special Designations

Special designation areas often indirectly benefit vegetation as a result of limiting surface-disturbing activities within the area as well as potentially including protective or otherwise beneficial management prescriptions. As under all alternatives, the WSA (approximately 12,419 acres) would continue to be managed to maintain wilderness characteristics. Under the Proposed Action, no ACEC or WHMA would be designated. Therefore, it is expected that with no area of special designation in addition to the WSA, impacts to vegetation resources would be considered negligibly beneficial.

Summary

Table 4-14 summarizes estimated impacts to vegetation resources, by alternative.

Table 4-14 Summary of Impacts to Vegetation Resources

Land Use or Management Action	Alternative I (No Action)	Alternative II	Alternative III (Proposed Action)
Vegetation Resources Management	Minor (+) Reduction in noxious weeds	Moderate (+) Fence problem reclamation areas	Moderate (+) Reclamation and noxious weed performance standards
Wildlife and Special Status Species Resources Management	No Impact	Minor (+) Potential grazing deferment	Minor (+) Potential grazing management
Fluid Minerals Management	Minor (-) 3,536-acre (3.5%) disturbance	Minor (-) 2,249-acre (2.2%) disturbance	Minor (-) 2,092-acre (2.1%) disturbance
Other Resource Management			
Soil Resources	Minor (+) Exceptions apply	Minor (+) No exceptions	Minor (+) Exceptions apply
Special Designations	Negligible (+) WSA protections	Minor (+) ACEC and WHMA	Negligible (+) WSA protections

4.3.4.3. Cumulative Impacts

Cumulative impacts to vegetation resources were evaluated for the entire PRB, including the FCPA in the PRB O&G FEIS (BLM 2003a). Total acreage affected by CBNG development would not be disturbed simultaneously because development would occur over approximately 7 years. Disturbed areas would be revegetated or would be in the process of being revegetated while new disturbance was occurring (BLM 2003a). BLM estimated that 2,300 acres per day were being colonized by weeds in the western U.S. (BLM 1995a). From 1999 to 2002, the area of infestation of Canada thistle almost doubled in Campbell County, and Scotch thistle and salt-cedar tripled in distribution in Johnson County (BLM 2003a). Water quality, quantity, and long-term production can be reduced by spotted knapweed, diffuse knapweed, saltcedar, and other noxious weeds invading watersheds. In western Montana, surface runoff was increased by 56 percent and sediment yield was 192 percent higher in spotted knapweed sites, compared to those sites dominated by native bunch grass (Wyoming State Weed Team 2003). CBNG development in the FCPA will result in an increase in noxious weeds in areas of surface disturbance (potentially 3,536 acres), which could spread to areas outside the FCPA. Similarly, noxious weed colonization of disturbed land inside the FCPA could be caused by current and future CBNG development.

4.3.5. Fish and Wildlife Resources

Fish and wildlife resources typically include vertebrates that are not threatened, endangered, or other special status species. Special status species are discussed in the next section (Section 4.3.6). The goals of fish and wildlife management in the FCPA are to maintain biological diversity; support Wyoming Game and Fish Department (WGFD) population objective levels to the extent practical and to the extent consistent with BLM multiple use; maintain and improve forage production and quality of rangelands, fisheries, and wildlife habitat; provide habitat for threatened and endangered and special status species to the extent possible; and provide habitat for elk and other big game species. The management objectives related to this goal are to support big game and fisheries management levels identified in the WGFD's 2007–2011 strategic plan (WGFD 2006a) and protect the isolated elk herd in the FCPA while allowing CBNG development.

Elk and raptor TLs are common to all alternatives. The following alternative analysis considers the impacts of the various management actions on fish and wildlife.

Evaluation Criteria

The boundary of the FCPA was used as the impact analysis area. This is the boundary specified for the PRMPA/EA. The WGFD has developed boundaries for the elk yearlong range (defined by the core use area for the herd) and elk crucial range (the crucial winter range and parturition range, combined). The boundaries for both the elk yearlong range and elk crucial range extend south beyond the limits of the FCPA. For purposes of analysis, the yearlong and crucial ranges within the boundaries of the FCPA will be the analysis area for elk. To avoid confusion, it should be noted that, in other documents (BLM 2007a, WGFD 2007a), the term "Fortification Creek Area" is used to refer to the entire elk yearlong range.

The WGFD has identified a herd management objective of 150 elk for the yearlong range (WGFD 2007a). The 2008 post-hunt population estimate was 219 animals in the Fortification Creek herd unit (WGFD 2009a). Anticipated changes in elk population numbers are difficult, if

not impossible, to predict. In addition to elk population numbers, useful and measurable metrics include effective habitat and security habitat, defined below. BLM has indicated that loss of habitat, in the form of effective habitat or security habitat, would serve to evaluate management actions, and these are the metrics used in the present analysis.

The discussion below describes the factors that define habitat loss for wildlife, with specific references to elk, and to the Fortification Creek elk herd where data were available.

Direct Habitat Loss

Direct habitat loss occurs when required life-sustaining conditions are lost (i.e., through removal of vegetation or draining a pond). Removal of vegetation affects wildlife by reducing the extent or quality of habitat in terms of food, cover, and structure for nesting and other uses. These impacts are relatively simple to quantify by comparing the amount of habitat lost to the amount preserved. For example, removal of vegetation during construction of a road or well pad essentially strips the affected area of any wildlife value. While closure and reclamation of temporarily disturbed areas can eventually restore lost habitat values, the disturbance may have a long duration (20 or more years for a well) or require years or decades for recovery of pre-disturbance structure and function (pipeline corridors or reclaimed roads). For the purposes of this analysis, the impact of direct habitat loss is dwarfed by effective habitat loss (see detailed description below). As a consequence, many of the impacts will be evaluated in terms of effective habitat loss.

Effective Habitat Loss

While some species are more tolerant of human activity than others, virtually all species have some threshold of disturbance above which they will abandon or avoid an area. The result is a de facto loss of habitat, because avoided areas meet no survival needs. The amount of habitat actually available to wildlife is called effective habitat, and reductions in the amount of effective habitat can greatly exceed any direct habitat loss. Also important is security habitat, defined as a place to escape from disturbance. Security habitat is typically defined in patches of a minimum size.

Effective loss of habitat can occur as a result of habitat modification, habitat fragmentation, disturbance, and interference with movement. These impacts to habitat reduce the ability of the habitat to provide the basic needs of the wildlife in question.

Habitat modification, or changes in habitat, are generally less obvious than losses of habitat, but can be significant, especially if small impacts accumulate across large areas. Weed invasion leading to a reduction in native plant vigor or cover is a notable habitat modification in the FCPA. Habitat modification can also be beneficial and is an important tool in wildlife management. Examples include use of prescribed fires to stimulate new growth on senescent (older) woody vegetation, thinning of overly dense shrubs to enhance forage production, construction of protective fencing along riparian areas, and creation of alternative watering features for elk and other wildlife to allow for a potentially greater dispersion across the landscape.

Habitat fragmentation is increasingly recognized as an important impact on wildlife. Impacts of habitat fragmentation relate to the loss of large habitat blocks and the increased percentage of “edge” on smaller blocks as compared to larger blocks. Roads can cause habitat fragmentation and, hence, the loss of effective habitat, because many species exhibit a decline in use of areas

adjacent to roads. Habitat-interior birds may avoid habitat within 300 to 450 feet from forested roads, and up to 1.2 miles away from grassland roads (Forman 2000, Forman and Alexander 1998). Sagebrush-obligate birds experienced a 39 to 60 percent reduction in density near roads in a natural gas oil field (Ingelfinger and Anderson 2004). In one study, use by mule deer was reduced within 0.125 mile of a road (Knight et al. 2000). A study in central Wyoming reported that mineral drilling activities displaced mule deer by more than 0.5 mile (Hiatt and Baker 1981). Small mammal studies in sagebrush-steppe landscapes indicate that species richness decreased with increasing isolation of habitat patches (Hanser and Huntly 2006). The authors suggest that these sagebrush-obligate species are at risk of extirpation as sagebrush becomes ever more fragmented. Another cause of habitat fragmentation is the replacement of native vegetation by weeds. The presence of cheatgrass further added to the decrease in species richness (Hanser and Huntly 2006).

Disruptive impacts occur when some type of activity, typically of human origin, causes animals to shift their activity or alter their behavior. Disruptive impacts generally overlap with habitat fragmentation because many of the more common and important types of fragmentation (e.g., roads) also include increased levels of human activity.

Habitat loss or modification, habitat fragmentation, and disruptive activities can also affect wildlife by altering important daily or seasonal movement patterns. These patterns may be altered through shifts to avoid human activity or to avoid crossing open areas that provide inadequate cover. Conversely, some species and populations adapt to disturbance. This effect, called habituation, is very difficult to predict with a species such as elk. Some populations appear to habituate, such as in Yellowstone National Park, and yet others do not adapt and continue to be stressed and move away from human disturbance, as appears to be the case for the Fortification Creek herd. Elk habituate in areas where activity is predictable and non-lethal. Hunted populations show a reduced tendency to habituate, which appears to be the case in the Fortification Creek herd.

Disruption is a key factor in effective habitat loss, and typically exceeds the more obvious direct habitat loss. For example, Reed et al. (1996) estimated that the effective habitat loss caused by roads was 2.5 to 3.5 times as great as actual habitat loss. In the Fortification Creek area, behavior was monitored for 26 elk collared in 2005 by BLM and WGFD (BLM 2007a, WGFD 2007a). These elk avoided areas within 1.7 miles of oil, natural gas, and CBNG wells and 0.5 mile of roads. A study in the Jack Morrow Hills reported elk avoidance distances of 1.73 miles from roads and 1.24 miles from oil and gas activity (Powell 2003, Sawyer et al. 2007).

Direct Mortality

Direct mortality can result from collisions with vehicles, electrocution of raptors on utility lines, increased likelihood of illegal hunting, or inadvertent trampling of nests, as well as other events. The most likely cause of direct mortality in the FCPA is vehicle collisions. Because of their slow mobility, amphibians, reptiles, prairie dogs, and other small mammals are particularly vulnerable to mortality while crossing roads to access hibernation, breeding, and foraging sites.

Road and Elk Model Analysis

For the purposes of analyzing the impact of CBNG development scenarios on elk habitat, a modeling effort, similar to that used by BLM (2007e), was conducted for the same portion of the elk yearlong range and the elk crucial ranges within the FCPA. The elk ranges are defined in

WGFD Fortification Creek Elk Study Progress Report (2007b). The analysis was limited to lands with Federal mineral estate, except when actions led to impacts on elk or other wildlife elsewhere.

The analysis evaluated the acreage of effective and security habitat available to elk under the three alternatives and baseline. Effective habitat was modeled as all areas within the elk ranges that were 0.5 mile from roads or less than 0.5 mile where visibility of the road was obscured by topography at a lesser distance. The model does not account for vegetation because a previous study found that vegetation did not explain observed elk use in relation to roads (BLM 2007e). Rather than calculate the buffering around individual wells, especially because their exact location is difficult to predict, it was assumed that by calculating the loss of effective habitat around roads that access the wells, the loss of effective habitat around wells was accommodated because elk are avoiding human activity more than the physical roads or wells, and more surface area and activity occurs on the roads than at the wells. The visibility model employed a 98-foot digital elevation model to account for topography (U.S. Geological Survey [USGS] National Elevation Database). Because no development will occur in the WSA, it was assumed that no roads occurred or were used in the WSA. The model was run for the entire yearlong elk range and subsequently clipped to the FCPA. This ensures that roads immediately outside the FCPA but within 0.5 mile show the loss of effective habitat. The same algorithm was used for elk crucial range.

Security habitat, the number of patches and total acreage, were also analyzed. A security patch was defined as a block of contiguous effective habitat with a size of 250 acres or more. This is a common minimum patch size that has been used in other elk studies (Christensen, Lyon, and Lonner 1991, Leege 1984, BLM 2007a).

The modeling and alternative analyses assume that human activity on roads will cause security habitat loss. However, during implementation, when wells are in production, if disruptive activities are kept to a level where elk use complies with the appropriate performance standards, security habitat may be regained.

Alternative I is identical to the 2008 analysis and does not use the updated roads layers used in the baseline and Alternatives II and III. It was analyzed using a planimetric road layer designed to avoid slopes greater than 25 percent and accommodate the 80-acre well spacing. The methodology for all three alternatives is further described in Appendix E.

The Alternative II model added roads to the baseline but provided some protection in crucial ranges (crucial winter and parturition ranges) and the yearlong range in order to meet the recommendations of the WGFD. No roads were added to the overlapping crucial ranges. The model added roads to the non-overlapping crucial ranges and limited the loss of security habitat to 25 percent. Outside the crucial ranges, roads were added in by maintaining 50 percent of security habitat within the yearlong range outside of the crucial ranges. Roads were added if they would terminate in an unused 80-acre spacing grid in lands with Federal minerals and avoided slopes greater than 25 percent.

The Alternative III model added roads to the baseline and provided some protection in security habitat in the yearlong range and complete protection in the overlapping crucial ranges. The model added roads to the FCPA, but limited the loss of security habitat to 20 percent in the yearlong range. Roads were added if they terminated in an unused 80-acre spacing grid in lands with Federal minerals and avoided slopes greater than 25 percent.

Loss of habitat is measurable. However, it is not possible to translate this information directly to changes in elk population estimates. It is difficult to predict exactly what the elk herd will do in response to the various development scenarios (O'Brien 2008). With that in mind, the analysis of available habitat is the best measure that can be applied to estimate impacts to the elk herd.

Alternative Analysis

Impact intensity defines the degree or extent of impacts. For this analysis, the categories are defined as follows:

- *Minor* – The effect is slight but detectable; there would be a small change. Resource indicator thresholds are potentially exceeded, but on a short-term or highly localized basis. This would be characterized as less than 15 percent alteration in resource indicators.
- *Moderate* – The effect is readily apparent; there would be a measurable change that could result in long-term or permanent alteration to a resource. Some resource indicator thresholds are exceeded. This would be characterized by a 15 to 20 percent alteration.
- *Major* – The effect is large; there would be a highly noticeable, long-term, or permanent measurable change. Resource indicator thresholds are clearly exceeded. An alteration of more than 20 percent in resource indicators would qualify as a major impact.

The occurrence, abundance, and distribution of wildlife are most strongly affected by habitat availability and accessibility. These habitat characteristics may be severely altered as a result of increased human activity and resource development. Adverse impacts are a typical result of management actions associated with fluid minerals development. Other management actions can be beneficial or adverse, such as soil and water resources management, and others, depending on how and what actions are implemented.

Wildlife also can benefit from resource management activities aimed at specific wildlife or other environmental concerns, such as protective measures for special status species, TLs, no surface occupancy (NSO), disturbance-free buffer zones, and other actions aimed at preserving or enhancing fish and wildlife resources.

Impacts to fish and wildlife resources associated with Alternatives I through III are summarized in the following subsections. These impacts can be either direct or indirect and can result from any activity involving increased levels of human activity and removal or modification of habitat.

Alternative I (No Action Alternative)

Fish and Wildlife Management

Common to all alternatives, surface disturbance would not be allowed in elk crucial winter range between November 15 and April 30 and in parturition range from May 1 through June 30. New surface-disturbing activities would be precluded within 0.5 mile of raptor nest sites to prevent increased stress and displacement during the critical nesting period from February 1 through July 31. Stock tanks would be required to be wildlife-friendly with ramps to allow escape by small mammals and birds.

Alternative I, the No Action Alternative, would allow CBNG development at an unrestricted pace. Well metering and visitation and water management facility and compressor locations would not be restricted. No replacement water sources would be required for elk. No elk security habitat standards would be implemented. Because these management actions are also fluid

minerals management actions, they are further described below along with their impacts to wildlife.

Fluid Minerals Management

The BLM goal for CBNG management is to facilitate the extraction of CBNG and minimize the effects on the landscape that would impact the resource values in the FCPA. Associated objectives are to identify stipulations, COAs, and BMPs for exploration, development, production, and reclamation to ensure that activities would not impact resource values in the FCPA. A number of wildlife-protective restrictions for CBNG development are common to all alternatives. These include avoiding placement of impoundments in sagebrush, where possible; fencing of impoundments; installing noise mufflers on compressors; limiting noise levels to 55 decibels; and restriction (when deemed necessary) of surface disturbance and disruptive activities in elk crucial winter range between November 15 and April 30 and elk parturition range from May 1 through June 30. There are additional restrictions that relate to special status species. They are also listed as management actions common to all alternatives for management of special status species, and will be addressed under Special Status Species Management.

Management actions specific to Alternative I include an unrestricted development pace, and no restrictions on the location of compressors and water management facilities. Further actions include no restrictions on well metering and visitation, no replacement of water sources for elk, no elk security habitat standards implemented, and overhead power lines would be prohibited on BLM surface land.

Fluid minerals development has many aspects that are detrimental to wildlife populations. Often, it is the roads and associated disruptive activities that impact wildlife in these otherwise isolated areas. One example is the increase in shooting of prairie dogs (Reeve and Vosburgh 2006) and other species that can occur when roads open up an otherwise inaccessible area.

Unrestricted development pace has a major adverse impact on wildlife, especially the Fortification Creek elk herd. Unrestricted development, including roads, wells, and ancillary facilities, would result in habitat fragmentation and loss. Because roads, wells, and facilities could be placed anywhere in the FCPA without regard for timing or coordination among operators, the elk would be forced into smaller areas. In the FCPA this would be the WSA, which is not large enough to support an elk population of 120.

Roads cause direct habitat loss; however, the larger impact comes from the reduction in effective habitat due to habitat fragmentation, and interference with movement patterns caused by disruptive activities associated with roads. Direct mortality is also an occurrence on roads. These impacts were evaluated for elk in particular. The comparison of road length, road density, effective habitat, and security habitat under the three alternatives is shown in Table 4-15.

Table 4-15 Comparison of Linear Road Miles and Road Density, Effective Elk Habitat, and Elk Security Habitat Under the Three Alternatives

Alternative	Linear Road Miles and Road Density (miles/mile²)	Effective Habitat (acres)	Number of Security Patches	Security Area Total (acres)
Elk Yearlong Range in FCPA (78,251.0 acres or 122.3 mile²)				
Baseline Existing Conditions	140 miles 1.1 miles/mile²	44,537	4	40,781
Alternative I **80-acre spacing (8 wells/section)**	428 miles 3.5 miles/mile²	11,405 *74% decrease from baseline*	1	6,628 *84% decrease from baseline*
Alternative II **Retain all security habitat in overlapping crucial ranges, 75% in non-overlapping crucial ranges, and 50% in yearlong outside of crucial ranges**	220 miles 1.8 miles/mile²	35,662 *20% decrease from baseline*	5	31,663 *22% decrease from baseline*
Alternative III **Retain 80% of security habitat in yearlong range**	192 miles 1.6 miles/mile²	37,820 *15% decrease from baseline*	5	33,687 *17% decrease from baseline*
Elk Crucial Ranges (includes parturition range and crucial winter range) in FCPA (52,068.9 acres or 81.4 mile²)				
Baseline Existing Conditions	64 miles 0.8 miles/mile²	34,452	4	32,406
Alternative I **80-acre spacing**	245 miles 3.0 miles/mile²	9,505 *72% decrease from baseline*	1	6,628 *80% decrease from baseline*
Alternative II **Retain all security habitat in overlapping crucial ranges, 75% in non-overlapping crucial ranges, and 50% in yearlong outside of crucial ranges**	86 miles 1.1 miles/mile²	30,239 *12% decrease from baseline*	5	27,807 *14% decrease from baseline*

Table 4-15 Comparison of Linear Road Miles and Road Density, Effective Elk Habitat, and Elk Security Habitat Under the Three Alternatives

Alternative	Linear Road Miles and Road Density (miles/mile²)	Effective Habitat (acres)	Number of Security Patches	Security Area Total (acres)
Alternative III **Retain 80% of security habitat in yearlong range**	89 miles 1.1 miles/mile²	31,210 *9% decrease from baseline*	5	28,960 *11% decrease from baseline*
FCPA Outside of All Elk Ranges (22,402.6 Acres or 35.0 mile²)				
Baseline Existing Conditions	159 miles 4.5 miles/mile²	0	0	0
Alternative I **80-acre spacing**	188 miles 5.4 miles/mile²	0	0	0
Alternative II **Retain all security habitat in overlapping crucial ranges, 75% in non-overlapping crucial ranges, and 50% in yearlong outside of crucial ranges**	181 miles 5.2 miles/mile²	0	0	0
Alternative III **Retain 80% of security habitat in yearlong range**	184 miles 5.3 miles/mile²	0	0	0

Notes:
Limited to specified elk ranges within FCPA and includes all lands.
Model assumes no roads in WSA. Conducts model before clipping to the FCPA.
Uses 0.5-mile buffer on roads, or less than 0.5 miles if road not visible at lesser distance (see text for explanation).

In the elk yearlong range, road density would increase from 1.1 miles/square mile (mile²) under present baseline conditions to 3.5 miles/mile² under Alternative I. The 44,537 acres of effective habitat under existing conditions would decrease by 33,132 acres, representing a loss of 74 percent of the existing effective habitat. Whereas current conditions show four security patches with a total of 40,781 acres, Alternative I would cause the loss of three of the security patches (75 percent loss from existing conditions) and a loss of 34,149 acres of security habitat, or 84 percent of that currently available. The only security habitat would be inside the WSA. Elk yearlong security areas are shown on Figure 4-2 for baseline conditions and Figure 4-3 for Alternative I.

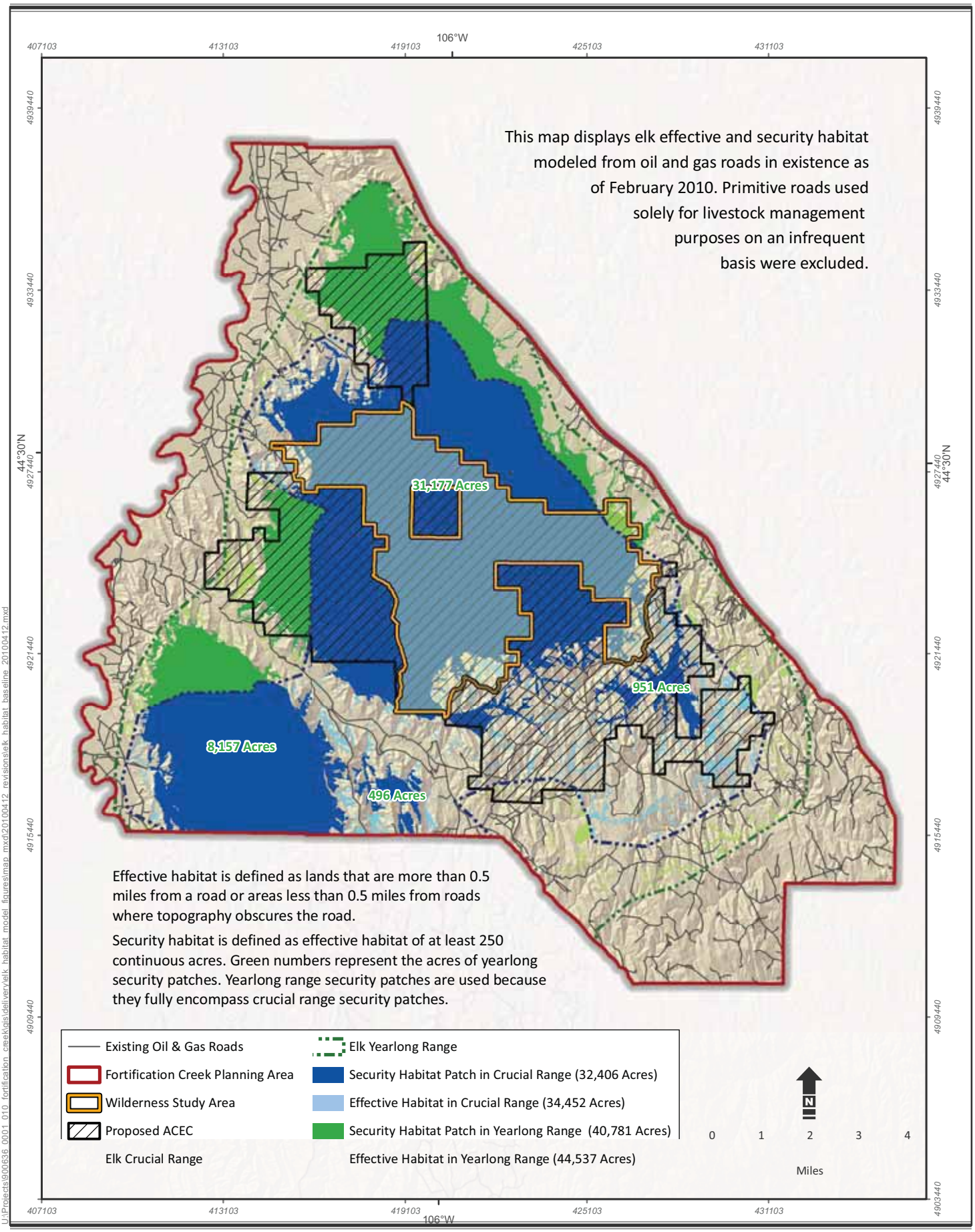


Figure 4-2

Elk Effective and Security Habitat Baseline Conditions

Campbell, Johnson, and Sheridan Counties, Wyoming

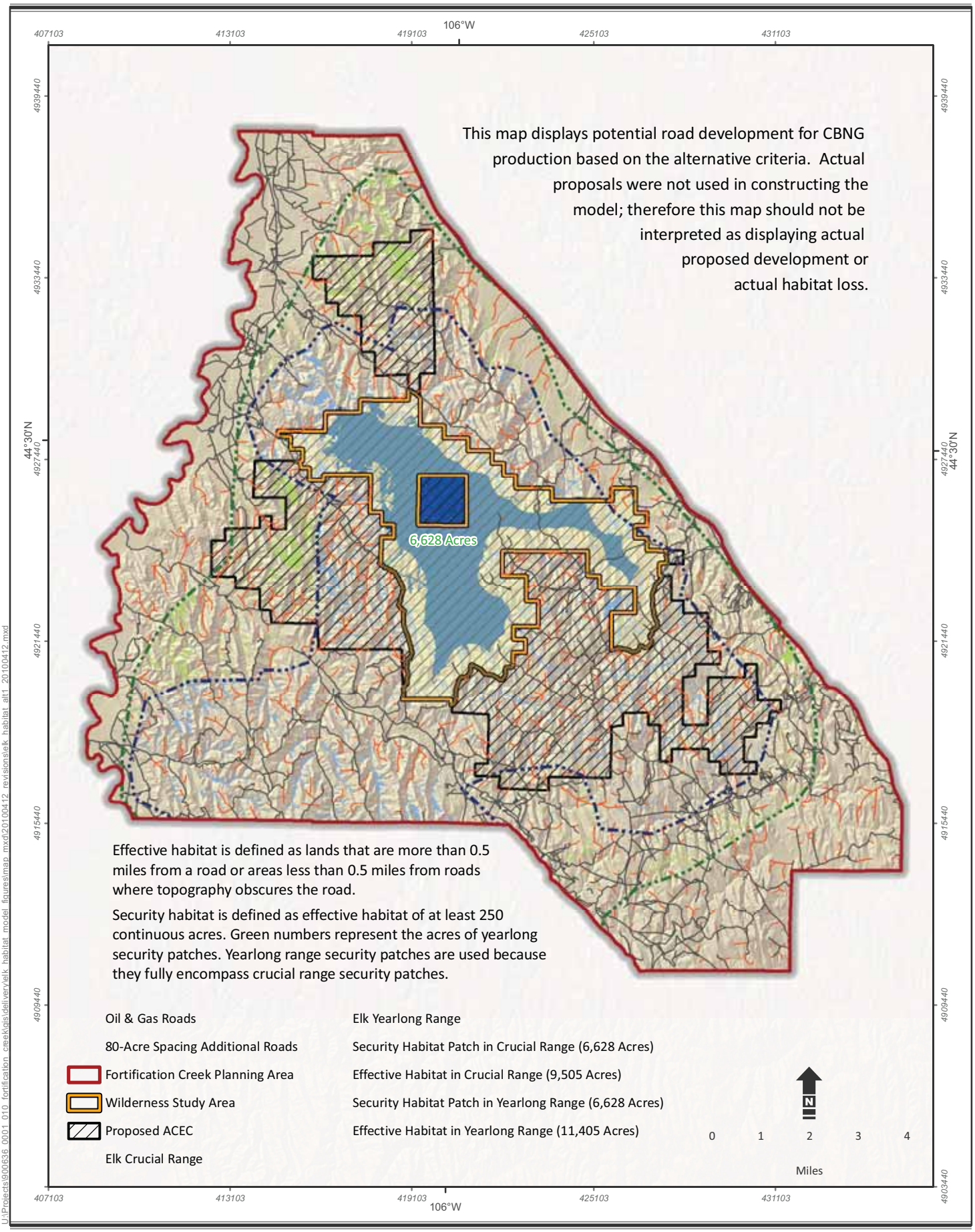


Figure 4-3

Alternative I

Elk Effective and Security Habitat

Campbell, Johnson, and Sheridan Counties, Wyoming

For elk crucial range, road density would increase from 0.8 mile/mile² under present baseline conditions to 3.0 mile/mile² under Alternative I. The 34,452 acres of effective habitat under existing conditions would decrease by 24,947 acres, representing a loss of 72 percent of the existing effective habitat. Whereas current conditions show four security patches with a total of 32,406 acres, Alternative I would cause the loss of three of the security patches (representing a 75 percent loss from existing) and a loss of 25,774 acres of security habitat, or 80 percent of that currently available. The only security habitat would be inside the WSA. Elk crucial range security areas under Alternative I are shown on Figure 4-3. These three measures across the yearlong and crucial ranges indicate habitat impacts of 72 to 80 percent. Road density was modeled and the road locations are theoretical and do not represent actual roads.

If adequate security habitat is not available within the FCPA and/or the WSA, it is likely that some elk will flee the area and may or may not return as has been observed with the collared elk (O'Brien 2008). Individuals that leave likely will move to areas with less human activity such as downriver to Montana. Although some individuals may flee, it is suspected that most of the elk would remain in the FCPA, causing overcrowding in the WSA (BLM 2007a). Overcrowding will increase habitat degradation and disease transmission eventually resulting in decreased herd health and population size.

Although the Powder River is a naturally turbid river, increased sedimentation into channels from road construction may affect aquatic habitat conditions. Sediment from roads may carry seeds of invasive plant species such as saltcedar and Russian-olive and exacerbate an already serious problem. Sediment from roads may be especially damaging during low-flow periods when the river is relatively clear, and when larval fish inhabit shallow, low- or zero-velocity habitats.

Increasing sediment to larval fish habitats can smother eggs directly or reduce primary food sources by covering epipelic benthos. Channel morphology may also be affected, particularly on the descending limb of the hydrograph following high-flow events when deposition occurs (reducing complexity, filling pools, altering deposition features, etc.).

Habitat-interior birds avoid use within 300 to 450 feet from forested roads, and up to 1.2 miles away from grassland roads (Forman 2000, Forman and Alexander 1998). The size of an undisturbed habitat block also affects the number of bird species present. In Georgia Piedmont forests, contiguous forest areas larger than 25 acres are needed to maintain high levels of avian diversity (McIntyre 1995). Although these studies were not conducted in sagebrush/juniper woodlands, it is not unreasonable to assume that the same concept applies. Similarly, small mammal species richness is sensitive to fragmentation in sagebrush shrublands (Hanser and Huntly 2006).

Under Alternative I, overhead power lines would be prohibited on BLM surface land. The prohibition on overhead power lines would avoid electrocutions and collision fatalities to raptors. However, these impacts would occur on adjacent non-Federal lands where power lines would not be prohibited. Generators are used as a temporary power source and typically run for a period of two years. The presence of generators would require fuel truck visits, on the order of one to two trips per week, and the sound of generators would be heard around the clock. Even limited to 55 decibels at 0.25 mile, this noise level would be readily heard by elk and other wildlife. These combined impacts would cause additional disruption to wildlife, including elk, due to truck visitations and associated exhaust fumes, increased noise, and the potential for fuel spills. There

are other means of onsite power generation that provide less disturbance (e.g., natural gas microturbines, wind, or solar), but gas generators are, to date, the most commonly used power source.

The sum of impacts from fluid minerals development under Alternative I is a major adverse impact because all measured criteria show an impact greater than 20 percent. This is a major impact because of the following:

- For elk yearlong range:

  74 percent of the existing effective habitat is lost; three security patches (75 percent loss from existing) are lost;

  34,149 acres of security habitat, or 84 percent of that currently available, is lost; and

  Unrestricted development pace would restrict elk to the WSA, which only provides habitat for 46 to 64 elk for the 20-year duration (BLM 2007a).

- For elk crucial ranges:

  72 percent of the existing effective habitat (24,947 acres) would be lost;

  Three security patches would be lost (75 percent); and

  80 percent (25,774 acres) of security habitat is lost.

Other Resources Management

Soil Resources

Alternative I would allow for potential control or exclusion of surface-disturbing activities on slopes greater than 25 percent, or soils with a severe erosion hazard. No surface disturbing activity would be allowed on badlands, rock outcrop, or soils susceptible to mass failure. Standard lease terms and conditions would apply. Activities on 25 percent slopes would very likely lead to increased erosion, which causes habitat modification in the form of a loss of vegetation. It is anticipated that few exceptions would be allowed to the restriction of activities on slopes of 25 percent or greater. Soil resource management actions would have moderately beneficial impacts on wildlife because some exceptions to the 25 percent slope restriction would be allowed, but most of the resource would be protected.

The avoidance of slopes would protect the broken country favored by this elk herd (WGFD 2007a), and would place much of the development on bottomlands. Soil resources management under Alternative I is a major beneficial impact because approximately 33,694 acres would be protected by the 25 percent slope restrictions. The bottomland riparian areas would be impacted by both roads (discussed above) and impoundments. In-channel impoundments for CBNG produced water would be located in the drainage bottoms. Overall, there are few suitable locations for impoundments within the FCPA because of the highly incised drainages and rough topography that dominate the landscape. With limited available acreage of level locations within the FCPA, off-channel impoundments would not be commonly proposed. These impacts are discussed under Water Resources Management.

Water Resources

A number of management actions are common to all alternatives. These include locating discharge points in areas that will minimize erosion and in stable, low gradient drainage systems

and below headcuts, when possible; or employing mitigation measures. All discharge points will require energy dissipation measures and produced water will not exceed two-year peak flows. Discharge points will not be located in playas or closed basins, or valley bottoms with no defined low-flow channel; these may be reviewed on a site-specific basis. All stock tanks will include escape ramps for trapped birds and mammals.

Under Alternative I, the location of water management facilities is not restricted and discharge to drainages is authorized when permitted by the State of Wyoming; no subsequent monitoring or mitigation of downstream effects is required; and no replacement water resources are required specifically for elk. Produced water discharge is estimated at 3.2 mgd.

Many different techniques are potentially used for discharge of produced water. Two commonly employed methods are impoundments and pipelines to transport CBNG water outside of the FCPA. Impoundments would be developed in bottomlands along the Powder River and Fortification Creek, and alongside tributaries. Off-channel impoundments would be used on flat terraces. The unrestricted placement of impoundments inside the elk yearlong and crucial ranges will likely have conflicting effects: elk and deer are likely to leave areas with disruptive activities but be attracted to water sources with little or no human activity. The need for water may cause elk to leave their security habitat and experience higher levels of stress and exposure to potential poaching. In addition to impoundments on Federal lands, a large proportion of impoundments would likely be placed on private lands along the Powder River with water piped in from Federal projects. An 80-foot-wide pipeline corridor through elk crucial range has already been constructed on private land to conduct piped water from Fortification Creek to the Powder River through the Kinney Divide Unit. These CBNG-related actions on the FCPA will likely continue and impact habitat and wildlife on adjacent lands. Non-game wildlife such as bats, small carnivores, birds, and amphibians would likely benefit from access to additional water sources. Canada geese and other waterfowl are known to frequent these newly developed water sources.

Development of impoundments leads to water leakage, which causes changes in vegetation from existing range grasses, sagebrush, and juniper to more mesic species such as sedges, foxtail barley, and, in places, cattails. Saltcedar and leafy spurge have toeholds in the FCPA. Expansion of mesic habitats allows for further invasion by these species. Typically, the area of disturbance to construct an impoundment is as much as twice the size of the containment area. Under Alternative I, an estimated 390 acres will be disturbed as a result of water impoundments. This amount of ground disturbance would lead to a potential for weed infestation, and have an adverse impact on wildlife.

The discharge to channels, although treated if needed as required by WDEQ, would likely have an adverse impact on aquatic habitats of native species because of increased sedimentation and increased flows. Additionally, discharge would result in an adverse impact on downstream native fish and amphibians adapted to more seasonally fluctuating conditions. Increased turbidity may alter fish assemblages and sedimentation may fragment fish populations. The continuous contribution of constant-temperature waters may disrupt environmental cues that native fish depend on for reproductive behavior (Davis et al. 2006). There is also concern that CBNG waters would transport heat from coal beds to streams. With no monitoring requirement, there would be no opportunity to evaluate this issue and use adaptive management if necessary.

No water source replacement is required for elk and this would likely indicate that the increased level of disturbance would not be offset by secure access to water. Because stock tanks would be

wildlife friendly, small animals that entered the stock tank would have a means of getting out and avoiding drowning.

Actions from water management would result in a moderately adverse impact on elk and other wildlife and their habitat, and a moderate adverse impact to downstream aquatic resources.

Special Designations

Alternative I specifies that, although an ACEC was proposed in the PRB O&G FEIS (BLM 2003a), it would not be designated and current status would be maintained. In addition, no WHMA would be designated. However, because elk and other wildlife can use the WSA for security habitat, there would be a minor beneficial impact to wildlife resources.

Alternative II

Fish and Wildlife Management

Alternative II would incorporate a number of management actions including a tri-phased development plan to occur over three years followed by one year of successful interim reclamation. This may include livestock grazing deferment; an authorized activity management plan for construction, metering, monitoring, and maintenance; and restricted visitation. Provisions would be made for emergencies including any unforeseen circumstance or combination of circumstances that create a dangerous situation that threatens human health, safety, or the environment if repair/remedial actions are delayed until BLM approval can be obtained.

Water management facilities would be located outside elk crucial ranges; summer water sources would be provided by CBNG projects if a loss was attributable to development; and compressors within crucial ranges would be limited to the minimum number necessary. All security habitat within overlapping crucial ranges would be retained; in non-overlapping crucial ranges, 75 percent of the security habitat would be retained. Because these management actions are also fluid minerals management actions, they are further described below along with their impacts on wildlife.

Fluid Minerals Management

The BLM goal for CBNG management is to facilitate the extraction of CBNG and minimize the effects on the landscape that would impact the resource values in the FCPA. Associated objectives are to identify stipulations, COAs, and BMPs for exploration, development, production, and reclamation to ensure that activities would not impact resource values in the FCPA. A number of wildlife-protective management actions for CBNG development are common to all alternatives and are described under Alternative I. Alternative II would incorporate a number of management actions including a tri-phased development approach by geographic area, to occur over three years followed by one year of successful interim reclamation. This approach would restrict development to three geographical areas as shown in Figure 4-4.

The tri-phased development approach would authorize continued CBNG development, while allowing the elk herd to move to areas without construction activities. The tri-phased development approach would have a beneficial impact on wildlife because it would limit construction to one third of the FCPA during any given development phase thereby providing two-thirds of the FCPA without construction activities.

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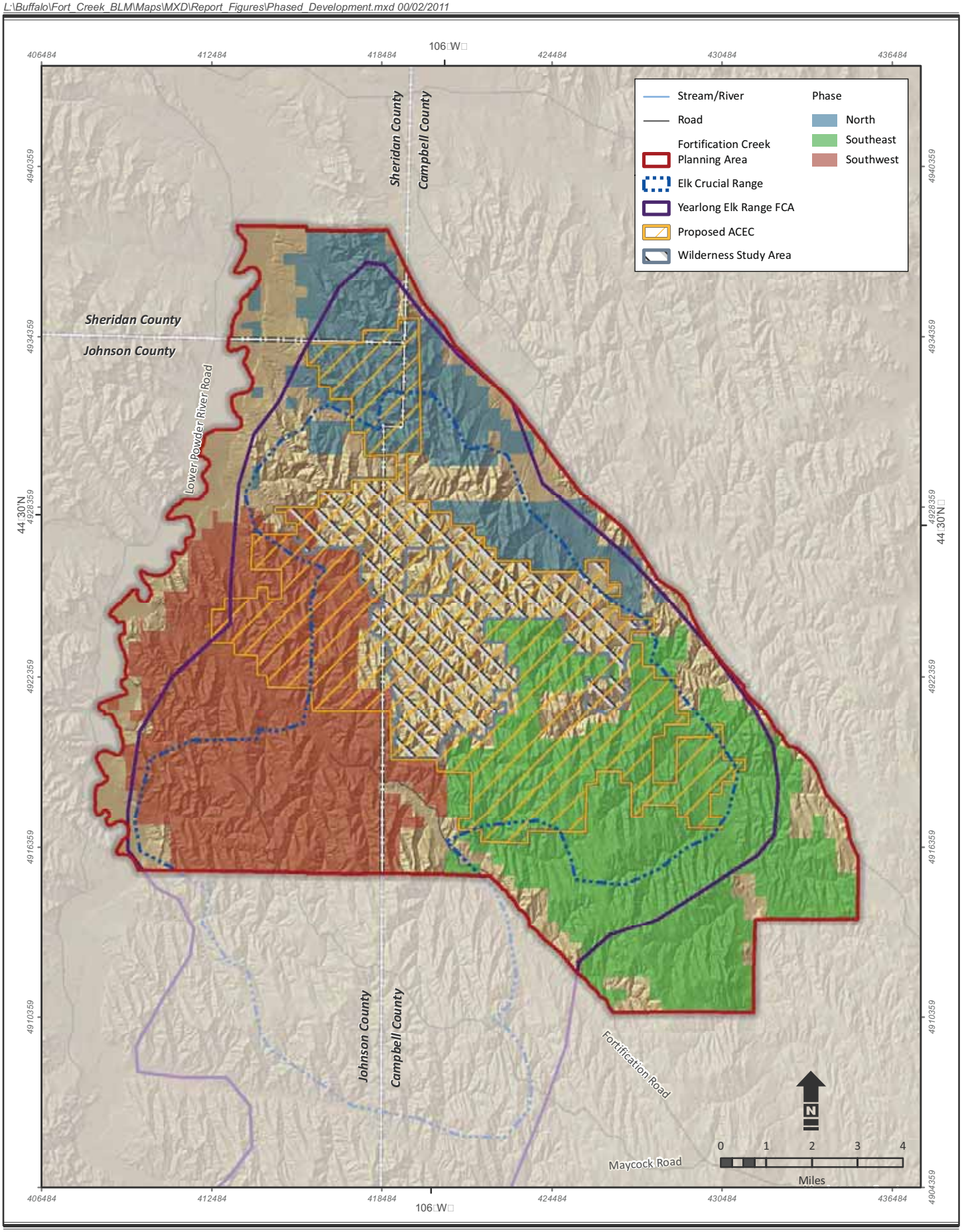

Source:
Topography - United States Geological Survey 2005
Hydrography - National Hydrography Dataset 2003

Figure 4-4

Phased Development

Campbell, Johnson, and Sheridan Counties, Wyoming

An activity management plan for construction, metering, monitoring, and maintenance must be authorized and restricted visitation would be allowed. Provisions would be made for emergencies including any unforeseen circumstance or combination of circumstances that creates a dangerous situation and threatens human health, safety, or the environment if repair/remedial actions are delayed until BLM approval can be obtained.

Additionally, water management facilities would be located outside elk crucial ranges; summer water sources would be provided by CBNG projects if development caused their loss; and compressors in crucial range would be limited to the minimum number necessary. All overlapping crucial ranges would be retained, and non-overlapping crucial ranges would retain 75 percent of their security habitat. Fifty percent of security habitat would be retained in the yearlong range outside the crucial ranges.

Under Alternative II, overhead power lines would be allowed, with a focus on minimizing cross-country power line construction by maximizing use of existing disturbance corridors and roads and following drainages where disturbance corridors are not present. Power poles located within 0.5 mile of sage-grouse and/or sharp-tailed grouse leks (if buffer requirements cannot be met) would be fitted with raptor perch preventers, thus minimizing the potential for raptor predation on grouse. Generators would be used in all three alternatives due to a backlog in the overhead power line construction schedule. Generators, with their associated fuel truck visits, on the order of one to two trips per week, and the around-the-clock noise, cause additional disruption to wildlife, including elk, caused by truck visits and exhaust fumes, increased noise, and the potential for fuel spills.

The tri-phased development approach (Figure 4-4) would have a moderately adverse impact to the elk herd because although it would limit disturbance to one-third of the FCPA during any given development phase, the elk would be displaced. Wide-ranging animals, such as the elk, have the potential for locating secure areas away from the activity. This approach ensures that effective and security habitat are likely available within the overall range. Animals with small home ranges, such as rodents, would be displaced from the immediate area.

Deferring livestock grazing would provide time for revegetation efforts, and for vegetation at the edges of the new water reservoirs to take hold. This would benefit all wildlife. Timing limitations and restrictions on visitation during critical periods for the elk will benefit the herd in terms of body condition and reproductive potential, and the lesser disturbance would benefit all wildlife in general as well. The limitation of compressors in the crucial range to the minimum necessary would limit sound and human activity to some degree; where compressors are placed in crucial ranges, moderate disruption to elk can be anticipated.

The security habitat standards will have a moderate adverse impact. Security habitat will be lost, but combined with the tri-phased development approach and the ability of the animals to move to other security area, this impact should be sufficiently mitigated. The WGFD provided security habitat standards designed to support their population objective of 150 elk. Habitat standards designed for a large mobile species such as elk should provide sufficient suitable habitat for smaller species as well. The allowance for overhead power lines, with careful location of these lines, would not impact the elk.

Limiting the number of power lines will minimize raptor mortalities. Fluid minerals development may adversely affect wildlife populations. For example, roads and associated disturbances may cause wildlife to avoid these otherwise isolated areas. One example is the increased shooting of

prairie dogs (Reeve and Vosburgh 2006) and other species that can occur when roads open up an otherwise inaccessible area.

Roads cause direct habitat loss. However, the larger impact comes from the reduction in effective habitat due to habitat fragmentation, displacement, and interference with movement patterns. Direct mortality is also an occurrence on roads. These impacts were evaluated for elk in particular. The comparison of road length, road density, effective habitat, and security habitat under the three alternatives is shown in Table 4-15.

In the elk yearlong range, road density is 1.1 miles/mile² under baseline conditions. There are 44,537 acres of effective habitat and four security patches with a total of 40,781 acres (Table 4-15). Under Alternative II, the road density is 1.8 miles/mile²; there are 35,662 acres of effective habitat, five security patches, and 31,663 acres of security habitat. For elk crucial range, baseline road density is 0.8 mile/mile² with 34,452 acres of effective habitat, and four security patches with a total of 32,406 acres. Under Alternative II, the road density would be 1.1 miles/mile², the effective habitat would be 30,239 acres, and there would be five security patches and 27,807 acres of security habitat. One large security patch was fragmented into two smaller patches. Elk security habitat under Alternative II is shown on Figure 4-5.

These measures across the yearlong and crucial ranges indicate impacts to security habitat of 12 to 22 percent. The combined management actions related to CBNG development under Alternative II result in an anticipated moderate adverse impact on elk and other wildlife.

Other Resources Management

Soil Resources

As part of Alternative II, no surface-disturbing activities would be allowed on soils with a severe erosion hazard, badlands, rock outcrop, slopes susceptible to mass failure, or slopes more than 25 percent. No exceptions would be allowed, and standard lease terms would apply.

The 25 percent slope restriction, along with wildlife restrictions, would reduce the amount of CBNG development. These actions would result in a decrease of 239 potential wells (33 percent) from Alternative I, producing beneficial impacts to wildlife, because habitat would be preserved especially within elk crucial ranges and surrounding the WSA.

Under this alternative, erosive soils would be protected, localized loss of vegetation would be reduced, and the potential for additional stream sedimentation would be minimized. Slope avoidance would protect the broken country favored by this elk herd (WGFD 2007a). It is anticipated that this action would be protective of habitat and have a major beneficial impact on wildlife.

Water Resources

Under Alternative II, reservoirs and water management facilities would be located outside the elk crucial ranges, surface disturbing activities related to produced water discharge to ephemeral or intermittent drainages would not be permissible, and summer water sources would be provided by CBNG projects if their loss was attributable to development.

Many different techniques are potentially employed for discharge of produced water. Two commonly used methods are impoundments and pipelines to transport waters outside of the FCPA. Impoundments would be developed in bottomlands along the Powder River and Fortification Creek, and alongside tributaries. Off-channel impoundments would be employed on

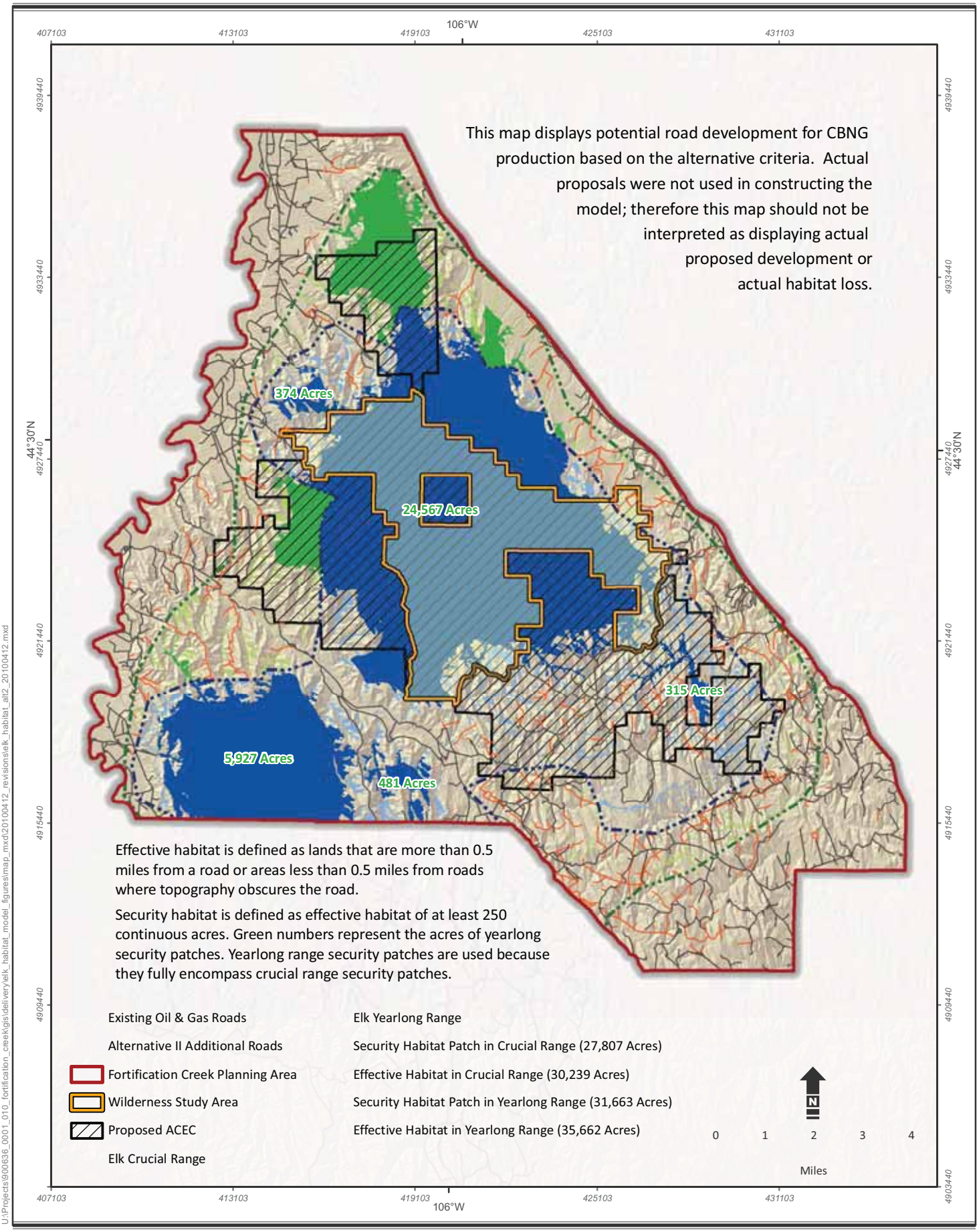

Figure 4-5

Alternative II

Elk Effective and Security Habitat

Campbell, Johnson, and Sheridan Counties, Wyoming

flat terraces. The placement of impoundments outside crucial ranges will reduce impacts in those areas and be beneficial. In addition to impoundments on Federal lands, a large proportion of impoundments would likely be placed on private lands along the Powder River with water piped in from Federal projects.

An 80-foot-wide pipeline corridor through elk crucial range has already been constructed on private land to conduct piped water from Fortification Creek to the Powder River through the Kinney Divide Unit. These actions associated with CBNG development in the FCPA will likely continue and impact habitat and wildlife on adjacent lands. Non-game wildlife such as bats, small carnivores, birds, and amphibians would likely benefit from access to additional water sources. Canada geese and other waterfowl are known to frequent these newly developed water sources.

Development of impoundments leads to water leakage, which causes changes in vegetation from existing range grasses, sagebrush, and juniper to more mesic species such as sedges, foxtail barley, and, in places, cattails. Saltcedar and leafy spurge have a toehold in the FCPA. Expansion of mesic habitats allows for further invasion by these species. Generally, the area of disturbance is twice the size of the impoundment. Under Alternative II, an estimated 262 acres will be disturbed as a result of water impoundments. This amount of ground disturbance would lead to a large potential for weed infestation and have an adverse impact on wildlife.

With limited discharge allowable to ephemeral or intermittent streams, aquatic species will benefit because there will not be the increased flows detrimental to native species.

Required summer water resources, if water loss is due to development, would provide replacement water for elk and other wildlife during the summer. Proposed stock tanks would be required to have a wildlife-friendly design, with small animals entering the stock tank having the capability of exiting the tank to avoid drowning.

In summary, there would be no impact to elk from loss of summer water resources as they would be replaced; and non-game wildlife and waterfowl outside crucial elk ranges would benefit from the presence of reservoirs. Terrestrial wildlife will be impacted by some changes in vegetation around impoundments, but native fish will benefit from the lack of discharge to streams and the resultant lack of changes to water quality and quantity. The net result is anticipated to be a minor adverse impact on fish and wildlife.

Special Designations

Alternative II specifies the establishment of an ACEC in accordance with the citizen proposed boundaries, with management prescriptions being the same as those in the FCPA, and the designation of a WHMA that includes the elk crucial range. Although ACECs and WHMAs are typically managed with a resource in mind, to the benefit of that resource, the management would be the same as those in the FCPA with the only difference being a formal name. This action, if implemented, would have a negligible beneficial impact on wildlife.

Alternative III – Proposed Action

Fish and Wildlife Management

Alternative III, the Proposed Action would incorporate a performance-based development approach: livestock grazing management should be addressed but there is no requirement for grazing deferment and surface disturbance and disruptive activity TLs (as in all alternatives) for

elk and special status species would be implemented. Additionally, all authorized water management facilities would be located so as to meet performance-based objectives; summer water sources would be provided if their equivalent loss was due to CBNG projects; compressors would meet performance-based objectives; and elk security habitat would be maintained at 80 percent of baseline conditions. Because these management actions are also fluid minerals management actions, they are further described below along with their impacts to wildlife.

Fluid Minerals Management

The BLM goal for CBNG management is to facilitate the extraction of CBNG and minimize the effects to the landscape that would impact the resource values in the FCPA. Associated objectives are to identify stipulations, COAs, and BMPs for exploration, development, production, and interim reclamation to ensure that activities would not impact resource values in the FCPA. A number of wildlife-protective restrictions on management actions for CBNG development are common to all alternatives, and are described under Alternative I.

The Proposed Action would incorporate a performance-based development approach. Additionally, CBNG development will generally follow the three geographic phases of Alternative II but deviations may be granted if performance standards are met. Operators would supply comprehensive annual development plans detailing which areas are to be developed each year within each geographic area. Operator performance will be closely monitored by BLM. BLM may authorize additional drilling if BLM determines that the security habitat standard has been met.

Livestock grazing management should be addressed in POD proposals, but no grazing deferment would be required. Surface disturbance and disruptive activity TLs (as in all alternatives) would be implemented in elk crucial winter range from November 15 through April 30 and in parturition range from May 1 through June 30. Additionally, all authorized water management facilities would be located so as to meet performance-based objectives; summer water sources would be provided if their equivalent loss was due to CBNG projects; compressors would meet performance-based objectives; and elk security habitat would be maintained at 80 percent of baseline conditions.

Overhead power lines on BLM surface will be limited to within road and disturbance corridors. The Proposed Action would also require operators to locate aboveground power lines, where practical, at least 0.5 miles from sage-grouse breeding or nesting grounds and, if that is not practical, power poles would be fitted with raptor perch preventers. Operators would construct power lines to minimize the potential for raptor collisions, with potential modification to include burying the lines, avoiding areas of high avian use, and increasing the visibility of the individual conductors. Operators would limit the construction of aboveground power lines near water bodies, and wetlands to minimize collision fatalities for waterfowl. Generators are used in all three alternatives because of a backlog in the overhead power line construction schedule. Generators, with their associated fuel truck visits, on the order of one to two trips per week, and the round-the-clock noise of generators, cause additional disturbance to wildlife and elk, because of truck visits and exhaust fumes, increased noise, and the potential for fuel spills. The incorporation of performance standards for elk use could encourage CBNG operators to minimize fuel trips and potentially find alternate short-term or long-term electricity supply solutions.

The performance-based phased development approach would maintain elk populations within 80 percent (120 individuals) of the population objective (currently 150); calf production, winter and summer survival, and fidelity to yearlong range would be maintained above 80 percent of current levels. Security habitat and effective habitat also would be maintained at 80 percent or greater levels within both crucial and yearlong ranges. Regular monitoring of collared elk would occur and adaptive management would allow for response and ensure that elk population numbers and use of effective and security habitat are within the parameters set by the objectives. Animals with small home ranges, such as amphibians, songbirds, and rodents, would be displaced in the immediate area. The incorporation of a grazing management within the reclamation plan would be beneficial. But, there would be very little benefit to wildlife. Performance standards and TLs restricting visitation during critical periods for elk would benefit the herd in terms of body condition and reproductive potential; reducing disruptive activities would benefit all wildlife species as well. Well metering and visitation would be to performance-based standards because disruptive activities can alter daily or seasonal elk movement patterns and lead to effective habitat loss. The requirement of replacement of lost water sources represents no net change. As with development, the location of authorized water management facilities and compressors will be performance based, thus meeting the above-described 80 percent criteria for population numbers, calf survival, and habitat use.

Fluid minerals development has many aspects that are detrimental to wildlife populations. Often, it is the roads and associated disturbances that affect wildlife in these otherwise isolated areas. One example is the increased shooting of prairie dogs (Reeve and Vosburgh 2006) and other species that can occur when roads open up an otherwise inaccessible area.

Roads cause direct habitat loss. However, the larger impact comes from the reduction in effective habitat due to habitat fragmentation, disruption, and interference with movement patterns. Direct mortality from vehicular collisions on roads also occurs. These impacts were evaluated for elk, in particular. The comparison of road length, road density, effective habitat, and security habitat under the three alternatives is shown in Table 4-15.

In the elk yearlong range, road density would increase from 1.1 miles/mile^2 under present conditions to 1.6 miles/mile^2 under the Proposed Action, as shown in Figure 4-6. Road density was modeled; consequently, road locations are theoretical and Figure 4-6 does not indicate where all roads will go. The 44,537 acres of effective habitat under existing conditions would decrease by 6,717 acres, representing a loss of 15 percent of the existing effective habitat. Whereas current conditions show four security patches with a total of 40,781 acres, the Proposed Action would result in the loss of 7,094 acres of security habitat, or 17 percent of that currently available and fragmentation of one large security patch into two smaller patches.

For elk crucial range, road density would increase from 0.8 mile/mile^2 under present conditions to 1.1 miles/mile^2 under the Proposed Action. The 34,452 acres of effective habitat under existing conditions would decrease by 3,242 acres, representing a loss of 9 percent of the existing effective habitat. Current conditions show four security patches with a total of 32,406 acres. The Proposed Action would result in a loss of 3,446 acres of security habitat, or 11 percent of that currently available; the gain of one security patch is due to the breakup of a larger security patch.

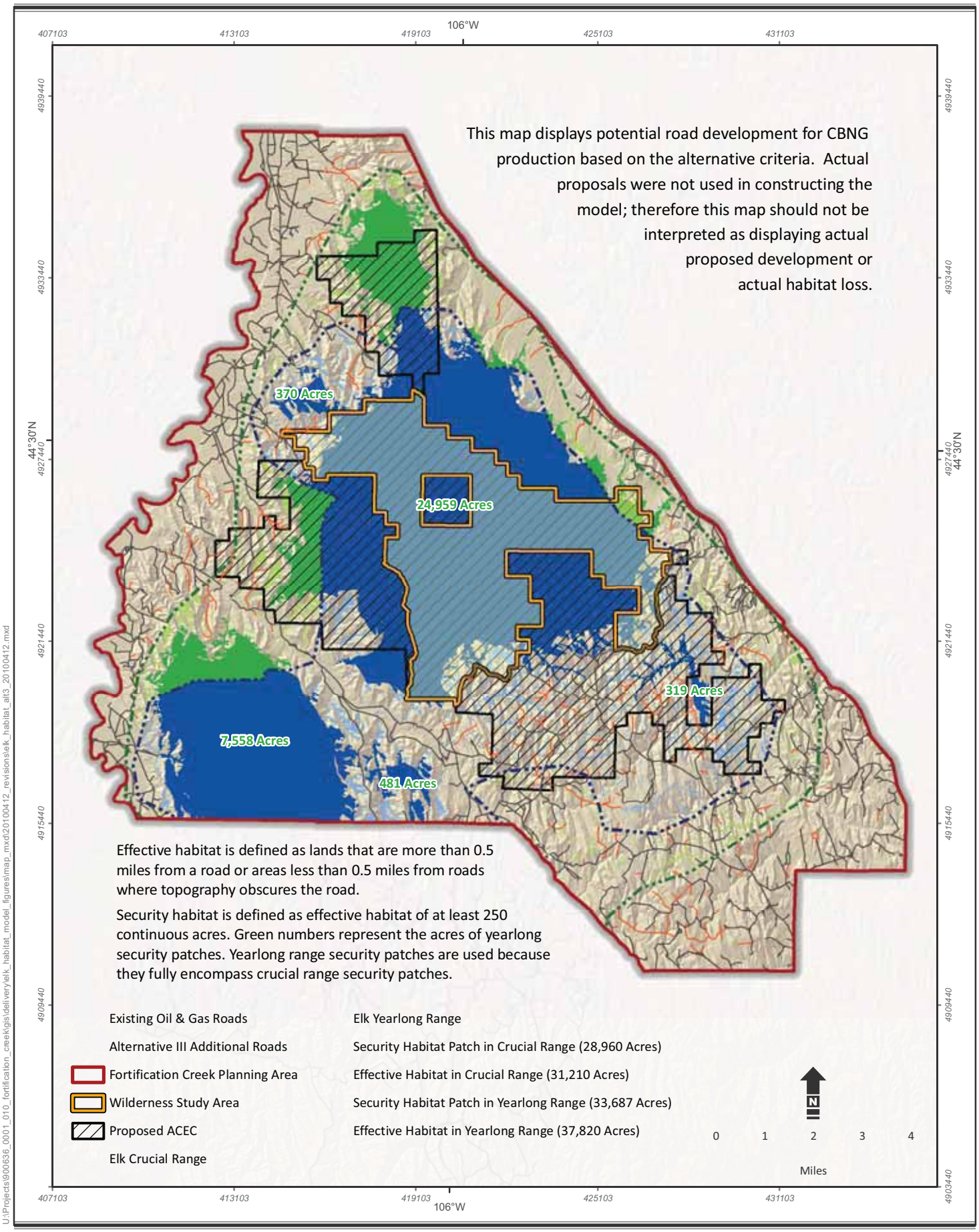

Figure 4-6

Alternative III

Elk Effective and Security Habitat

Campbell, Johnson, and Sheridan Counties, Wyoming

These measures across the yearlong and crucial ranges indicate impacts to security habitat of 9 to 17 percent.

If adequate security habitat is not available within the FCPA and/or the WSA, it is possible that some elk will flee the area and may or may not return as has been observed with collared elk (O'Brien 2008). Individuals that leave will likely move to less developed areas such as downriver to Montana. Although it is possible that some individuals may flee, it is suspected that most of the elk would remain in the FCPA, potentially causing overcrowding in the WSA (BLM 2007a). The security habitat standards and performance standards were developed to provide sufficient habitat to support the WGFD population objective and prevent individual elk from leaving the population.

Monitoring pursuant to the performance-based standards will ensure a bottom threshold (80 percent of current) and adaptive management to control potential declines. This sets the amount of allowable impact as moderately adverse.

Although the Powder River is a naturally turbid river, increased sedimentation into channels from road building may adversely affect aquatic habitat conditions. Sediment from roads may carry seeds of invasive plant species such as saltcedar and Russian-olive and exacerbate an already serious problem. Sediment from roads may be especially damaging during low-flow periods when the river is relatively clear, and when larval fish inhabit shallow, low- or zero-velocity habitats. Increasing sediment to larval fish habitats can smother eggs directly or reduce primary food sources by covering epipelic benthos. Channel morphology may also be affected, particularly on the descending limb of the hydrograph following high-flow events when deposition occurs (reducing complexity, filling pools, altering deposition features, etc.).

Habitat-interior birds avoid use within 300 to 450 feet from forested roads, and up to 1.2 miles away from grassland roads (Forman 2000, Forman and Alexander 1998). The size of an undisturbed habitat block also affects the number of bird species present. In Georgia Piedmont forests, contiguous forest areas larger than 25 acres are needed to maintain high levels of avian diversity (McIntyre 1995). Although these studies were not conducted in sagebrush/juniper woodlands, it is not unreasonable to assume that the same concept applies. Similarly, small mammal species richness is sensitive to fragmentation in sagebrush shrublands (Hanser and Huntly 2006).

Activities on slopes in excess of 25 percent would only be granted when BLM is confident that the reclamation performance criteria could be met and therefore protective of the soil resource. Avoidance of slopes will protect the broken country favored by this elk herd (WGFD 2007a) and would place much of the development on bottomlands that provide high forage value, particularly during the winter. These bottomland riparian areas will be impacted by both roads (discussed above) and impoundments. In-channel impoundments for CBNG produced water are located in the drainage bottoms. Overall, there are few suitable locations for impoundments within the FCPA because of the highly incised drainages and rough topography that dominate the landscape. With limited available acreage of level locations within the FCPA, off-channel impoundments would not be commonly proposed. These impacts are discussed under Water Resources Management.

Combined with the other management actions related to CBNG development under the Proposed Action, the sum of impacts from fluid minerals development under the alternative results in a moderately adverse impact on elk and other wildlife from the following:

- In elk yearlong range:

  15 percent (6,717 acres) of the existing effective habitat is lost;

  Reduced security habitat results in one additional patch as a larger patch becomes divided; and

  17 percent (7,094 acres) of security habitat is lost (moderate because less than 20 percent).
- For elk crucial range:

  9 percent (3,242 acres) of the existing effective habitat is lost;

  Reduced security habitat results in one additional patch as a larger patch becomes divided; and

  11 percent (3,446 acres) of security habitat is lost (minor because less than 15 percent).

Other Resources Management

Soil Resources

The Proposed Action would require that a disturbance and reclamation plan be submitted when requested by BLM. The disturbance and reclamation plan would take into account the performance-based standards for soil reclamation (Appendix B) and the operator would be required to meet these performance-based standards. Surface disturbing activities on slopes greater than 25 percent and on soils with severe erosion hazard would be allowed if the reclamation plan were acceptable.

Reclamation on 25 percent slopes and erosion hazard areas is challenging, as is reclamation in arid areas such as the FCPA. The difficulty of revegetation is exacerbated by the colonization of weeds including cheatgrass, as has occurred already at well sites in the FCPA. Control of erosion is also challenging and activities on 25 percent slopes are very likely to lead to increased erosion, which causes habitat modification in the form of vegetation loss. Soil resource management actions would have moderately beneficial impacts on wildlife because some exceptions to the 25 percent slope restriction would be allowed, but most of the resource would be protected.

Water Resources

Under the Proposed Action, the location of authorized water discharge facilities would meet performance-based standards. Any loss of summer water sources from CBNG would be replaced. Elk would have access to reservoirs located in elk habitat; however, there would be a displacement factor associated with elk based on human activity levels. Non-game wildlife such as bats, small carnivores, birds, and amphibians would likely benefit from access to additional water sources. Canada geese and other waterfowl are known to frequent these newly developed water sources and would make use of them. Authorized additional discharge to channels would have an adverse impact on water quality, affecting native fish and amphibians by altering the hydrology and water quality from sedimentation. Increased turbidity may alter fish assemblages and sedimentation may fragment fish populations. The continuous contribution of constant-temperature waters may disrupt environmental cues that native fish depend on for reproductive behavior (Davis et al. 2006). There is also a concern that CBNG waters would transport heat from coal beds to streams. These discharges have potential adverse impacts to water quality downstream as well. The replacement summer water sources would have no impact on elk and

other wildlife. There would be 2.2 mgd of produced water, and a total of 260 acres impacted by water resources actions. This amount of ground disturbance would lead to a loss in habitat and a potential for weed infestation, and have a minor adverse impact on wildlife.

In summary, elk would benefit from the availability of water from water management facilities except where disruptive activities may cause them to avoid areas; non-game wildlife and waterfowl would benefit from the presence of reservoirs; and native fish onsite and downstream, would be adversely impacted by changes in water quality and quantity. The net result is anticipated to be a moderate adverse impact on fish and wildlife.

Special Designations

The Proposed Action specifies that the proposed ACEC would not be designated. No WHMA would be designated. These actions would have a negligible impact on elk and other wildlife.

Summary

The summary of impacts to fish and wildlife resources is shown in Table 4-16.

Table 4-16 Summary of Impacts to Fish and Wildlife Resources

Land Use or Management Action	Alternative I (No Action)	Alternative II	Alternative III (Proposed Action)
Fish and Wildlife Management	See Fluid Minerals Management		
Fluid Minerals Management	Major (-) 34,149 acres (84%) of yearlong security habitat is lost 25,774 acres (80%) of crucial range security habitat is lost	Moderate (-) 9,118 acres (22%) of yearlong security habitat lost 4,536 acres (14%) of crucial range security habitat is lost	Moderate (-) 7,094 acres (17%) of yearlong security habitat is lost 3,446 acres (11%) of crucial range security habitat is lost
Other Resources Management			
Soil Resources Management	Moderate (+) 33,694 acres potentially protected	Major (+) 33,694 acres protected, no exceptions	Moderate (+) 33,694 acres potentially protected
Water Resources Management	Moderate (-) Discharge of 3.2 mgd produced water	Minor (-) Discharge of 2.2 mgd produced water and reduced direct discharge to streams	Minor (-) Discharge of 2.2 mgd produced water
Special Designations	Negligible (+) No ACEC and WHMA	Negligible (+) ACEC and WHMA	Negligible (+) No ACEC and WHMA

Cumulative Impacts

Cumulative impacts to wildlife resources were evaluated for the entire PRB, including the FCPA in the PRB O&G FEIS (BLM 2003a). CBNG development on non-Federal mineral estate in the FCPA as well as development on all mineral estate in adjacent areas would result in cumulative impacts to fish and wildlife. Almost all non-Federal mineral estate has been developed. This development is primarily along the edges of the FCPA and within the southeastern third of FCPA. Currently there are approximately 215 producing gas wells in the FCPA (WOGCC 2010b).

The cumulative impacts due to development within and beyond the FCPA boundary would cause changes to native vegetation and the amount of undisturbed habitat. Increased development, recreational use, and human interaction would have adverse impacts to non-game wildlife regardless of management actions taken in the FCPA.

CBNG produced water discharges would increase salinity and cumulatively impact water quality downstream. These accumulated salts have damaging effects on the physical condition of soil, such as infiltration rates that can affect permeability and plant growth (Ruckelshaus 2005). There is also the possibility of alterations in fish communities due to long periods of CBNG water discharges (Davis et al. 2006). Cumulative impacts for all species, except for elk, are within the parameters estimated within the PRB FEIS. The remainder of this section is specific to elk.

The Fortification Creek elk are a small isolated herd living in a prairie environment. The herd is unusual though not unique in their use of non-mountainous “prairie” habitat. Such prairie herds were more common prior to European expansion on the western plains. Because their habitat is more open than typical mountainous habitat, these herds can be more vulnerable due to the reduced protective cover. Small, isolated populations, such as Fortification Creek, are vulnerable to extirpation due to stochastic (random) events such as disease, fire, severe winter weather, or other factors (Noss and Cooperrider 1994). Should such an event occur, there is less ability for reproductive individuals from adjacent populations to provide an influx of animals.

Seasonal ranges for the Fortification Creek elk herd extend south of the FCPA. Continued monitoring of the Fortification Creek elk herd has revealed that elk use south of the FCPA differs from that reported in BLM’s 2007 Environmental Report (BLM 2007a). Specifically, animals captured from within the FCPA remain in the north (FCPA), while individuals captured in the southern portion tend to move throughout the yearlong range (BLM 2010). The 2007 conclusion understating the use of the southern yearlong range was a result of sampling bias. Despite efforts to capture elk from throughout the yearlong range they were all captured from within the planning area. The 2008 capture effort was successful in collaring elk south of Fortification Creek for a better distribution of capture locations.

Data from the 2008 collars support all other observations and conclusions of the 2007 report including that the elk have continued to avoid roads and CBNG well sites. Elk captured in the less disturbed areas to the north (the FCPA) enjoy a relative lack of CBNG activity, whereas animals captured from the more developed areas south of the FCPA tend to move throughout the elk yearlong range in an effort to avoid CBNG activities. A specific example of response to CBNG development occurred within the Augusta Unit in May 2008, where more than half the collared elk left the area during development and have been slow to return (BLM 2010).

Security habitat is necessary for maintaining this herd because elk are expected to move to security patches in response to development. The WGFD submitted a letter to the BFO on December 29, 2009 (WGFD 2009b) as part of the public comment on the Augusta Unit Zeta Environmental Assessment (WY-070-08-154; BLM 2009c). WGFD underscored the importance of the security habitat in the crucial winter and parturition ranges to the Fortification Creek elk. During calving season, more than 70 percent of collar locations were in the parturition range security habitat, and during winter more than 80 percent of collar locations were in crucial winter range security habitat (WGFD 2009b). Table 4-17 was included in the September 2010 Draft RMPA/EA and lists elk security habitat acreages for the entire Fortification Creek herd unit in July 2009 prior to authorization of Federal CBNG development in the Augusta Unit Zeta POD. In 2009, 66 percent (39,523 acres) of all security habitat and 79 percent (30,716 acres) of crucial range security habitat was contained within the FCPA.

Table 4-17 Acres of Elk Security Habitat within the Fortification Creek Elk Ranges, July 2009

Seasonal Range	Yearlong Range	Southern Range (% of seasonal range)	FCPA (% of seasonal range)
Single Crucial[1]	21,008	4,585 (22)	16,423 (78)
Dual Crucial[2]	17,957	3,665 (20)	14,292 (80)
Crucial Total	38,965	8,249 (21)	30,716 (79)
Yearlong [3](outside of crucial range)	21,035	12,228 (58)	8,807 (42)
Total	60,000	20,477 (34)	39,523 (66)

[1]Single crucial – non-overlapping crucial winter range or parturition range.
[2]Dual crucial – overlapping crucial winter and parturition range.
[3]This includes 541 acres that are within the FCPA and herd unit, but outside of the elk yearlong range. It is included as it is part of a much larger security habitat patch (3,2012 acres) in which the remainder of the patch does lie within the elk yearlong range.
Note: POD EAs, such as the Carr Draw III West modified decision (BLM 2010), did not consider the RMPA alternatives as reasonably foreseeable and did not differentiate the FCPA from the southern elk range. Therefore figures presented in this RMPA are not directly comparable to figures from the POD EAs.

Beginning in 2009, attention shifted to Federal minerals south of the FCPA. Several Federal PODs had been submitted and some were being processed while the Draft RMPA/EA was being prepared including Augusta Unit Zeta, Carr Draw III West, Carr Draw 5 Additions II, Carr Draw IV, Williams Draw Unit Gamma and Delta, Kinney Divide Unit Gamma, Queen B, and Camp John Unit Epsilon. In addition to the above Federal POD submissions, Wyoming Oil and Gas Conservation Commission (WOGCC) data were used to predict the reasonably foreseeable development. Wells were considered reasonably foreseeable if the WOGCC data showed the locations as Approved Permit (AP) status for state and fee locations. Security habitat projections south of the FCPA following the reasonably foreseeable development identified in the Draft RMPA/EA is presented in Table 4-18.

Table 4-18 Elk Security Habitat within the Southern Fortification Creek Elk Ranges, as presented in the Draft RMPA/EA after Reasonably Foreseeable Development			
Seasonal Range	**Southern Range July 2009 (acres)**	**Foreseeable Development (acres of development)**	**Acres Lost (%)**
Single Crucial[1]	4,585	1,801	2,784 (61)
Dual Crucial[2]	3,665	2,159	1,506 (41)
Crucial Total	8,249	3,960	4,289 (52)
Yearlong[3](outside of crucial range)	12,228	4,029	8,199 (67)
Total	20,477	7,989	12,488 (61)

[1]Single crucial – non-overlapping crucial winter range or parturition range.
[2]Dual crucial – overlapping crucial winter and parturition range.
[3]This includes 541 acres that are within the FCPA and herd unit, but outside of the elk yearlong range. It is included as it is part of a much larger security habitat patch (3,2012 acres) in which the remainder of the patch does lie within the elk yearlong range.
Note: POD EAs, such as the Carr Draw III West modified decision (BLM 2010), did not consider the RMPA alternatives as reasonably foreseeable and did not differentiate the FCPA from the southern elk range. Therefore figures presented in this RMPA are not directly comparable to figures from the POD EAs..

Several of the PODs considered as reasonably foreseeable in the DRMPA/EA have now been authorized or are nearing authorization including Augusta Unit Zeta (July 2009; BLM 2009c), Carr Draw III West (September 2009, January 2011), Carr Draw 5 Additions II (September 2009), Carr Draw IV (April 2010), Williams Draw Unit Gamma and Delta (November 2010), Kinney Divide Unit Gamma (August 2010), and Camp John Unit Epsilon (pending). Queen B straddles the FCPA boundary and therefore will not be processed until completion of the RMPA.

The January 2011 third modified decision record for the Carr Draw III West POD included a detailed accounting of CBNG development for the entire Fortification Creek elk range. However, it is important to note that the estimated development in the Carr Draw III decision differs from that estimated in this RMPA/EA because the FCPA development scenarios modeled in this RMPA/EA were not considered reasonably foreseeable in the Carr Draw III West decision. The Carr Draw III West analysis is used here to update the reasonably foreseeable development south of the FCPA (Table 4-19).

Table 4-19 Updated Elk Security Habitat within the Southern Fortification Creek Elk Ranges, after updating the Reasonably Foreseeable Development Projection			
Seasonal Range	**Southern Range July 2009 (acres)**	**After Foreseeable Development (acres)**	**% Acres Lost**
Single Crucial[1]	4,585	1,364	3,221 (70)
Dual Crucial[2]	3,665	2,147	1,518 (41)
Crucial Total	8,249	3,511	4,738 (57)
Yearlong [3](outside of	12,228	4,112	8,116 (66)

Table 4-19 Updated Elk Security Habitat within the Southern Fortification Creek Elk Ranges, after updating the Reasonably Foreseeable Development Projection

Seasonal Range	Southern Range July 2009 (acres)	After Foreseeable Development (acres)	% Acres Lost
crucial range)			
Total	20,477	7,623	12,854 (63)

[1]Single crucial – non-overlapping crucial winter range or parturition range.
[2]Dual crucial – overlapping crucial winter and parturition range.
[3]This includes 541 acres that are within the FCPA and herd unit, but outside of the elk yearlong range. It is included as it is part of a much larger security habitat patch (3,2012 acres) in which the remainder of the patch does lie within the elk yearlong range.
Note: POD EAs, such as the Carr Draw III West modified decision (BLM 2010), did not consider the RMPA alternatives as reasonably foreseeable and did not differentiate the FCPA from the southern elk range. Ttherefore figures presented in this RMPA are not directly comparable to figures from the POD EAs.

The updated development projection identifies that an additional 336 acres of security habitat were lost. This is most likely because, there has been little direct elk habitat mitigation outside the FCPA. There are no requirements for mitigation with non-Federal CBNG development and mitigation for Federal CBNG development has consisted of TLs for surface disturbing activities within crucial ranges and limited movement of infrastructure from effective elk habitat. Indirectly, avoidance of steep slopes and rough topography has been effective in preserving elk habitat, in both Federal and non-Federal development.

Based on development south of the FCPA and the percentage of baseline security habitat within the FCPA (66 percent of all security habitat and 79 percent of crucial range security habitat; see Table 4-17) it is evident that the sustainability of the Fortification Creek elk herd is largely dependent upon the FCPA and the management actions in this RMPA/EA.

The loss of security habitat will likely result in elk overcrowding the remaining security habitat, especially during construction. Crowding could decrease forage availability as animals consume finite resources and increase stress, potentially causing animals to move to less developed areas, including leaving the herd unit. Overall, some reduction in the population can be anticipated through reduced calving rates, emigration, and potential increased mortality.

While some habituation may occur, there are not enough data to determine the magnitude of potential habituation. Hunted populations, such as the Fortification Creek herd unit, tend to habituate to human activity less than non-hunted populations, such as those inhabiting national parks (BLM 2007). The slow rate of elk return to the Augusta Unit Zeta area (BLM 2009c) further illustrates this concern.

Under this RMPA/EA Alternative I, there would be 6,628 acres of security habitat remaining within the FCPA after CBNG development, an 84 percent security habitat loss, as shown in Table 4-20. Animals using the current 40,781 acres would be adversely impacted as they crowded into the remaining 6,628 acres. This impact, when combined with the cumulative effects of pending development outside the FCPA, would likely lead to a substantial population decline and possible extirpation of this herd.

Table 4-20 Elk Security Habitat within the FCPA, After Forecasted RMPA Development				
Seasonal Range	**Base Security Habitat**	**Alternative 1 (acres and % loss)**	**Alternative II (acres and % loss)**	**Alternative III (acres and % loss)**
Single Crucial[1]	17,338	2,956 (83)	12,888 (26)	13,992 (19)
Dual Crucial[2]	15,068	3,672 (76)	14,918 (1)	14,968 (1)
Crucial Total	32,406	6,628 (80)	27,807 (14)	28,960 (11)
Yearlong (outside of crucial range)	8,375	0 (100)	3,856 (64)	4,727 (44)
Total	40,781	6,628 (84)	31,663 (22)	33,687 (17)

[1]Single crucial – non-overlapping crucial winter range or parturition range.
[2]Dual crucial – overlapping crucial winter and parturition range.
[3]This includes 541 acres that are within the FCPA and herd unit, but outside of the elk yearlong range. It is included as it is part of a much larger security habitat patch (3,2012 acres) in which the remainder of the patch does lie within the elk yearlong range.
Note: POD EAs, such as the Carr Draw III West modified decision (BLM 2010), did not consider the RMPA alternatives as reasonably foreseeable and did not differentiate the FCPA from the southern elk range. Therefore figures presented in this RMPA are not directly comparable to figures from the POD EAs.

The PRMPA/EA action alternatives, with their security habitat standards and other components, were designed to provide sufficient habitat to support of the WGFD population objective. Alternative II would retain 75 percent of security habitat in non-overlapping crucial ranges (and retain all in overlapping crucial ranges); it would result in 31,663 acres of security habitat remaining, within the FCPA, from the baseline of 40,781. The purpose of Alternative II's transportation management plan requirement is to reduce disruptive activities within CBNG areas to a tolerable level. In other words, human activities are reduced to a point that the elk return to CBNG areas and do not crowd into the remaining security habitat for the duration of CBNG production.

Alternative III retains 80 percent of security habitat within the yearlong and crucial ranges and would result in 33,687 acres of security habitat remaining, within the FCPA, following CBNG construction. The performance-based approach requires monitoring of elk return. Similar to Alternative II, the goal is to reduce disruptive activities to the point that elk return to CBNG areas and do not crowd into the remaining security habitat for the duration of CBNG production.

Both Alternatives II (prescriptive) and Alternative III (performance based) would enable retention of 31,663 to 33,687 acres of security habitat and, thus, provide sufficient habitat to balance the forecasted impacts of development outside of the FCPA. There could be some reduction in current herd size, but it is anticipated that enough quality habitat would remain to support the herd at the WGFD population objective. Proper management of disruptive activities could increase the amount of security habitat from what was modeled.

4.3.6. Special Status Species Resources

There are four goals for special status species management in the FCPA: (1) maintain biological diversity of plant and animal species; (2) support the WGFD's 2007–2011 strategic plan (WGFD 2006a) to the extent practical and consistent with BLM multiple-use management requirements; (3) maintain and, where possible, improve forage production and quality of rangelands, fisheries,

and wildlife habitat; and (4) provide habitat for threatened and endangered and special status plant and animal species on all public lands in compliance with the Endangered Species Act (ESA) and approved recovery plans to the extent possible. The management objective is to protect special status species while allowing CBNG development.

Some management actions common to all alternatives are also listed under Fluid Minerals Management, where they are addressed. These include avoiding placement of impoundments in sagebrush, where possible; fencing of impoundments; installing wildlife escape ramps in stock tanks; installing noise mufflers on compressors; and limiting noise levels to 55 decibels. Restrictions common to all alternatives are listed for bald eagle, black-footed ferret, mountain plover, Ute ladies'-tresses orchids, blowout penstemon, greater sage-grouse, plains sharp-tailed grouse, and special status raptors. However, these restrictions relate to small areas containing few individuals, as described below.

Bald eagle habitat is restricted to the Powder River and Wild Horse Creek and there are no known nests within the FCPA (Figure 3-7). Bald eagles commonly roost and forage along the Powder River and other open waters during the winter. The black-footed ferret is not present (BLM 2005b). Mountain plovers are very unlikely because of the lack of suitable habitat and there are no mountain plover observations documented within the FCPA. Ute ladies'-tresses orchids are unlikely to occur because of lack of perennial water; the Wyoming Natural Diversity Database (WYNDD) habitat model does not predict suitable habitat for the orchid within the FCPA. However, it should be noted that the WYNDD model was based on vegetation characteristics at four sites and general soils data, which may define suitable orchid habitat too narrowly. There is only one sage-grouse lek, in the southeastern corner of the FCPA, and there are two sharp-tailed grouse leks (Figure 3-9). Raptors are present throughout the FCPA; data collected by BLM show active and inactive raptor nests from 2004 through 2007 for the FCPA (Figure 3-7).

Management restrictions applied to sage-grouse leks include reducing noise levels to 49 decibels at the lek, restricting surface-disturbing activity within 0.25 mile of the lek, and precluding new surface-disturbing activity and/or disruptive activities from March 15 through June 30 within suitable sage-grouse nesting and early brood-rearing habitat and within habitat important for connectivity. Clearance surveys are required in sagebrush habitat prior to surface-disturbing activities to identify new leks and verify occupancy of known leks. Management actions apply to sharp-tailed grouse, by restricting surface-disturbing activity within 250 yards of leks and restricting surface-disturbing activities (0.25 mile from the lek) from April 1 through May 31. For raptors, the restrictions preclude new surface-disturbing activities within 0.5 mile of nests during the period from February 1 through July 31. These management actions and the realities of actual occurrence of the subject species apply to all three alternatives and will not be repeated.

Potential impacts to special status species fall into one or more of the categories that include habitat loss or modification, habitat fragmentation, disruption, interference with movement patterns, and direct mortality. These impacts can reduce numbers of one or more species, potentially to the point of local extirpation, disrupt community composition and function through changes in the distribution, relative abundance, and habitat use by various species (e.g., reduced prey abundance affects predator abundance), and make populations and communities overly vulnerable to other perturbations. For example, increases in roads can cause habitat fragmentation. This can result in habitat specialist species being more vulnerable to disturbance by reducing patch size, increasing the amount of edge, and increasing accessibility to predators

or, in the case of songbirds, nest parasitism by brown-headed cowbirds. The sage thrasher, Brewer's sparrow, and sage sparrow are three species that might suffer from fragmentation of sagebrush habitat by the addition of roads.

Impacts associated with changes in management, human use, and resource development can have direct and indirect impacts on these species. For wide-ranging or migratory species such as migratory songbirds, onsite impacts can also affect community composition and function in the southern portion of the species' range where they overwinter, and project impacts can combine with non-project impacts to cause cumulative impacts.

The special status species listed in Chapter 3 are those with special or protective designations by State or Federal agencies. In addition, this analysis may also make reference to species or groups that do not have any special status, but are included with protective measures listed in Table 2-2 under Special Status Species. These include sharp-tailed grouse and raptors (other than the ferruginous hawk, which is state-listed but does not appear to occur in the FCPA).

4.3.6.1. Alternative Analysis

Impact intensity defines the degree or extent of impacts. For this analysis, the categories are defined as follows:

- *Minor* – The effect is slight but detectable; there would be a small change. Resource indicator thresholds are potentially exceeded, but on a short-term or highly localized basis. This would be characterized as less than 15 percent alteration in resource indicators.
- *Moderate* – The effect is readily apparent; there would be a measurable change that could result in a long-term or permanent change to a resource. Some resource indicator thresholds are exceeded. This would be characterized by a 15 to 20 percent alteration.
- *Major* – The effect is large; there would be a highly noticeable, long-term, or permanent measurable change. Resource indicator thresholds are clearly exceeded. An alteration of more than 20 percent in resource indicators would qualify as a major impact.

The occurrence, abundance, and distribution of wildlife are most strongly affected by habitat availability and accessibility. These habitat characteristics may be severely altered as a result of increased human activity and resource development. Adverse impacts are typically the result of management actions associated with fluid minerals development. Other management actions can be beneficial or harmful, such as soil resources management, water resources management, visual resources management, and others, depending on how and what actions are implemented.

Special status species also can benefit from resource management activities aimed at all wildlife species or other environmental concerns, such as protective measures, TLs, NSOs, disturbance-free buffer zones, and other actions aimed at preserving or enhancing resources.

Impacts to special status species associated with Alternatives I through III are summarized in the following subsections. These impacts can be either direct or indirect and can result from any activity involving increased levels of human activity and removal or modification of habitat.

The following alternatives analysis considers both short-term and long-term impacts to special status wildlife resources. For the purpose of this analysis, short-term or temporary impacts are those that most often are associated with a period of initial habitat loss or modification and intensive human activity. Short-term impacts are those that last five to 10 years or less. In the context of future management and development scenarios for the FCPA, short-term impacts are

mostly associated with fluid minerals development, during which activity in specific POD areas may last for several weeks or months, but then is reduced in severity as that POD enters the production phase.

Long-term impacts are those that last longer than 10 years, and most of these would extend throughout or potentially beyond the period of the management action or development activity. Examples include impacts associated with the continued presence of elevated levels of human activity throughout the life of CBNG development (10 years or longer) and the protracted period needed for final reclamation of disturbed areas. Permanent impacts are those with a likely duration of more than 50 years, such as may occur at developed cultural sites.

For purposes of expediency, the analysis addresses generalized impacts for all special status species as a group. Occasionally, specific mention is made of one or more species when particular potential impacts are noteworthy. Special status species that could potentially occur in the FCPA were listed in Chapter 3 and include all species that are Federally-listed, State listed, or BLM sensitive. Discussions with WGFD and BLM staff indicated that many of these species are uncommon or unlikely, or not known to occur on the FCPA because of lack of suitable habitat. The focus for this analysis is on those species that are known to occur, or are representative of a group or guild, and/or are monitored (and, thus, data exist). These focus species groups are:

- Bald eagle (*Haliaeetus leucocephalus*), and raptors in general:
- Greater sage-grouse (*Centrocercus urophasianus*);
- Sage thrasher (*Oreoscoptes montanus*), Brewer's sparrow (*Spizella breweri*), and sage sparrow (*Amphispiza belli*), as a guild of sagebrush-obligates;
- Myotis bats, representing the long-legged myotis (*Myotis volans*), western small-footed myotis (*Myotis ciliolabrum*), and little brown myotis (*Myotis lucifugus*); and
- Native fishes.

Alternative I (No Action Alternative)

Special Status Species Management

Unique to Alternative I is that overhead power lines would be prohibited on BLM surface. The impacts of this action are discussed under Fluid Minerals Management, below, and will not be addressed here.

All of the restrictions for special status species will benefit these species. However, as discussed above, the benefits are relatively limited because of the small number of individuals of the special status species present and the localized extent of the restrictions. The sage-grouse at the single lek will benefit from the restriction on surface-disturbing activity and noise level limitations, as will sharp-tailed grouse at their two leks (Figure 3-9). Nesting raptors will benefit from restrictions within 0.5 mile of their nests (Figure 3-7). Timing limitations initially apply to nearly all nests. After occupancy surveys are conducted, operators may request exceptions for nests that are not active; the same procedure will apply for grouse leks. Other special status species, such as migratory birds nesting within TL areas, will also benefit. The impact of these management actions is beneficial to a minor degree.

Fluid Minerals Management

The BLM goal for CBNG management is to facilitate the extraction of CBNG and minimize the effects to the landscape that would impact the resource values in the FCPA. Associated objectives are to identify stipulations, COAs, and BMPs for exploration, development, production, and interim reclamation to ensure that activities would not impact resource values in the FCPA.

A number of wildlife-protective restrictions on management actions for CBNG development are common to all alternatives. These include locating pipelines in corridors; avoiding placement of impoundments in sagebrush, where possible; fencing impoundments; installing wildlife escape ramps in stock tanks; installing noise mufflers on compressors; limiting noise levels to 55 decibels as measured at 0.25 mile for sensitive receptors; and restriction of surface disturbance and disruptive activity in elk crucial winter range between November 15 and April 30 and elk parturition range between May 1 and June 30. The placement of pipelines in corridors will reduce impacts of habitat fragmentation. The potential avoidance of impoundments in sagebrush will benefit sage-grouse and sage-obligate songbirds. Installation of wildlife escape ramps could potentially benefit special status species if they were to land in stock tanks. The installation of noise mufflers will benefit all special status species by reducing noise disturbance. The restriction of activities in elk crucial ranges during the specified times will benefit the sage-obligate breeding songbirds during their breeding season.

Management actions specific to Alternative I include an unrestricted development pace and location, and no restrictions on location of compressors and water management facilities. Further actions include no restriction on well metering and visitation; no requirement of replacement water sources lost because of CBNG development; no elk security habitat standards would be implemented; and overhead power lines would be prohibited on BLM surface lands.

Roads are directly associated with development and cause direct habitat loss; however, the larger impact comes from the reduction in effective habitat due to fragmentation, displacement, and interference with movement patterns. An example of displacement relates to raptors. The proximity to roads is a major factor in reduced availability of nesting sites for raptors. A typical buffer distance for nesting raptors and human activity is 0.5 mile. Distances less than 0.5 mile can lead to reduced productivity and possible nest abandonment. Direct mortality is also an occurrence on roads. A comparison of road length, road density, effective elk habitat, and elk security habitat under the three alternatives is shown in Table 4-15. The presence and amount of this effective habitat and security habitat, by being distant from roads and other disruptive human activities, are important for all special status species. In particular, there will be benefits to sage-obligate bird species because these habitat-interior species are more successful away from disruptive activities that create edges, such as roads. Alternative I maintains the least amount of this interior elk habitat, with 11,405 acres of effective habitat and 6,628 acres of security habitat.

Sediment from roads may carry seeds of invasive plant species such as saltcedar and Russian-olive and exacerbate an already serious problem. Sediment from roads may be especially damaging during low-flow periods when the river is relatively clear, and when larval fish inhabit shallow, low- or zero-velocity habitats. Increasing sediment to larval fish habitats can smother eggs directly or reduce primary food sources by covering epipelic benthos. Channel morphology may also be affected, particularly on the descending limb of the hydrograph following high-flow events when deposition occurs (reducing complexity, filling pools, altering deposition features,

etc.). Alternative I has the largest number of roads of the three alternatives. This would result in the largest adverse impact to special status species.

Habitat-interior birds avoid use within 300 to 450 feet from forested roads, and up to 1.2 miles away from roads in grasslands (Forman 2000, Forman and Alexander 1998). Increases in habitat loss from oil and gas development and the associated displacement and habitat fragmentation have an adverse impact on birds. For sagebrush-obligate birds, bird densities were 50 percent lower within 100 meters of roads constructed for natural gas development in Wyoming than at greater distances (Ingelfinger 2001). The size of an undisturbed block also affects the number of bird species present. In Georgia Piedmont forests, for example, contiguous forest areas larger than 25 acres are needed to maintain high levels of avian diversity (McIntyre 1995). Although these studies were not conducted in sagebrush/juniper woodlands, it is not unreasonable to assume that the same concept applies. Similarly, small mammal species richness is sensitive to fragmentation in sagebrush shrublands (Hanser and Huntly 2006). The extent of effective elk habitat, number of security patches, and amount of security habitat are all measures that are important to these disturbance-sensitive birds. All three measures are reduced the most under Alternative I compared to Alternatives II and III.

There would be long-term disturbance and habitat alteration impacts to special status species from compressors and impoundments. Impoundments may also provide foraging habitat for some special status species such as bald eagles and bats. Unrestricted well metering and visitation would be disruptive because many operators continue to visit each well multiple times per week despite using remote metering technologies.

Under Alternative I, new overhead power lines would be prohibited on BLM surface. Power line impacts would likely be transferred to adjacent non-Federal lands. Generators are used as a temporary power source as a result of the shortage of available power, and they typically run for a period of two years. Generators would require fuel truck visits, on the order of one to two trips per week, and the sound of generators would be heard 24 hours per day. Even limited to 55 decibels, this noise level would be readily heard by various species including bald eagles and other raptors, sage-grouse, sage-obligate birds, and bats. These combined impacts would cause additional short-term disturbance to special status species from truck visits and associated exhaust fumes, increased noise, and the potential for fuel spills. The loss of some water sources from CBNG development would result in a loss of drinking water locations and would especially affect the special status bats, songbirds, and potentially some fish species.

The sum of impacts from fluid minerals development under Alternative I is a major adverse impact.

Fish and Wildlife Management

Alternative I would allow CBNG development at an unrestricted pace. Common to all alternatives, surface disturbance and disruptive activities would not be allowed in elk crucial winter range between November 15 and April 30 and in elk parturition range from May 1 through June 30. Well metering and visitation, and water management facility locations would not be restricted. No water sources would be required for elk or other wildlife to replace sources lost to CBNG development; and stock tanks would be required to be wildlife-friendly. Compressor locations would not be restricted. No elk security habitat standards would be implemented. To avoid repetition, these management actions are addressed under Fluid Minerals

Management, above. No other specific actions would be identified and no impacts would be anticipated.

Other Resources Management

Soil Resources

Alternative I would allow for the potential control or exclusion of surface-disturbing activities on slopes greater than 25 percent, or soils with severe erosion hazards including badlands, rock outcrop, and soils susceptible to mass failure. Standard lease terms and conditions would apply. Activities on 25 percent slopes would lead to increased erosion, which causes habitat modification in the form of a loss of vegetation and added siltation of streams. It is anticipated that very few exceptions would be allowed.

The avoidance of slopes would place much of the development on bottomlands. These bottomland riparian areas would be impacted both by roads (discussed above under Fluid Minerals Management) and impoundments (discussed below under Water Resources). The impact of soil resource management on special status species is anticipated to be adverse to a minor degree.

Water Resources

Under Alternative I, the location of water management facilities is not restricted; discharge to drainages is permissible with authorization and no subsequent monitoring or mitigation of downstream effects; no replacement of water resources is required; and proposed stock tanks would be required to be wildlife-friendly.

Impoundments would be developed in bottomlands along the Powder River and Fortification Creek, and alongside tributaries. Off-channel impoundments would be used on flat terraces. In addition to upland impoundments, impoundments would likely also be placed along the Powder River with water piped in from interior projects. These actions related to CBNG development on the FCPA will likely continue and affect habitat on adjacent lands. There would also be displacement associated with added human activity.

Development of impoundments leads to water leakage, which causes changes in vegetation from existing range grasses, sagebrush, and juniper to more mesic species such as sedges, foxtail barley, and, in places, cattails. Saltcedar and leafy spurge have toeholds in the FCPA. Expansion of mesic habitats allows for further invasion by these species. Another concern is that impoundments can provide habitat for mosquitoes associated with the West Nile virus (Oedekoven 2004). West Nile virus represents a significant new stressor, which in 2003 reduced late summer survival of sage-grouse by an average of 25 percent within four populations including the PRB (Naugle et al. 2004).

Generally, the area of disturbance is twice the size of the impoundment. Under Alternative I, an estimated 390 acres of native habitat will be disturbed as a result of water impoundments. The loss of native sagebrush would cause the loss of habitat for sage-obligate species, and the loss of grassland and sagebrush would adversely impact raptors. The very slow pace and low success rate of revegetation, with an increase in weeds, would lead to habitat loss for special status species. The creation of impoundments may benefit bats because they are extremely water dependent and need to drink every night when they forage. Bats would also benefit from mosquitoes and other insects that hatch in water, although the added sodium in the water may

present a problem to bats because they are sensitive to water chemistry (Adams 2003, Adams et al. 2003).

The discharge to channels, although treated if necessary as required by WDEQ, would likely have an adverse impact on aquatic habitats of native species because of increased flows and result in an adverse impact on downstream (Powder River) native fish adapted to seasonally fluctuating conditions. Alternative I would result in 2.4 mgd of produced waters discharged to channels. Increased turbidity may alter fish assemblages and sedimentation may fragment fish populations. The continuous contribution of constant-temperature waters may disrupt environmental cues that native fish depend on for reproductive behavior (Davis et al. 2006). There is also concern that CBNG waters would transport heat from coal beds to streams.

Fortification Creek is primarily an ephemeral stream and does not provide fish habitat; however, native fish occur in the Powder River. Sustained high flows, due to CBNG produced water, could potentially inundate the shallow water habitats that native fish in the Powder River use for breeding and rearing habitats. These native fish have evolved with the variable flows of the Powder River system, so they thrive under those conditions. This would have an adverse impact on special status fish species that are adapted to ephemeral flows or lower flows, and the potential would exist for expansion of non-native fish species that may out-compete native species.

Some stock tanks would likely be added and would be wildlife-friendly to prevent drowning of small animals. These would benefit bats as well as other special status species.

Actions from water management would result in a potential beneficial effect for bats, although this would be reduced because of the increased amount of associated human disturbance. It would result in an adverse impact to special status species, such as raptors, sage-grouse, and sage-obligate species, that require expanses of sagebrush and other native habitat, and an adverse impact for downstream aquatic resources due to changes in hydrology. Overall, water resource management actions result in moderately adverse impacts to special status species.

Alternative II

Special Status Species Management

Alternative II allows for a power line network to extend from existing overhead lines along drainages and existing corridors and roads to minimize cross-country power line construction. The impacts of these actions are discussed under Fluid Minerals Management, below, and will not be addressed here.

Alternative II management actions require the following: (1) operators will locate aboveground power lines, where practical, at least 0.5 mile from sage-grouse breeding or nesting grounds, and power poles within that area would be raptor-proof; (2) operators will construct power lines to minimize the potential for raptor collisions, with potential modifications to include burying the lines, avoiding areas of high avian use, and increasing the visibility of individual conductors; and (3) operators will limit the construction of aboveground power lines near streams, water bodies, and wetlands to minimize the potential for waterfowl collisions.

Restrictions for special status species that are common to all alternatives will benefit these species. However, as discussed in detail under Alternative I, these management actions have limited reach in terms of species, individuals, and surface area. The further restrictive actions outlined in Alternative II will benefit the single sage-grouse lek on the FCPA by restricting

activity within 0.25 mile, and will benefit raptors by reducing mortalities due to collisions and electrocutions. The impact of special status species management on special status species is beneficial to a minor degree.

Fluid Minerals Management

The BLM goal for CBNG management is to facilitate the extraction of CBNG and minimize the effects to the landscape that would impact the resource values in the FCPA. Associated objectives are to identify stipulations, COAs, and BMPs for exploration, development, production, and interim reclamation to ensure that activities would not impact resource values in the FCPA. A number of wildlife-protective restrictions on management actions for CBNG development are common to all alternatives and are described under Alternative I. Replacement water sources would be provided for those lost as a result of CBNG development. The potential avoidance of impoundments in sagebrush will benefit sage-grouse and sage-obligate songbirds. Installation of wildlife escape ramps could potentially benefit special status species if they were to land in the tank. The installation of noise mufflers will benefit all special status species by reducing noise disturbance. The restriction of activities in elk crucial ranges during the specified times will benefit the sage-obligate breeding songbirds during their breeding season.

Alternative II would incorporate a tri-phased geographic development approach, to occur over three years followed by one year of successful interim reclamation. An activity management plan for construction, metering, monitoring, and maintenance must be authorized. Provisions would be made for emergencies including any unforeseen circumstance or combination of circumstances that creates a dangerous situation that threatens human health, safety, or the environment if repair/remedial actions are delayed until BLM approval can be obtained.

Additionally, water management facilities would be located outside elk crucial ranges, summer water sources would be provided by CBNG projects if development caused their loss, and compressors in crucial range would be limited to the minimum number necessary. All overlapping crucial ranges would be retained, and non-overlapping crucial ranges would retain 75 percent of their security habitat. Fifty percent of security habitat would be retained in the yearlong range outside the crucial ranges.

Alternative II allows for a power line network to extend from existing overhead lines along drainages and existing corridors and roads to minimize cross-country power line construction. Alternative II would also require operators to locate aboveground power lines, where practical, at least 0.5 miles from sage-grouse breeding or nesting grounds. If not practical, power poles would be fitted with raptor perch preventers. Operators would construct power lines to minimize the potential for raptor collisions, with potential modification to include burying the lines, avoiding areas of high avian use, and increasing the visibility of the individual conductors. Operators would limit the construction of aboveground power lines near streams, water bodies, and wetlands to minimize collision fatalities for waterfowl.

The tri-phased development approach would benefit broader-ranging species that can move relatively long distances to escape disturbance, such as bald eagles and other raptors, but may not benefit smaller or site-dependent species, such as sage-grouse and sage-obligate songbirds. Although raptors may be able to search for alternative nest sites away from development, many species prefer to use the same nest site from year to year. Any development activities that would occur near sagebrush-obligate songbirds would be disruptive to these species. The requirement of successful interim reclamation and potential deferment of grazing would benefit habitat

restoration for special status species. The work management plan would provide some degree of control over well metering and visitation and reduce disturbance. The location of water management facilities outside elk crucial ranges will provide for areas free from disruption. While large, mobile animals can move to undisturbed areas, many special status species are more restricted in their movements; therefore, individuals in the crucial ranges will benefit. The replacement of lost water sources will result in a negligible impact to the special status bats, songbirds, fish, and others who depend on them. The limitation of compression facilities to the minimum necessary will be beneficial to wildlife.

Roads are directly associated with development and cause direct habitat loss. However, the larger impact comes from the reduction in effective habitat due to habitat fragmentation, displacement, and interference with movement patterns. An example of displacement relates to raptors. The proximity to roads is a major factor in reduced availability of nesting sites for raptors. A typical buffer distance for nesting raptors from human activity is 0.5 mile. Distances less than the buffer can lead to reduced productivity and possible nest abandonment. Direct mortality is also an occurrence on roads. A comparison of road length, road density, effective elk habitat, and elk security habitat under the three alternatives is shown in Table 4-15. The presence and amount of this effective habitat and security habitat, by being distant from roads and other disruptive human activities, are important for all special status species. In particular, there will be benefits to sage-obligate bird species because these habitat-interior species are more successful away from disturbance activities that create edges, such as roads. Alternative II maintains 35,662 acres of effective elk habitat and 31,663 acres of security habitat in four patches in the elk yearlong range, and is beneficial when compared with Alternative I (Table 4-15).

Although the Powder River is a naturally turbid river, increased sedimentation into channels from road building may affect aquatic habitat conditions. Sediment from roads may carry seeds of invasive plant species such as saltcedar and Russian-olive and exacerbate an already serious problem. Sediment from roads may be especially damaging during low-flow periods when the river is relatively clear, and when larval fish inhabit shallow, low- or zero-velocity habitats. Increasing sediment to larval fish habitats can smother eggs directly or reduce primary food sources by covering epipelic benthos. Channel morphology may also be affected, particularly on the descending limb of the hydrograph following high-flow events when deposition occurs (reducing complexity, filling pools, altering deposition features, etc.). Alternative II has fewer roads than Alternative I. This would result in less adverse impacts to special status fishes compared with Alternative I.

Under Alternative II, overhead power lines would be allowed, and would extend from existing lines along drainages and corridors to minimize excessive cross-country power line construction and to reduce the potential for raptor collisions. This management action would result in the potential for some electrocutions and collision fatalities to raptors.

The combined management actions related to CBNG development under Alternative II result in an anticipated moderate adverse impact to special status species.

Fish and Wildlife Management

Alternative II would incorporate a tri-phased geographic development approach, to occur over three years followed by one year of successful interim reclamation. An activity management plan for construction, metering, monitoring, and maintenance must be authorized, and restricted visitation would be allowed. Provisions would be made for emergencies including any

unforeseen circumstance or combination of circumstances that creates a dangerous situation that threatens human health, safety, or the environment if repair/remedial actions are delayed until BLM approval can be obtained.

Additionally, water management facilities would be located outside elk crucial ranges; summer water sources would be provided by CBNG projects if development caused their loss; and compressors in crucial range would be limited to the minimum number necessary. All overlapping crucial ranges would be retained, and non-overlapping crucial ranges would retain 75 percent of their security habitat. Fifty percent of security habitat would be retained in the yearlong range outside the crucial ranges. To avoid repetition, these management actions are addressed under Fluid Minerals Management. No other specific actions would be identified and no impacts would be anticipated.

Other Resources Management

Soil Resources

Under Alternative II, no surface-disturbing activities on soils with a severe erosion hazard, badlands, rock outcrop, slopes susceptible to mass failure, or slopes greater than 25 percent would be allowed. No exceptions would be allowed, and standard lease terms would apply. Under this alternative, there would be protection of erosive soils and a reduced localized loss of vegetation and potential for additional stream sedimentation. It is anticipated that this action would be protective of habitat. The avoidance of slopes would place much of the development on bottomlands. These bottomland riparian areas would be impacted both by roads (discussed above under Fluid Minerals Management) and impoundments (discussed below under Water Resources). Soil resources management would have a minor adverse impact on special status species.

Water Resources

Under Alternative II, reservoirs and water management facilities would be located outside the elk crucial ranges; discharge to channels would be minimized; and summer water sources would be provided to replace those lost due to CBNG projects.

Impoundments would be restricted to areas outside crucial ranges, leaving crucial ranges free of physical disturbance and disruptive human activities. Off-channel impoundments would be located on flat terraces. In addition to impoundments on Federal mineral lands, impoundments would likely also be placed on private lands along the Powder River with water piped in from Federal projects. These actions will likely continue and affect habitat and wildlife on adjacent lands. There would also be disturbance associated with added human activity.

The reduction of additional discharge to channels would have a beneficial impact on water quality, thus beneficially affecting special status fish by not altering the hydrology (increased flows) and water quality (sedimentation). This action removes the potential for adverse impacts to water quality downstream, as well. This action, or lack thereof, could have a beneficial impact on downstream fish.

It is anticipated that alternative methods will be used for removal of produced water. These may include piping water to private lands along the Powder River or its tributaries. Native fish occur in the Powder River. Sustained high flows from the CBNG produced water could potentially inundate the shallow water habitats that the native fish in the Powder River use for breeding and rearing habitats. These native fish have evolved with the variable flows of the Powder River

system, and they thrive under those conditions. This alternative would have an adverse impact on special status fish species that are adapted to natural flow regimes experienced in an arid prairie environment. Sustained high flows have the potential for expansion of non-native fish species.

Development of impoundments leads to water leakage that causes changes in vegetation from existing range grasses, sagebrush, and juniper to more mesic species such as sedges, foxtail barley, and, in places, cattails. Saltcedar and leafy spurge have toeholds in the FCPA. Expansion of mesic habitats allows for further invasion by these species. Additionally, impoundments can provide habitat for mosquitoes associated with the West Nile virus (Oedekoven 2004). West Nile virus represents a significant new stressor, which in 2003 reduced late summer survival of sage-grouse by an average of 25 percent within four populations including the PRB (Naugle et al. 2004).

Generally, the area of disturbance is twice the size of the impoundment. Under Alternative II, an estimated 262 acres would be disturbed as a result of water impoundments. The very slow pace and low success rate of revegetation, with an increase in weeds, would lead to habitat loss for special status species. The creation of impoundments may benefit bats because of their extreme dependence on water, as well as other special status species, by providing drinking water for these species. The high sodium content of these waters may, however, present a problem to bats because they are sensitive to water chemistry (Adams 2003, Adams et al. 2003).

Alternative II will result in 2.2 mgd of produced waters. The reduction of discharge to channels would be protective of aquatic habitats of native species as there would be less sedimentation and increased flows. This would result in a beneficial impact on downstream native fish adapted to natural flow regimes experienced in an arid prairie environment.

Summer water sources to replace lost sources would result in a benefit to water-dependent special status species such as bats and songbirds. The requirement that proposed stock tanks be wildlife-friendly would benefit all special status species.

In summary, all special status species benefit from water sources. However, sagebrush-obligates and raptors that use grasslands lose 262 acres of native habitat. The restriction on discharge protects special status fish downstream. The net result is anticipated to be a minor adverse impact on special status species.

4.3.6.2. Alternative III – Proposed Action

Special Status Species Management

Alternative III, the Proposed Action, requires that overhead power lines on BLM surface be limited to road corridors. The impact of this action is discussed under Fluid Minerals Management, below.

Shared with Alternative II are three actions: (1) operators will locate aboveground power lines, where practical, at least 0.5 mile from sage-grouse breeding or nesting grounds, and power poles within that area would be raptor-proof; (2) operator will construct power lines to minimize the potential for raptor collisions, with potential modifications to include burying the lines, avoiding areas of high avian use, and increasing the visibility of individual conductors; and (3) operators will limit the construction of aboveground power lines near streams, water bodies, and wetlands to minimize the potential for waterfowl collisions.

Restrictions for special status species that are common to all alternatives will benefit wildlife. However, as discussed in detail under Alternative I, these management actions have limited reach in terms of species, individuals, and surface area. The further restrictive actions outlined in Alternatives II and III will benefit the single sage-grouse lek and two sharp-tailed grouse leks on the FCPA by restricting activity within the 0.25-mile buffer, and will benefit raptors by reducing mortalities due to collisions. The impact is beneficial to a minor degree.

Fluid Minerals Management

The BLM goal for CBNG management is to facilitate the extraction of CBNG and minimize the effects to the landscape that would affect the resource values in the FCPA. Associated objectives are to identify stipulations, COAs, and BMPs for exploration, development, production, and interim reclamation to ensure that activities would not impact resource values in the FCPA. A number of wildlife-protective restrictions on management actions common to all alternatives are described under Alternative I. The Proposed Action would incorporate a performance-based phased development approach: livestock grazing management should be addressed but there is no requirement for grazing deferment, and surface disturbance and disruptive activity TLs (as in all alternatives) for elk and special status species would be implemented in elk crucial winter range from November 15 through April 30 and in parturition range from May 1 through June 30. Additionally, all authorized water management facilities would be located so as to meet performance-based objectives; summer water sources would be provided if their equivalent loss was due to CBNG projects; compressors would meet performance-based objectives; and elk security habitat would be maintained at 80 percent of baseline conditions.

Overhead power lines on BLM surface will be limited to road corridors. The Proposed Action would also require operators to locate aboveground power lines, where practical, at least 0.5 mile from sage-grouse breeding or nesting grounds and, if that is not practical, power poles would be fitted with raptor perch preventors. Operators would construct power lines to minimize the potential for raptor collisions, with potential modification to include burying the lines, avoiding areas of high avian use, and increasing the visibility of the individual conductors. Operators would limit the construction of aboveground power lines near streams, water bodies, and wetlands to minimize collision fatalities for waterfowl. Generators are used in all three alternatives due to a backlog in the overhead power line construction schedule. Generators, with their associated fuel truck visits, on the order of one to two trips per week, and the round-the-clock noise of generators, cause additional disturbance to wildlife and elk, because of truck visits and exhaust fumes, increased noise, and the potential for fuel spills. The incorporation of performance standards for elk use could encourage CBNG operators to minimize fuel trips and potentially find alternate short-term or long-term electricity supply solutions.

The performance-based phased approach would maintain 80 percent of elk population objectives. Although not a special status species management action, it would afford them some protection as a result of limitations on disturbance.

Any development activities that would occur near a roost site of special status bats, or in sagebrush habitat of sagebrush-obligate songbirds, would cause disturbance to these species. The requirement for replacement of lost water sources represents no net change for summer, though they would not be replaced in winter. As with development, the location of authorized water management facilities and compressors will be performance based, thus meeting the above-described 80 percent criteria for population numbers, calf survival, and habitat use. Timing

limitations and restrictions on visitation during critical periods for the elk will benefit special status species in general as a result of fewer disturbances.

Roads are directly associated with development and cause direct habitat loss; however, the larger impact comes from the reduction in effective habitat due to habitat fragmentation, displacement, and interference with movement patterns. An example of displacement relates to raptors. The proximity to roads is a major factor in reduced availability of nesting sites for raptors. A typical buffer distance for nesting raptors from human activity is 0.5 mile. Direct mortality is also an occurrence on roads. A comparison of road length, road density, effective elk habitat, and elk security habitat under the three alternatives is shown in Table 4-15. The presence and amount of this effective and security habitat, by being distant from roads and other disruptive human activities, is important for all special status species. In particular, there would be benefits to sage-obligate bird species because these habitat-interior species are more successful away from disturbances that create edges, such as roads. The Proposed Action maintains 37,820 acres of effective habitat and 33,687 acres of security habitat in five patches in the elk yearlong range (Table 4-15). These protected areas will benefit special status species.

Although the Powder River is a naturally turbid river, increased sedimentation into channels from road building may affect aquatic habitat conditions. Sediment from roads may carry seeds of invasive plant species such as saltcedar and Russian-olive and exacerbate an already serious problem. Sediment from roads may be especially damaging during low-flow periods when the river is relatively clear, and when larval fish inhabit shallow, low- or zero-velocity habitats. Increasing sediment to larval fish habitats can smother eggs directly or reduce primary food sources by covering epipelic benthos. Channel morphology may also be affected, particularly on the descending limb of the hydrograph following high-flow events when deposition occurs (reducing complexity, filling pools, altering deposition features, etc.). The Proposed Action has fewer roads, when compared to Alternative I, with 192 miles of roads in the elk yearlong range (Table 4-15).

Combined with the other management actions related to CBNG development under the Proposed Action, this alternative results in a moderately adverse impact to special status species.

Fish and Wildlife Management

Alternative III, the Proposed Action, would incorporate a performance-based development approach: livestock grazing management should be addressed but there is no requirement for grazing deferment, and surface disturbance and disruptive activity TLs (as in all alternatives) for elk and special status species would be implemented in elk crucial winter range from November 15 through April 30 and in parturition range from May 1 through June 30. Additionally, all authorized water management facilities would be located so as to meet performance-based objectives; summer water sources would be provided if their equivalent loss was due to CBNG projects; compressors will meet performance-based objectives; and elk security habitat would be maintained at 80 percent of baseline conditions per development phase.

Overhead power lines on BLM surface would be limited to road corridors and would be required to be located, where practical, at least 0.5 mile from sage-grouse breeding or nesting grounds and, if that is not practical, power poles would be fitted with raptor perch preventors. Operators would construct power lines to minimize the potential for raptor collisions, with potential modification to include burying the lines, avoiding areas of high avian use, and increasing the visibility of the individual conductors. Operators would limit the construction of aboveground

power lines near streams, water bodies, and wetlands to minimize collision fatalities for waterfowl.

To avoid repetition, these management actions are addressed under Fluid Minerals Management. No other specific actions would be identified and no impacts would be anticipated.

Other Resources Management

Soil Resources

Alternative III, the performance-based Proposed Action, would restrict surface disturbance on slopes greater than 25 percent, badlands, rock outcrop, slopes susceptible to mass failure, and soil with a severe erosion hazard. There could be exceptions to this restriction if the operator proposed an acceptable disturbance and reclamation plan with their POD when required by BLM. The disturbance and reclamation plan would take into account the performance-based standards for soil reclamation (Appendix B) and the operator would be required to meet these performance-based standards for three years. Reclamation on 25 percent slopes and for erosion hazard areas is challenging, as is reclamation in arid areas such as the FCPA. The difficulty of revegetation is exacerbated by the colonization of weeds including cheatgrass, as has occurred already at well sites in the FCPA. Control of erosion is also challenging and activities on 25 percent slopes are very likely to lead to increased erosion, which causes habitat modification in the form of a loss of vegetation. Increased erosion and habitat modification would have minor adverse impacts on wildlife in the FCPA.

Water Resources

Actions related to CBNG development on the FCPA will likely continue to impact habitat and special status species on adjacent lands. There would also be displacement associated with added human activity. The creation of impoundments may benefit special status bats due to their extreme dependence on water, although the high sodium content of these waters may present a problem to the species, as they are sensitive to water chemistry (Adams 2003, Adams et al. 2003). Added water may benefit other special status species by providing drinking water, although this is somewhat offset by the additional disturbance.

Development of impoundments leads to water leakage, which causes changes in vegetation from the existing range grasses, sagebrush, and juniper to more mesic species such as sedges, foxtail barley, and, in places, cattails. Saltcedar and leafy spurge have toeholds in the FCPA. Expansion of mesic habitats would allow further invasion by these species. In addition, the Proposed Action has a higher potential for West Nile virus if reservoirs are not constructed properly. CBNG impoundments can provide habitat for mosquitoes associated with West Nile virus (Oedekoven 2004). West Nile virus represents a significant new stressor which, in 2003, reduced late summer survival of sage-grouse by an average of 25 percent within four populations including the PRB (Naugle et al. 2004).

Typically, the physical disturbance to construct the impoundment is twice the size of the impoundment's containment area. Under the Proposed Action there would be 260 acres of habitat impacted.

Sustained high flows from the CBNG produced water could potentially inundate the shallow water habitats that the native fish in the Powder River use for breeding and rearing habitats. These native fish have evolved with the variable flows of the Powder River system, so they thrive under these conditions. This alternative would have an adverse impact on special status

fish species that are adapted to natural flow regimes experienced in an arid prairie environment. Sustained high flows have the potential for non-native fish species expansion.

In summary, some special status species would likely benefit from water sources whereas others would experience losses due to increased presence of West Nile virus. Sagebrush-obligates and raptors that use grasslands would lose native habitat due to impoundments. In addition the waters discharged to the Powder River would have an adverse impact on special status fish species. The net result is anticipated to be a minor adverse impact on fish and wildlife.

Summary

The summary of impacts to special status species is shown in Table 4-21.

Table 4-21 Summary of Impacts to Special Status Species Resources

Land Use or Management Action	Alternative I (No Action)	Alternative II	Alternative III (Proposed Action)
Special Status Species Management	Minor (+) Special status stipulations	Minor (+) Special status stipulations	Minor (+) Special status stipulations
Fluid Minerals Management	Major (-) Loss of habitat	Moderate (-) Loss of some habitat	Moderate (-) Loss of some habitat
Fish and Wildlife Management	No Impact	No Impact	No Impact
Other Resources Management			
Soil Resources Management	Minor (-) Development in bottomlands	Minor (-) Development in bottomlands	Minor (-) Development in bottomlands
Water Resources Management	Moderate (-) Discharge of 3.2 mgd produced water	Minor (-) Discharge of 2.2 mgd produced water	Minor (-) Discharge of 2.2 mgd produced water

4.3.6.3. Cumulative Impacts

Cumulative impacts to special status species were evaluated for the entire PRB, including the FCPA, in the PRB O&G FEIS (BLM 2003a). As additional development occurs both within and outside the FCPA, cumulative impacts could include increased disturbance to nesting raptors, degradation or destruction of nesting habitats, increased raptor collisions with power lines, increased electrocutions of raptors, and increased vehicular collisions with carrion-feeding raptors (BLM 2003a). These impacts would affect raptor populations throughout the PRB.

There is only one sage-grouse lek in the FCPA, but sage-grouse leks are present in the vicinity of the FCPA. Continued CBNG development in and around the FCPA will continue to impact sage-grouse through human activity, noise, and loss of habitat.

Water quality concerns from CBNG water discharges involve increased salinity. The cumulative effect of CBNG water discharges from numerous sites is a concern for water quality

downstream. These accumulated salts have damaging effects on soil physical condition, such as infiltration rates that can affect permeability and plant growth (Ruckelshaus 2005). There is also the possibility of alterations in fish communities due to long periods of CBNG water discharges (Davis et al. 2006).

4.3.7. Cultural Resources

The goal of cultural resources management in the FCPA is to avoid or mitigate significant impacts to historic properties. The management actions related to this goal include: (1) requiring an archaeological inventory for all Federal undertakings, regardless of surface ownership; (2) identifying historic properties; (3) designing projects to avoid or mitigate impacts to historic properties prior to approval; and (4) mitigating impacts to historic properties inadvertently discovered during or after construction.

As described in Chapter 3, site density in the FCPA is the same as the rest of the PRB, and there are no known or anticipated unique sites in the FCPA that would require special management. Current management actions that are a required in order to comply with Section 106 of the National Historic Preservation Act (NHPA) should result in the identification and avoidance or mitigation of all historic properties that may be impacted. There are no foreseeable differences among the alternatives because the management (identification with avoidance or mitigation) must remain the same for each alternative.

4.3.7.1. Evaluation Criteria

Assumptions used in analyzing impacts to cultural resources include the following:

- Archaeological inventories will be conducted for all projects in the FCPA;
- Historic properties will be identified and will either be avoided or mitigated prior to project approval;
- Archaeological sites that are not eligible for listing on the NRHP need not be avoided or mitigated;
- Historic properties inadvertently discovered and impacted during or after construction will be mitigated; and
- The cultural resource types encountered in the FCPA are assumed to be consistent with those encountered in the rest of the PRB.

The following definitions and assumptions will be used for impacts to historic properties:

- *Negligible* – All historic properties that are located prior to project approval will be avoided or mitigated. No historic properties will be discovered during construction.
- *Minor* – All historic properties that are located prior to project approval will be avoided or mitigated. Between one and 10 historic properties could be discovered during construction and will be mitigated.
- *Moderate* – All historic properties that are located prior to project approval will be avoided or mitigated. More than 10 historic properties would be discovered during construction and mitigated. There will be unanticipated impacts to between one and five historic properties that cannot be mitigated.

- *Major* – All historic properties that are located prior to project approval will be avoided or mitigated. More than 10 historic properties will be discovered during construction and mitigated. There will be unanticipated impacts to more than five historic properties that cannot be mitigated.

4.3.7.2. Alternative Analysis

As described in Chapter 3, site density in the FCPA is the same as the rest of the PRB, and there are no known or anticipated site types in the FCPA that require special management. Current management actions that are a required in order to comply with Section 106 of the NHPA should result in the identification and avoidance or mitigation of all historic properties that may be affected. Unanticipated impacts to historic properties that were not located during the inventory can be mitigated. There are no foreseeable differences among the alternatives because the management (identification with avoidance or mitigation) must remain the same for each alternative.

Summary

The summary of impacts to cultural resources is shown in Table 4-22.

Table 4-22 Summary of Impacts to Cultural Resources

Land Use or Management Action	Alternative I (No Action)	Alternative II	Alternative III (Proposed Action)
Cultural Resources Management	No Impact	No Impact	No Impact
Wildlife and Special Status Species Resources Management	Minor (-) 3,536-acre (3.5%) disturbance	Minor (-) 2,249-acre (2.2%) disturbance	Minor (-) 2,092-acre (2.1%) disturbance
Fluid Minerals Management	Minor (-) Sites inventoried and mitigated	Minor (-) Sites inventoried and mitigated	Minor (-) Sites inventoried and mitigated
Other Resource Management Soil Resources	Minor (+) Erosive soils avoided	Minor (+) Erosive soils avoided	Minor (+) Erosive soils avoided

4.3.7.3. Cumulative Impacts

CBNG development on private mineral estate within and around the FCPA may result in cumulative impacts, including increased surface disturbance when additional well pads, pipelines, compressor stations, roads, and/or other facilities are built. Almost all private mineral estate has been developed. This development is primarily along the edges and within the southeastern third of FCPA. Currently, there are approximately 215 producing gas wells in the FCPA (WOGCC 2010b), and many leases are not fully developed in other parts of the FCPA. There are no requirements for survey and mitigation of cultural sites on private surface. Also, some sites may be missed on Federal development areas despite cultural surveys.

Cumulative impacts to cultural resources were evaluated for the entire PRB, including the FCPA in the PRB O&G FEIS (BLM 2003a). Results of this analysis indicate that 178 historic properties would be directly affected in the PRB. Continued development in and around the FCPA will result in increased erosion from roads and other facilities, increased vibration from traffic on roads, and overall increased access into the area. Even though significant sites are not expected in the FCPA, this type of disturbance would result in destabilization and increased vandalism at some sites.

4.3.8. Geologic Resources

The primary goal for geologic resources in the FCPA is to maintain or enhance opportunities for mineral exploration and development while maintaining other resource values. Because this goal pertains to CBNG development in the FCPA, impacts to geologic resources are the same as those described in Section 4.4.5, Fluid Minerals Management.

4.3.9. Paleontological Resources

The primary goal for paleontological resources in the FCPA is to protect the scientific value of significant fossils. The management actions related to this goal include the following:

- Paleontological inventories will be targeted to specific areas or will be issue driven as needed;
- Large, conspicuous, and/or scientifically significant fossils or localities found during development will be reported to BLM;
- Evaluation of discoveries during construction will be conducted by a BLM-approved professional paleontologist within five working days; and
- Adverse impacts to paleontological resources will be mitigated, as necessary.

4.3.9.1. Evaluation Criteria

Assumptions used in analyzing impacts to paleontological resources include the following:

- The potential for significant vertebrate fossil discovery is low in the FCPA.

The following definitions will be used for impacts to paleontological resources:

- *Negligible* – The effect on paleontological resources is barely detectable. All significant fossils are discovered and avoided or mitigated before project approval.
- *Minor* – Significant fossils are discovered and avoided or mitigated before project approval. Between one and five significant fossils are discovered during construction and adequately mitigated.
- *Moderate* – Significant fossils are discovered and avoided or mitigated before project approval. More than five significant fossils are discovered during construction and adequately mitigated. Between one and two significant fossils are disturbed by construction and adequate mitigation is unattainable.
- *Major* – Significant fossils are discovered and avoided or mitigated before project approval. More than 10 significant fossils are discovered during construction and adequately mitigated. More than three significant fossils are disturbed by construction and adequate mitigation is unattainable.

4.3.9.2. Alternative Analysis

Current management actions that are required prior to project approval should result in the identification and avoidance or mitigation of all significant fossils that may be impacted. Unanticipated impacts to significant fossils that were not located during the inventory can be mitigated. There are no foreseeable differences among the alternatives since the management (identification with avoidance or mitigation) must remain the same for each alternative.

The summary of impacts to paleontological resources is shown in Table 4-23.

Table 4-23 Summary of Impacts to Paleontological Resources

Land Use or Management Action	Alternative I (No Action)	Alternative II	Alternative III (Proposed Action)
Paleontological Resources Management	No Impact	No Impact	No Impact
Wildlife and Special Status Species Resources Management	Minor (-) 3,536-acre (3.5%) disturbance	Minor (-) 2,249-acre (2.2%) disturbance	Minor (-) 2,092-acre (2.1%) disturbance
Fluid Minerals Management	Minor (-) Fossils inventoried and mitigated	Minor (-) Fossils inventoried and mitigated	Minor (-) Fossils inventoried and mitigated
Other Resource Management Soil Resources	Minor (+) Erosive soils avoided	Minor (+) Erosive soils avoided	Minor (+) Erosive soils avoided

4.3.9.3. Cumulative Impacts

CBNG development on non-Federal mineral estate within and around the FCPA may result in cumulative impacts, including increased surface disturbance when additional well pads, pipelines, compressor stations, roads, and/or other facilities are built. Almost all non-Federal mineral estate has been developed. This development is primarily along the edges of the FCPA and within the southeastern third of FCPA. Currently, there are approximately 215 producing gas wells in the FCPA (WOGCC 2010b). Many leases are not fully developed in other parts of the FCPA.

CBNG development on non-Federal mineral estate within and around the FCPA may result in cumulative impacts, including increased erosion and fossil collecting associated with ground disturbance when additional well pads, pipelines, compressor stations, roads, and/or other facilities are built. Continued development in and around the FCPA will result in increased erosion from roads and other facilities, increased vibration from traffic on roads, and overall increased access into the area. Even though significant fossils are not expected in the FCPA, this type of disturbance would result in destabilization and increased vandalism at some sites. Additionally, because the paleontological resources in the FCPA are not unique or significant, impacts to overall scientific knowledge would be extremely minor.

4.3.10. Visual Resources

The goal for visual resource management (VRM) under Alternatives I, II, and III is to maintain or improve scenic values and visual quality, and establish visual resource management priorities in conjunction with other resource values (BLM 2003a).

To achieve the goal for Alternatives I, II, and III, the following objectives were established:

- Protect, maintain, improve, or restore visual resource values by managing all public lands in accordance with the VRM system; and
- Retain visual resources within and surrounding the WSA.

4.3.10.1. Evaluation Criteria

Assumptions used in analyzing impacts to visual resources include the following:

- Facilities or structures such as power lines, gas wells, and storage tanks are required to be screened, painted, and designed to blend with the surrounding landscape except where safety indicates otherwise.
- The WSA is the visual reference point for the analysis.
- Any facilities or structures proposed in or near WSAs will be designed so as not to impair wilderness suitability.
- The FCPA is designated and managed as VRM Class III.
- The WSA is managed under interim guidance for non-impairment, (i.e., VRM Class I).
- The operator will complete the following measures where practical: use existing well pads where feasible, use vegetative and topographic screening when siting well locations, and avoid highwall cuts.
- The operator will mount lights at compressor stations and other facilities on a pole or building and direct them downward to illuminate key areas within the facility while minimizing the amount of light projected outside the facility.
- The operator will use buried power lines to each well, where feasible, to reduce the linear element in the landscape.

Viewpoint sensitivity for the viewers in the FCPA includes high-sensitivity viewpoints from locations within the WSA boundary and moderate- to low-sensitivity viewpoints from county roads in the FCPA. Ranches and other homes in the FCPA may also experience sensitivity to visual disturbances. Sensitivity is assigned to these levels because the expectation for scenic views from within the WSA boundary is much higher than to motorists traveling general use roadways not currently designated as scenic highways. Additionally, duration of view is longer for viewpoints within the WSA boundary.

The following definitions will be used for impacts to visual resources:

- *Negligible* – The effect on visual resources is barely detectable. Less than 1 percent of the resource would be affected. This could include surface disturbance that would be visible in the seldom seen distance zone (beyond 5 miles) from WSA viewpoints.

- *Minor* – The effect on visual resources is slight but detectable; there would be a small change in the resource. This could include surface disturbance that would be visible in the background distance zone (beyond 3 miles) from WSA viewpoints.
- *Moderate* – The effect on visual resources is readily apparent; there would be a measurable change in the resource. This could include surface disturbance that would be visible in the foreground to middle ground distance zone (between 0.5 and 3 miles from the WSA viewpoint).
- *Major* – The effect on visual resources is large; there would be a highly noticeable, long-term, or permanent measurable change in the resource. This could include surface disturbance that would be visible within the proximate distance zone (less than 0.5 mile away from the WSA viewpoint). This intensity level equates to a significant impact for this resource if the transmission poles were greater than 70 feet tall and would occupy the entire view perspective. The development of gas wells and associated road and pipeline networks, impoundments, water treatment facilities, compressors, and other facilities would not be considered a highly noticeable change to visual resources found on VRM Class III lands unless the management activity would remain completely visible and dominant from any portion of the WSA.

4.3.10.2. Alternative Analysis

Alternative I – No Action

Visual Resource Management

Current management actions for the FCPA under Alternative I include the following:

- VRM Class III standards apply to the entire resource area unless otherwise stated;
- Actions in the FCPA must meet VRM Class III standards; and
- Overhead power lines are prohibited on BLM surface within FCPA.

The FCPA is classified as VRM Class III with a special provision prohibiting overhead power lines on the Federal surface. According to BLM classification, overhead power lines typically would be permitted in VRM Class III areas; however, FCPA management specifies, “power lines will be buried” on BLM surface (BLM 2003a).

Under Alternative I, overhead power is estimated to encompass 9.3 miles of poles and conductors on private surface for the approximately 726 wells as shown on Figure 3-14. These power lines would likely be along Fortification and Deer creeks. While the length of power lines would be relatively small, the placement of power lines along the creeks would result in some impairment of visual resources. This management would continue to result in negligible adverse impacts to visual resources because power lines would be installed on non-BLM surface lands.

Wildlife and Special Status Species Resource Management

Under this alternative, there are TLs for elk habitat and special status species; however, these restrictions are temporary and, therefore, do not impact visual resources. There are no restrictions on the location of water management facilities resulting in minor adverse impacts, because water management facilities will be visible throughout the FCPA.

Fluid Minerals Management

Fluid minerals management actions include the proposed road, power lines, pipeline networks, and ancillary facilities needed to support the proposed gas wells. The road networks (approximately 179 miles) would cause moderately adverse visual impacts because the cut and fill slopes have greater visibility than a buried pipeline corridor. Additionally, road (and associated pipeline) network scars would remain visible for an extended period of time, even when revegetated. The linear lines would detract from the overall natural appearance of the landscape currently found upon VRM Class III lands in the FCPA. Under this alternative, more than 108 additional water treatment facilities along with other ancillary facilities would be constructed in the FCPA. Along with roads and wells, there would be approximately 3,536 acres of disturbance that would impact visual resources. This additional infrastructure would also be visible to dispersed recreational viewpoints. Alternative I would have a moderately adverse impact to visual resources as it has the greatest amount of road and pipeline networks and ancillary facilities.

Other Resource Management

Soil Resources

Where restrictions are placed on the location of gas wells and road networks because of sensitivity to soil erosion the VRM impacts would be reduced especially from the WSA. Under Alternative I, surface-disturbing activities may be restricted or excluded on slopes greater than 25 percent, on badlands, rock outcrop, slopes susceptible to mass failure, and soils with a severe erosion hazard although some exceptions may be authorized. This management action would have a beneficial impact on VRM because few wells, power lines, and other infrastructure would be constructed on high viewpoints. Impacts to visual resources would be minor and beneficial.

Alternative II

Visual Resource Management

For Alternative II, the number of wells is estimated at 487. This option allows for gas extraction with fewer overhead power lines and well pads as compared to Alternative I. An estimated 2.5 miles of overhead power would be constructed along drainages. It is anticipated that overhead power lines would be constructed along Fortification Creek. Most of the overhead power lines would be built beyond the proximate distance zone from WSA viewpoints; however one stretch of line would be within approximately 0.5 mile of the WSA, and this option would have moderately adverse impacts to visual resources.

Wildlife and Special Status Species Resource Management

Under Alternative II, there are TLs for elk habitat and special status species; however, these restrictions are temporary and, therefore, do not impact visual resources. Water management facilities would be located outside the elk crucial ranges and overall disturbance in crucial ranges and the yearlong range would be limited. These actions would result in minor beneficial impacts to VRM around the WSA because water management facilities would be located on the periphery of the FCPA; however, visual impacts would increase at the edges of the FCPA where ancillary facilities would be located. Overall, impacts would be minor and beneficial.

Fluid Minerals Management

Approximately 487 wells would be developed with 2.5 miles of overhead power lines. In addition to the visual impacts to VRM Class III from overhead power, the road network (and associated buried power lines) would result in visual impacts because the cut and fill slopes have greater visibility than the surrounding landscape. Additionally, road (and associated pipeline) network scars would remain visible for an extended period of time, even when revegetated. The linear lines would detract from an overall natural appearance of the landscape currently found upon VRM Class III lands in the FCPA.

Under Alternative II, there would be approximately 141 ancillary facilities to support CBNG development with approximately 2,249 acres of new disturbance. Water treatment facilities will be located outside the elk crucial ranges where they would be most visible to the public. The additional infrastructure would also be visible to dispersed recreational viewpoints. Compared to Alternative I, Alternative II would have less impact to visual resources due to the reduced number of road, pipeline, and ancillary facilities; however, impacts would be moderate and adverse.

Other Resource Management

Soil Resources

Where restrictions are placed on the location of gas wells and road networks because of sensitivity to soil erosion, the VRM impacts would be reduced. Under Alternative II, surface-disturbing activities would be restricted or excluded on slopes greater than 25 percent, on badlands, rock outcrop, slopes susceptible to mass failure, and soils with a severe erosion hazard. This management action would have a beneficial impact on VRM because few wells, power lines, and other infrastructure would be constructed on high viewpoints.

Alternative III – Proposed Action

Visual Resource Management

Overhead power lines would be allowed along road corridors. It is estimated that 483 new wells would be installed under the Proposed Action, with 1.6 miles of overhead power lines needed to supply electrical requirements. This option would have less visual impact than Alternative II because less infrastructure would be visible to dispersed recreational and ranching viewpoints. It is anticipated that overhead power lines would be constructed along Fortification Creek. The overhead power lines would be built beyond the proximate distance zone from WSA viewpoints resulting in moderately adverse impacts to visual resources.

Fish and Wildlife Resource Management

Under this alternative, there are TLs for elk habitat; however, these restrictions are temporary and, therefore, do not impact visual resources. Water management facilities would be located to meet performance-based objectives, which could make them more visible to the public from public roads, but less visible from the WSA. These actions would result in minor beneficial impacts to visual resources.

Fluid Mineral Management

Alternative III, the Proposed Action, has the least number of wells and the fewest miles of overhead power compared to Alternatives I and II. Approximately 483 wells would be developed

with 1.6 miles of overhead power lines. The road networks would cause visual impacts because the cut and fill slopes have greater visibility than a buried pipeline corridor. Additionally, road (and associated pipeline) network scars would remain visible for an extended period of time, even when revegetated. The linear lines would detract from the overall natural appearance of the landscape found upon VRM Class III lands in the FCPA. Under the Proposed Action, there would be approximately 140 ancillary facilities and approximately 2,092 acres of disturbance, located to meet performance-based objectives. These facilities would likely be more visible to the public from county roads and dispersed recreational viewpoints. The Proposed Action would have a moderately adverse impact to visual resources as a result of it requiring the smallest quantity of roads, pipelines, and facilities.

Other Resource Management

Soil Resources

Where restrictions are placed on the location of gas wells and road networks because of sensitivity to soil erosion, the VRM impacts would be reduced. Under all alternatives, surface-disturbing activities may be restricted or excluded on slopes greater than 25 percent, on badlands, rock outcrop, slopes susceptible to mass failure, and soils with a severe erosion hazard. This management action would have a minor beneficial impact on VRM because fewer wells, power lines, and other infrastructure would be constructed on high viewpoints.

Summary

The summary of impacts to visual resources is shown in Table 4-24.

Table 4-24 Summary of Impacts to Visual Resources Management

Land Use or Management Action	Alternative I (No Action)	Alternative II	Alternative III (Proposed Action)
Visual Resources Management	Moderate (-) 9.3 miles of power lines on non-BLM surface	Moderate (-) 2.5 miles of power lines on all surfaces	Moderate (-) 1.6 miles of power lines on all surfaces
Wildlife and Special Status Species Resources Management	Minor (-) CBNG facilities dispersed	Minor (+) Facilities outside crucial ranges	Minor (+) Facility location performance based
Fluid Minerals Management	Moderate (-) 9.3 miles of power lines on non-BLM surface 179 miles of new roads	Moderate (-) 2.5 miles of overhead power lines 101 miles of new roads	Moderate (-) 1.6 miles of overhead power lines 77 miles of new roads
Other Resource Management Soil Resources	Minor (+) Erosive soils avoided	Minor (+) Erosive soils avoided	Minor (+) Erosive soils avoided

4.3.10.3. Cumulative Impacts

Cumulative impacts to visual resources were evaluated for the entire PRB, including the FCPA, in the PRB O&G FEIS (BLM 2003a). CBNG development on Federal, State, and private lands in and around the FCPA would increase the industrial character of the area. As described in the PRB O&G FEIS, approximately 39,367 CBNG wells would be drilled in the PRB (BLM 2003a). Associated facilities would include water facilities, aboveground power lines, roads, generators, and other ancillary facilities. This development would result in an overall increase in the industrial character of the area including a decrease in air and visual quality as the number of CBNG wells and facilities increase, especially near roads.

Almost all non-Federal mineral estate has been developed. This development is primarily along the edges of the FCPA and within the southeastern third of the FCPA. Currently, there are approximately 215 producing gas wells in the FCPA (WOGCC 2010b). This development has already affected visual resources, most notably in the southeastern portion of the FCPA.

4.3.11. Fuels and Fire

The primary goals for fuels and fire management in the FCPA are to restore the natural role of fire in the ecosystem; cost-effectively protect life, property, and resource values from wildfire; and to use prescribed fire to achieve multiple-use management goals. The management actions related to these goals include the following:

- Unwanted wildland fires will be suppressed. The use of some types of suppression equipment will be restricted in some areas, and fire and suppression damage will be rehabilitated.
- Wildfires will be managed in all areas of the planning area. Priority will be given to suppressing fires within or that are threatening higher value resources (the WSA) and keeping fires from spreading onto private, State, or other Federal lands. Protecting human life will be the highest priority.
- Heavy equipment (dozers) will be restricted for wildfire suppression in the WSA and areas of known cultural values.
- Aerial retardant use will be restricted to keep retardant out of water sources. Specific restrictions on retardant use apply to the WSA.
- Helispot construction is prohibited in the WSA.
- Firelines that are constructed using heavy equipment or on steep slopes will be rehabilitated to prevent or control erosion. Rehabilitation includes, but is not limited to, water barring and reseeding.
- Prescribed burns will be used as a tool to reach management objectives planned for areas in conjunction with other goals such as range and wildlife habitat management projects.

These management actions are common to all alternatives. The following alternative analysis considers adverse and beneficial impacts, direct and indirect impacts, as well as short- and long-term impacts to fuels and fire.

4.3.11.1. Evaluation Criteria

Because of the unpredictable nature of fire, and the general lack of long-term quantitative data, assessment of potential impacts from the management of other resources on fuels and fire is difficult to quantify.

The following definitions will be used for impacts to fuels and fire:

- *Negligible* – The effect on fuels and fire is barely detectable. This may include firefighting capacity, firefighter safety, increased or decreased fuels, ignition sources, and prescribed burns. A negligible change would be less than 1 percent of the FCPA
- *Minor* – The effect on fuels and fires is slight but detectable; there would be a small change in firefighting capacity, increased or decreased fuels, ignition sources, and prescribed burns. A minor change would be from one to 10 percent of the FCPA, or if there is a major impact with a short-term or highly localized basis.
- *Moderate* – The effect on fuels and fire is readily apparent; there would be a measurable change in firefighting capacity, increased or decreased fuels, ignition sources, and prescribed burns that could result in a long-term or permanent change to the fuels and fire. This would be a change that affects 10 to 20 percent of the FCPA.
- *Major* – The effect on fuels and fire is readily apparent; there would be a measurable change in firefighting capacity, increased or decreased fuels, ignition sources, and prescribed burns that could result in a long-term or permanent change to the fuels and fire. This would be a change that affects more than 20 percent of the FCPA.

4.3.11.2. Alternative Analysis

Impacts to fuels and fire are those that would inhibit firefighting ability or increase the chances for wildfire. Impacts to fuels and fire may differ in extent and severity, depending on specific management actions proposed under each alternative for different resource uses. The following sections describe the impacts under each alternative resulting from fuels and fire management, as well as those anticipated to result from the management actions proposed for wildlife and special status species, visual resources, and fluid minerals.

Alternative I (No Action Alternative)

Fuels and Fire Management

Alternative I, the No Action Alternative, would continue current management goals and objectives, including suppressing unwanted wildland fires, restricting heavy equipment in some areas, and reclaiming firelines on steep slopes. Additionally, prescribed burns may be used to enhance wildlife habitat. The continuation of current management includes application of prescribed fire on an average of 600 to 1,000 acres per year with a cumulative total over a 10-year period of up to 10,000 acres; however, an increase in the amount of CBNG development would limit the prescribed burns because of the risk of setting a well or pipeline on fire, which would be a minor adverse impact. Impacts would be minor and beneficial due to a reduced threat of catastrophic wildland fire resulting from fuel reduction and an increase in fuel breaks.

Wildlife and Special Status Species Resources Management

Current management actions for wildlife resources under Alternative I include restrictions and limitations for wildlife values. Current restrictions for elk habitat and special status species are

TLs; however, these are not in force during the driest and hottest part of the year when CBNG development would be occurring. These management actions would not have any impact on fuels and fire management.

Under Alternative I, water impoundments could be used as water sources during wildfires. This action would result in a minor beneficial impact because there would be more water for firefighting. Overall, the impact would be beneficial as there would be a safer environment for the firefighters to address wildland fires.

Fluid Minerals Management

The BLM goal for CBNG management is to facilitate the extraction of CBNG and minimize the effects to the landscape that would impact the resource values in the FCPA. Associated objectives are to identify requirements, BMPs, and COAs for exploration, development, production, and reclamation to ensure that activities would not impact resource values.

Current management actions for CBNG development under Alternative I include the potential for approximately 726 wells with associated infrastructure. These actions would result in minor adverse impacts to fuels and fire because additional development could require fire protection. The risk of fire in the FCPA would increase because of the storage of natural gas, diesel fuel, or other materials needed for power generation that will be in the area. Hot vehicles and equipment and tossed cigarettes could also increase the potential for wildfire. The incidence of equipment-caused fires in California is 27 percent, vehicle caused fires is 14 percent, and smoking-caused fires is 2 percent (California Department of Forestry and Fire [CDF] 1999). The CDF did not distinguish between wildland, wildland-urban interface, or urban areas in their statistics, nor did they distinguish between industrial or other fires. In general, fire is more prevalent in urban areas and wildland-urban interfaces. While this is not currently the case in the FCPA, increased development (roads, structures, and people) could result in a transition to more urban areas. Additionally, the CDF Office of the State Fire Marshal (OSFM) states that, historically, the gas development operation most likely to cause fires is welding (CDF 1999). This is not likely in the FCPA because most of the pipe used is polyethylene. CBNG development would likely reduce the risk of wildfire because sparks would be expected to fall on bare ground; however, increased disturbance from CBNG development and a subsequent increase in cheatgrass would increase fuels for wildland fires in the long-term.

Under Alternative I, no overhead power lines are allowed on BLM lands; however, there would likely be approximately 9.3 miles of overhead power lines on non-Federal lands. These management actions would result in a negligible increase in the potential for fire on BLM surface caused by overhead power lines because a fire ignited on non-Federal surface could spread onto BLM surface. In the State of California overhead power lines caused approximately 1 to 3 percent of wildland fire ignitions (CDF 2006).

The increase in CBNG water impoundments that could be used as water sources during wildfires would be a negligible beneficial impact, as would the increase in roads that would provide better access for firefighting and additional firebreaks. This would provide a safer environment for the firefighters to address wildland fuels; however, some additional risk or increased hazard from concentrations of produced fossil fuels would potentially occur. As a result, impacts would be minor and beneficial.

Overall, impacts from fluid minerals management on fuels and fire are minor and adverse, because, while the firefighting environment would be safer, there would be more fuels available and fewer prescribed burns in developed areas.

Other Resources Management

Vegetation Resources

Under this alternative, vegetation resources management would result in minor adverse impacts to fuels and fire because hazardous fuels would not be controlled by prescribed burns in areas of CBNG development and production (less than 5 percent of the FCPA); therefore, hazardous fuels would not be reduced.

Alternative II

Fuels and Fire Management

Alternative II would continue current management goals and objectives, including suppressing unwanted wildland fires, restricting heavy equipment in some areas, and reclaiming firelines on steep slopes. The continuation of current management includes application of prescribed fire on an average of 600 to 1,000 acres/year with a cumulative total over a 10-year period of up to 10,000 acres. However, an increase in the amount of CBNG development would limit the prescribed burns because of the risk of setting a well or pipeline on fire, which would be a minor adverse impact. Impacts would be minor and beneficial because of reduced threat of catastrophic wildland fire resulting from fuel reduction and increased fuel breaks.

Wildlife and Special Status Species Resources Management

Current management actions for wildlife resources under Alternative II include restrictions and limitations for wildlife values including TLs. This management action would have no impact on fuels and fire management. Under this alternative, water impoundments that could be used as water sources during wildfires would be restricted to areas outside of the elk crucial winter and parturition ranges. This action would result in a negligible beneficial impact because there would be more water for firefighting, although the impact would be restricted to areas outside of the elk crucial ranges. Overall, there would be a safer environment for the firefighters to address wildland fires.

Fluid Minerals Management

Management actions for CBNG development under Alternative II include the potential for approximately 487 wells and well pads with associated infrastructure. These actions would result in minor adverse impacts to fuels and fire because additional development could require fire protection for approximately 2,249 acres (approximately 2.2 percent of the FCPA).

The risk of fire in the FCPA would increase because of the storage of natural gas, diesel fuel, or other materials needed for power generation that will be in the area. A discussion of the remaining potential impacts to fuels and fire management is provided under Alternative I.

Roads would increase by approximately 101 miles, which would result in an overall increase in firebreaks or access for firefighters. The associated increase in water impoundments that could be used as water sources during wildfires would be a negligible beneficial impact because while there would be more water for firefighting, it would be restricted to areas outside of the crucial winter and parturition ranges. Overall, Alternative II would promote a safer environment for the

firefighters to address wildland fires but some additional risk or increased hazard from concentrations of produced fossil fuels would potentially occur. Impacts from this alternative would be negligible and beneficial.

Under Alternative II, approximately 2.5 miles of overhead power lines would be constructed. This management action would result in minor adverse impacts to fuels and fire because the additional infrastructure may require fire protection and the overhead power lines would result in a safety risk for firefighters. Additionally, there is a very small risk (approximately 1 to 3 percent; CDF 2006) of a power line causing a fire.

Overall, impacts from fluid minerals management on fuels and fire are minor and adverse, because while the firefighting environment would be safer, there would be more fuels available and fewer prescribed burns in developed areas.

Other Resources Management

Vegetation Resources

Under this alternative, vegetation resources management would result in minor adverse impacts to fuels and fire because hazardous fuels would not be controlled by prescribed burns in areas of CBNG development and production (less than 5 percent of the FCPA) and fuels would not be reduced.

Alternative III – Proposed Action

Fuels and Fire Management

Alternative III, the Proposed Action, would continue current management goals and objectives, including suppressing unwanted wildland fires, restricting heavy equipment in some areas, and reclaiming firelines on steep slopes. The continuation of current management includes application of prescribed fire on an average of 600 to 1,000 acres per year with a cumulative total over a 10-year period of up to 10,000 acres; however, an increase in the amount of CBNG development would limit the prescribed burns due to the risk of setting a well or pipeline on fire, which would be a minor adverse impact. Impacts would be minor and beneficial because of a reduced threat of catastrophic wildland fire resulting from fuel reduction and breaking up of fuel continuity.

Wildlife and Special Status Species Resources Management

Current management actions for wildlife resources under the Proposed Action include restrictions and limitations for wildlife values. These management actions would have negligible adverse impacts on fuels and fire management. Because the number of CBNG water impoundments would be performance-based, more water sources for wildfires would be available, but the number and location are not yet known. This would be a negligible beneficial impact because additional water would be readily available.

Fluid Minerals Management

Management actions for CBNG development under the Proposed Action include the potential for approximately 483 wells and well pads with associated infrastructure. These actions would result in minor adverse impacts to fuels and fire because additional development could require fire protection for approximately 2,092 acres (approximately 2 percent of the FCPA).

The risk of fire in the FCPA would increase because of the storage of natural gas, diesel fuel, or other materials needed for power generation that will be in the area. Alternative I provides further discussion on the remaining potential impacts to fuels and fire management.

Under the Proposed Action, overhead power lines would be constructed along road corridors. This management action would result in minor adverse impacts to fuels and fire because the additional infrastructure may require fire protection and the overhead power lines would result in a safety risk for firefighters. Additionally, there is a very small risk (1 to 3 percent; CDF 2006) of a power line causing a fire.

An increase in road density in the FCPA would result in negligible beneficial impacts because there would be better access for firefighting equipment and more firebreaks. The associated increase in water impoundments that could be used as water sources during wildfires would be a negligible beneficial impact because additional water would only be available in some areas. The Proposed Action would provide a safer environment for the firefighters to address wildland fires, but some additional risk or increased hazard from concentrations of produced fossil fuels could potentially occur. Overall, impacts from this alternative would be minor and adverse.

Other Resources Management

Under the Proposed Action, vegetation resources management would result in minor adverse impacts to fuels and fire because hazardous fuels would not be controlled by prescribed burns in areas of CBNG development and production (less than 5 percent of the FCPA) and fuels would not be reduced.

Summary

The summary of impacts to fuels and fire is shown in Table 4-25.

Table 4-25 Summary of Impacts to Fuels and Fire

Land Use or Management Action	Alternative I (No Action)	Alternative II	Alternative III (Proposed Action)
Fuels and Fire Management	Prescribed Fire Minor (-) Reduced opportunity Wild Fire Minor (+) Fuel reduction plus increase in fuel breaks	Prescribed Fire Minor (-) Reduced opportunity Wild Fire Minor (+) Fuel reduction plus increase in fuel breaks	Prescribed Fire Minor (-) Reduced opportunity Wild Fire Minor (+) Fuel reduction plus increase in fuel breaks
Wildlife and Special Status Species Resources Management	Minor (+) Water impoundments dispersed	Negligible (+) Water impoundments outside crucial ranges	Negligible (+) Water impoundments located to meet performance-based standards
Fluid Minerals Management	Minor (-) Increased fire risk	Minor (-) Increased fire risk	Minor (-) Increased fire risk

Table 4-25 Summary of Impacts to Fuels and Fire			
Land Use or Management Action	**Alternative I (No Action)**	**Alternative II**	**Alternative III (Proposed Action)**
Other Resource Management			
Vegetation Resources	Minor (-) Fewer prescribed burns, more fuels	Minor (-) Fewer prescribed burns, more fuels	Minor (-) Fewer prescribed burns, more fuels

4.3.11.3. Cumulative Impacts

Cumulative impacts to fuels and fire management may include smoke dispersion, escaped fire from private lands and the surrounding wildland-urban interface, and potential flash flooding into FCPA streams from destabilized burned areas on private lands. Almost all non-Federal mineral estate in the FCPA has been developed. This development is primarily along the edges of the FCPA and within the southeastern third of the FCPA. Currently, there are approximately 215 producing gas wells in the FCPA (WOGCC 2010b). Current conditions in developed portions of the FCPA and adjacent to the FCPA include cheatgrass invasion, insect infestation, poor soil conditions, and long-term drought, which may collectively increase the likelihood of high-intensity wildfires. The risk of fires from CBNG development (from fuel, electrical lines, compressors, and other CBNG-related activity) increases with the number of wells installed.

4.4 Resource Uses

4.4.1. Rangeland Resources

Management goals for rangeland resources within the FCPA are: (1) manage livestock grazing in order to be consistent with Standards for Healthy Rangelands and Guidelines for Livestock Grazing Management for Public Lands Administered by the Bureau of Land Management in the State of Wyoming (BLM 1997); and (2) maintain a thriving natural ecological balance, multiple-use relationships, and productive forage resources.

Most management actions related to these goals are common to all alternatives and include the following:

- Livestock grazing is allowed on all public lands in the resource area.
- Any permanent increases in the amount of forage produced are considered for wildlife and watershed protection before additional livestock use is authorized.
- Fences will be constructed to maintain wildlife mobility in important habitat areas. Fences on public land that are hindering natural movement of wildlife will be modified to conform to BLM standards.
- Reservoirs, wells, troughs, and pipelines may be constructed to provide water in dry areas and to disperse grazing use. The grazing lessee or other cooperator will be required to maintain water in all troughs located on public land during the frost-free period (April through October) for wildlife.
- All stock tanks will include a ramp to enable trapped small birds and mammals to escape.

The following alternative analysis considers adverse and beneficial impacts and direct and indirect impacts to rangeland resources.

4.4.1.1. Evaluation Criteria

Assumptions used in analyzing impacts to rangeland resources include the following:

- Federal lands within the boundary of the FCPA were used as the impact analysis area for both individual and cumulative impacts.

The degree of both beneficial and adverse estimated impacts to rangeland resources are defined in both quantitative terms (percent impairment to lease terms and conditions) when such analyses are possible, and in more qualitative terms (visibility, duration, and in the context of Wyoming Standards for Healthy Public Rangelands) when there are no quantitative parameters available for analysis. Impacts to rangeland resources are described using the following categories:

- *None* – Effects are unlikely to affect the resource value, with no amount of physical disruption to the resources. Lessees would see no impacts to current lease terms and conditions, allotment sizes, stocking rates, or season-of-use conditions.
- *Negligible* – Detectable effects could occur but would last no more than one year (that is, not detectable after one full growing season). Anticipated effects are unlikely to result in noticeable impairment or enhancement of the resource value in terms of Wyoming Standards for Healthy Public Rangeland (BLM 1995a). Lessees would see no noticeable impacts to current lease terms and conditions, allotment sizes, stocking rates, or season-of-use conditions.
- *Minor* – Effects are likely to result in noticeable but not substantial impairment of the resource value in terms of Wyoming Standards for Healthy Public Rangeland (BLM 1995a), but the total area of disruption would include less than 5 percent of the resource. Lessees would see less than 5 percent impairment to current lease terms and conditions, allotment sizes, stocking rates, or season-of-use conditions.
- *Moderate* – Effects would be noticeable and could include substantial impairment of the resource value in terms of Wyoming Standards for Healthy Public Rangeland (BLM 1995a). These effects could increase over time, or be long-term or permanent. The total area of disruption would include 6 to 15 percent of the resource. Lessees would see 6 to 15 percent impairment of current lease terms and conditions, allotment sizes, stocking rates, or season-of-use conditions.
- *Major* – Effects would be noticeable and are likely to include substantial impairment of the resource value. These effects may increase over time or be long-term or permanent. Lessees would see more than 15 percent impairment in current lease terms and conditions, allotment sizes, stocking rates, or season-of-use conditions.

4.4.1.2. Alternative Analysis

A number of proposed management actions have the potential to impact rangeland resources. Direct impacts affect the quality of these resources in terms of forage quality and quantity because these factors influence the number of domestic grazers that can be supported. Impacts to forage quality and quantity may be adverse, such as reduced biomass production and increased prevalence of weeds. Introduction or expansion of noxious weeds through various vectors can poison livestock but, more commonly, they replace preferred forage with unpalatable and or less-

productive plant species. Beneficial impacts such as increased biomass production and increased prevalence of desirable species may also result from specific management actions. Direct impacts to grazing lessees are defined as those that affect lease conditions.

A number of indirect impacts to rangeland health and management are also possible. Indirect impacts of surface disturbance include a loss of forage area or availability of forage due to surface occupancy for other uses, construction or widening of roads, direct and indirect damage to soils and vegetation, closure of specific areas to livestock to protect or enhance one or more other resources, and loss of water sources. Vehicular traffic and human visitors and their dogs may harass livestock.

In general, there is a direct and proportional relationship between impacts to vegetation and rangeland resources. Therefore, as with vegetation resources, direct impacts to rangeland resources will be described in terms of the relative amount of surface disturbance due to any specific management action.

The estimated extent of ground-disturbing activities associated with fluid minerals management to each vegetation type, by alternative, was described in Vegetation Resources, Section 4.3.4, and summarized in Table 4-13.

The following sections describe the impacts under each alternative resulting from the management of rangeland resources, as well as those anticipated to result from the management actions proposed for wildlife and special status species, fluid minerals, and other resources management, including vegetation resources and special designations.

Alternative I (No Action Alternative)

Rangeland Resources Management

Alternative I, the No Action Alternative, would continue the current management goals and objectives summarized above. Most of the specific management actions are common to all alternatives, including continuation of livestock grazing; fencing to maintain wildlife mobility in important habitat; water projects being allowable in dry areas and for the purposes of dispersing livestock; and stock tanks including escape ramps for wildlife and birds. Range improvements are less likely in the WSA because of non-impairment prescriptions.

Rangeland health assessments have not been completed on all of the 17 allotments in the FCPA. However, the allotments that have been assessed have met the Wyoming Standards for Healthy Public Rangelands (BLM 1995a). Continuing current management for these resources is, therefore, expected to have no impacts.

Wildlife and Special Status Species Resources Management

Current management actions for wildlife resources under Alternative I include restrictions and limitations for wildlife values. Under this alternative, TLs for elk crucial ranges and special status species limit surface-disturbing activities during parts of the year. Such actions indirectly benefit rangeland resources because they result in seasonal limitations to surface disturbance and vegetation and some limitations of other activities that may adversely impact livestock. However, the TLs do not result in permanent restrictions. Existing wildlife resources management, including specific elk management actions, would not have any measurable impact on rangeland resources.

Fluid Minerals Management

The BLM goal for CBNG management is to facilitate the extraction of CBNG and minimize effects to the landscape that would impact the resource values in the FCPA. Associated objectives are to identify stipulations, BMPs, and COAs for exploration, development, production, and reclamation to ensure that activities would not adversely impact resource values in the FCPA. Under Alternative I, the pace of CBNG development would be unrestricted. Current management actions for CBNG development under Alternative I include restrictions and limitations for wildlife values and overhead power lines limited to non-BLM surface. These restrictions are reflected in the estimated surface disturbance.

Development of CBNG under Alternative I would result in an estimated 3,536 acres of vegetation disturbance (3.5 percent of the total area; see Table 4-13). This would affect allotments in proportion to their relative size and location. Allotments near the edge of the FCPA would be expected to be affected disproportionately by CBNG facility locations because areas with slopes less than 25 percent will have most of the development. However, most of the FCPA allotments contain both gentle and steep slopes; some portions of all of the allotments would be affected to some degree. Direct impacts would include loss of forage and AUMs and would result in minor adverse impacts to rangeland resources. CBNG construction activities can temporarily require the removal of allotment fencing, although all fencing is required to be repaired upon construction completion. Livestock may also be curious about CBNG structures or use structures for scratching posts or shade.

Current stock wells may go dry because of drawdown, but will be replaced if covered under a well agreement. CBNG discharged water will continue to increase the availability of surface water in the FCPA even though there is no requirement for CBNG developers to provide additional water sources. Available water in an otherwise dry landscape tends to attract livestock and encourage them to spend more time grazing in these areas; therefore, livestock may become more concentrated in CBNG areas (BLM 2003a). In some cases, CBNG discharged water may be high in selenium. Concentrations of selenium do not limit the use of water for stock watering; however, certain vegetation could become toxic to livestock through the uptake of selenium (BLM 2003a). These indirect impacts to rangeland resources would affect allotments in proportion to their relative size and are expected to result in minor adverse impacts to rangeland resources.

Increased flows could result in conversion of reaches of ephemeral drainages that currently support upland grassland vegetation to perennial stream habitat that supports riparian vegetation. The magnitude of this impact cannot be estimated at this time. Overall, the impacts to rangeland resources from these conversions would be minor in extent. In terms of rangeland resources, this impact can be considered adverse in that such conversions would replace upland forage in these drainage bottoms with less-palatable species.

These indirect impacts to rangeland resources would affect allotments in proportion to their relative size and location, but are overall expected to result in minor adverse impacts to rangeland resources.

Other Resources Management

Soil Resources

Under this alternative, surface-disturbing activities may be restricted or excluded on slopes greater than 25 percent, badlands, rock outcrop, slopes susceptible to mass failure, and erosive soils. This would result in indirect minor beneficial impacts to rangeland resources that occur in these areas because erosion would be minimized on approximately 33,694 acres. However, the restriction of CBNG development to slopes less than 25 percent results in concentrating development in areas preferred by livestock and impacts the best forage types. With CBNG infrastructure and livestock both avoiding the steep slopes, the remaining narrow drainage bottom areas would likely be the most impacted. Additionally, this restriction results in more development on the edges of the FCPA, where slopes are gentler. Because most of the FCPA allotments contain both gentle and steep slopes, some portions of all of the allotments would be affected to some degree. This alternative results in minor adverse impacts to rangeland resources.

Vegetation Resources

Vegetation resources management under Alternative I (Section 4.3.4) would result in beneficial impacts to vegetation as well as rangeland resources because a number of management actions specifically address controlling existing noxious weed populations and limiting the spread of noxious weeds. Management actions under Alternative I are expected to result in minor beneficial impacts.

Special Designations

Special designation areas often indirectly benefit vegetation and, therefore, rangeland resources, due to limiting surface-disturbing activities in this area. Under Alternative I, the WSA (approximately 12,419 acres) would continue to be managed to maintain wilderness characteristics. Some grazing allotments coincide with the WSA. In these areas, continued restrictions on the construction of permanent structures and facilities and on surface-disturbing activities, would continue to result in beneficial impacts because forage would not be disturbed in these areas. However, livestock operators often find it easier and more effective to manage their livestock through the construction of some facilities. Because this is a continuing situation, no impacts to rangeland resources are expected from this action. No ACEC or WHMAs would be designated; therefore, there would be no impacts to rangeland resources in these areas.

Alternative II

Rangeland Resources Management

Like Alternative I, Alternative II would continue the current management goals and objectives summarized above. Most of the specific management actions are common to all alternatives, including continuation of livestock grazing; fencing that maintains wildlife mobility; water projects being allowed in dry areas and for the purposes of dispersing livestock; and stock tanks with escape ramps for wildlife and birds.

Under Alternative II, tri-phased gas development would be implemented. This may include deferring livestock grazing following interim reclamation. This is expected to result in more complete revegetation, contributing to minor beneficial impacts to rangeland resources in these areas.

Rangeland health assessments have not been completed on all of the 17 allotments in the FCPA. However, the allotments that have been assessed have all met the Standards for Healthy Public Rangelands (BLM 1995a). Continuing current management for these resources is, therefore, expected to have negligible impacts.

Wildlife and Special Status Species Resources Management

Current management actions for wildlife resources under Alternative II include restrictions and limitations for wildlife values. Such actions indirectly benefit rangeland resources to some degree, because they result in limitations to vegetation disturbance as well as some limitations to other activities that may adversely impact livestock; however, the TLs do not result in permanent restrictions. Existing wildlife resources management, including specific elk management actions, would not have any measurable impact on rangeland resources. Deferring livestock grazing in interim reclamation areas would be expected to result in more complete revegetation, contributing to minor beneficial impacts to rangeland resources.

Under Alternative II, the requirement that summer water sources be provided with CBNG projects may result in minor beneficial impacts to rangeland resources because livestock as well as elk would use these water sources.

Fluid Minerals Management

Management actions for CBNG development under Alternative II include restrictions and limitations for wildlife values, no surface disturbance, with no exceptions, for slopes greater than 25 percent and soils with a severe erosion hazard, badlands, rock outcrop, or slopes susceptible to mass failure. Alternative II allows new roads and wells, but limits these to outside of overlapping crucial winter and parturition ranges. Overhead power lines could be constructed along road corridors and drainages. These restrictions are reflected in the estimated surface disturbance.

Development of CBNG under Alternative II would result in an estimated 2,249 acres of vegetation disturbance (2 percent of the total area; see Table 4-13), less than under Alternative I. All vegetation types would experience less than 1 percent surface disturbance. This would affect allotments in proportion to their relative size and location. Allotments near the edge of the FCPA would be expected to be disproportionately affected by CBNG facility location because areas with slopes less than 25 percent will have most of the development. However, because most of the allotments have gentle and steep slopes, some portions of all of the allotments would be affected to some degree. Additionally, under Alternative II, CBNG reservoirs and facilities would be concentrated outside crucial winter and parturition ranges along the edges of the FCPA. Direct impacts would result in minor adverse impacts to rangeland resources through loss of forage and AUMs.

CBNG construction activities can temporarily require the removal of allotment fencing, although all fencing is required to be repaired upon construction completion. Livestock may also be curious about CBNG structures or use structures for scratching posts or shade.

Current stock wells may go dry as a result of drawdown, but will be replaced where well agreements are in place. Because there will be fewer wells than under Alternative I, less drawdown will occur. CBNG developers would provide summer water sources. CBNG discharged water would increase the availability of surface water in the FCPA attracting elk and livestock; however, impoundments will only be allowed outside of the elk crucial winter and

parturition ranges resulting in minor beneficial impacts to livestock in these areas. Available water in an otherwise dry landscape tends to attract livestock to encourage them to spend more time grazing in these areas; therefore, they may become more concentrated in CBNG areas (BLM 2003a). In some cases, CBNG discharged water may be high in selenium. Concentrations of selenium do not limit the use of water for stock watering; however, certain vegetation could become toxic to livestock through the uptake of selenium (BLM 2003a). Overall, the impacts to rangeland resources from these conversions would be minor in extent. In terms of rangeland resources, this impact can be considered adverse in that the increased flows would replace upland forage in drainage bottoms with less-palatable riparian species.

These indirect impacts to rangeland resources would affect allotments in proportion to their relative size and location, but are overall expected to result in minor adverse impacts to rangeland resources.

Other Resources Management

Soil Resources

Under this alternative, surface-disturbing activities may be restricted or excluded on slopes greater than 25 percent, badlands, rock outcrop, slopes susceptible to mass failure, and erosive soils. There would be no exceptions to this restriction. This would result in indirect minor beneficial impacts to rangeland resources that occur in these areas because erosion would be minimized on approximately 33,694 acres. However, the restriction of CBNG development to slopes less than 25 percent results in concentrating development in areas preferred by livestock and in impacts to the best forage types. With CBNG infrastructure and livestock both avoiding the steep slopes, the remaining narrow drainage bottom would be affected most. Additionally, this restriction results in more development where slopes are gentler, disproportionately affecting those allotments. Because most of the FCPA allotments contain both gentle and steep slopes, some portions of all of the allotments are affected to some degree. This alternative results in minor adverse impacts to rangeland resources.

Vegetation Resources

Vegetation resources management under Alternative II would result in beneficial impacts to vegetation as well as rangeland resources because a number of management actions specifically address controlling existing noxious weed populations and limiting the spread of noxious weeds. Management actions under Alternative II are expected to result in minor beneficial impacts.

Special Designations

Special designations often indirectly benefit vegetation as a result of limiting surface-disturbing activities in this area. Under Alternative II, the WSA (approximately 12,419 acres) would continue to be managed to maintain wilderness characteristics. Some grazing allotments coincide with the WSA. In these areas, continued restrictions on the construction of permanent structures and facilities, and/or on surface-disturbing activities may continue to result in beneficial impacts because forage may not be disturbed in these areas. However, livestock operators often find it easier and more effective to manage their livestock through the construction of such facilities. Because this is a continuing situation, no impacts to rangeland resources are expected from this action.

Under Alternative II, an ACEC would be designated for the Citizen's proposed boundaries (approximately 33,757 acres). A WHMA for elk crucial ranges (approximately 52,069 acres)

would also be designated. It is expected these actions would result in minor beneficial impacts to vegetation as well as rangeland resources because management prescriptions for these areas would be designed to protect the Fortification Creek elk herd and would include restrictions on surface disturbance.

Alternative III – Proposed Action

Rangeland Resources Management

Like the other alternatives, the Proposed Action would continue the current management goals and objectives summarized above. Most of the specific management actions are common to all alternatives, including continuation of livestock grazing; fencing to maintain wildlife mobility; water projects being allowed in dry areas and for the purposes of dispersing livestock; and stock tanks with escape ramps for wildlife and birds.

Under the Proposed Action, performance-based development would be implemented. This could be expected to result in better revegetation than Alternative I, contributing to minor beneficial impacts to rangeland resources in these areas.

Rangeland health assessments have not been completed on all of the 17 allotments in the FCPA. However, the allotments that have been assessed met the Standards for Healthy Public Rangelands (BLM 1995a). Continuing current management for these resources is, therefore, expected to have negligible impacts.

Wildlife and Special Status Species Resources Management

Current management actions for wildlife resources under the Proposed Action include restrictions and limitations for wildlife values. Such actions indirectly benefit rangeland resources to some degree, because they result in limitations to vegetation disturbance as well as limitations on other activities that may adversely impact livestock. However, these restrictions are not permanent. Existing wildlife resources management, including specific elk management actions, would not have any measurable impact on rangeland resources.

Performance standards for interim reclamation areas would be expected to result in more complete revegetation, contributing to minor beneficial impacts to rangeland resources. Also under the Proposed Action, the requirement for summer water sources to be provided with CBNG projects may result in minor beneficial impacts to rangeland resources because livestock as well as elk would use these water sources.

Fluid Minerals Management

The Proposed Action would incorporate a performance-based development approach. Additionally, CBNG development will generally follow the three geographic phases of Alternative II but deviations may be granted if performance standards are met. Operators would supply comprehensive annual development plans detailing which areas are to be developed each year within each geographic area.

Continuing current management actions for CBNG development under the Proposed Action include restrictions and limitations for wildlife values, slopes greater than 25 percent, and erosive soils. No surface disturbance would be allowed in areas with badlands, rock outcrop, and slopes susceptible to mass failure. Development of CBNG under the Proposed Action would maintain 80 percent of elk security habitat of baseline conditions during each development phase. These conditions and restrictions are reflected in the estimated surface disturbance.

The Proposed Action would result in less surface disturbance than Alternatives I and II. An estimated 2,092 acres of vegetation disturbance (2 percent of the total area; see Table 4-13) would result for rangeland resources. All vegetation types would experience less than 1 percent surface disturbance. This would affect allotments in proportion to their relative size and location. Allotments near the edge of the FCPA would be expected to be disproportionately affected by CBNG facility location because areas with slopes less than 25 percent will have most of the development. However, because most of the FCPA allotments contain both gentle and steep slopes, some portions of all the allotments would be affected to some degree.

Under Alternative III, the Proposed Action, the location of CBNG reservoirs and facilities would be performance based. Direct impacts would result in minor adverse impacts to rangeland resources through loss of forage. CBNG construction activities can temporarily require the removal of allotment fencing, although all fencing is required to be repaired upon construction completion. Livestock may also be curious about CBNG structures or use structures for scratching posts or shade.

There would be less drawdown than under Alternative I. Current stock wells may go dry due to drawdown, but would be replaced where well agreements are in place. CBNG operators would provide summer water sources. CBNG discharged water will increase the availability of surface water in the FCPA attracting elk and livestock. Available water in an otherwise dry landscape tends to attract livestock and encourage them to spend more time grazing in these areas, which may lead to more concentrated livestock grazing in CBNG areas (BLM 2003a). In some cases, CBNG discharged water may be high in selenium. Concentrations of selenium do not limit the use of water for stock watering; however, certain vegetation could become toxic to livestock through the uptake of selenium (BLM 2003a). These indirect impacts to rangeland resources would affect allotments in proportion to their relative size and are expected to result in minor adverse impacts to rangeland resources.

Seepage from impoundments could result in conversion of upland vegetation to wetland vegetation. In terms of rangeland resources, this impact can be considered adverse because such conversions would replace upland forage with less-palatable species.

These indirect impacts to rangeland resources would affect allotments in proportion to their relative size and location, but are overall expected to result in minor adverse impacts to rangeland resources.

Other Resources Management

Soil Resources

Under this alternative, surface-disturbing activities may be restricted or excluded on slopes greater than 25 percent, badlands, rock outcrop, slopes susceptible to mass failure, and erosive soils. There could be exceptions to this restriction if the operator proposed an acceptable disturbance and reclamation plan. This would result in indirect minor beneficial impacts to rangeland resources that occur in these areas because erosion would be minimized on approximately 33,694 acres. However, the restriction of CBNG development to slopes less than 25 percent results in concentrating development in areas preferred by livestock and impacts the best forage types. With CBNG infrastructure and livestock both avoiding the steep slopes the remaining narrow drainage bottom areas are the most impacted. Additionally, this restriction results in more development on the gentler slopes, disproportionately affecting those allotments.

Because most of the FCPA allotments contain both gentle and steep slopes, some portions of all allotments are affected to some degree. This alternative results in minor adverse impacts to rangeland resources.

Vegetation Resources

Vegetation resources management under the Proposed Action would result in beneficial impacts to vegetation as well as rangeland resources because a number of management actions specifically address controlling existing noxious weed populations. Management actions under the Proposed Action are expected to result in minor beneficial impacts.

Special Designations

Special designations often indirectly benefit vegetation as a result of limiting surface-disturbing activities in this area. Under the Proposed Action, the WSA (approximately 12,419 acres) would continue to be managed to maintain wilderness characteristics. Some grazing allotments coincide with the WSA. In these areas, continued restrictions on the construction of permanent structures and facilities, and/or on surface-disturbing activities may continue to result in beneficial impacts because forage may not be disturbed in these areas. However, livestock operators often find it easier and more effective to manage their livestock through the construction of such facilities. Because this is a continuing situation, no impacts to rangeland resources are expected from this action.

Under the Proposed Action, neither an ACEC nor a WHMA would be designated. It is expected these actions would result in negligible beneficial impacts to vegetation and rangeland resources because the resource values would be protected by performance-based standards.

Summary

Table 4-26 summarizes estimated impacts to rangeland resources, by alternative.

Table 4-26 Summary of Impacts to Rangeland Resources

Land Use or Management Action	Alternative I (No Action)	Alternative II	Alternative III (Proposed Action)
Rangeland Resources Management	No Impact	Minor (+) Grazing deferment	Minor (+) Reclamation standards
Wildlife and Special Status Species Resources Management	No Impact	Minor (+) Grazing deferment summer water sources	Minor (+) Reclamation standards and summer water sources
Fluid Minerals Management	Minor (-) 3,536-acre disturbance Water impoundments dispersed	Minor (-) 2,249-acre disturbance Water impoundments outside crucial winter and parturition ranges	Minor (-) 2,092-acre disturbance Water impoundments based on performance-based standards
Other Resource Management			
Soil Resources	Minor (-)	Minor (-)	Minor (-)

Table 4-26 Summary of Impacts to Rangeland Resources			
Land Use or Management Action	**Alternative I (No Action)**	**Alternative II**	**Alternative III (Proposed Action)**
	Loss of preferred forage	Loss of preferred forage	Loss of preferred forage
Vegetation Resources	Minor (+) Reduction in noxious weeds	Minor (+) Reduction in noxious weeds	Minor (+) Reduction in noxious weeds
Special Designations	No Impact	Minor (+) ACEC and WHMA	Negligible (+) Values protected by performance-based standards

4.4.1.3. Cumulative Impacts

Cumulative impacts to rangeland resources were evaluated for the entire PRB, including the FCPA, in the PRB O&G FEIS (BLM 2003a). Potential cumulative impacts to rangeland resources from CBNG development around the FCPA include increased surface disturbances that introduce non-palatable vegetation or weed species. Reclamation on private lands is negotiated between the landowner and CBNG operator and may be less stringent in terms of plant species composition, cover, and/or structure. Failure to perform adequate reclamation may result in impacts to rangeland in the FCPA because a seed source for noxious weed infestations could be created. Increased weeds and non-palatable vegetation would reduce the grazing capacity of the rangelands.

4.4.2. Recreation

The goals for recreation in the FCPA are to provide outdoor recreational opportunities while providing for resource protection, visitor services, and the health and safety of public land visitors. The primary recreation activity in the FCPA is big game hunting.

Public recreational use in the FCPA is limited by access to BLM lands. Because the areas inside the FCPA generally most desired by recreationists (WSA and proposed ACEC) are surrounded by private land, hunters and other recreationists must be granted permission to cross private land before they can access most of the recreation resources in the FCPA. The major recreational use in the FCPA is deer and elk hunting, even though the area is suitable for many other uses including dispersed camping, small game hunting, horseback riding, and hiking.

Organized group recreation such as guided hunts in the FCPA is managed with Special Recreation Permits (SRPs). The SRP includes requirements that are designed to protect other resources while allowing recreational use. Currently, there are four active SRPs for the FCPA held by big-game hunting outfitters.

The FCPA is a popular hunting destination and a Fortification Creek “any Type 1 elk” is highly sought after. In the 2007 draw, a Fortification Creek elk license ranked as the toughest resident draw statewide, with only a 4.07 percent success rate among resident applicants (Wyoming Public Lands 2008). Even after successfully drawing a license, a hunter must gain permission from the surrounding landowners to access the WSA.

4.4.2.1. Evaluation Criteria

Assumptions used in analyzing recreation impacts include the following:

- Public access to BLM recreation resources in the FCPA;

  Surrounding landowners have legal access,

  Public, with permission from surrounding landowners, has legal access, and

  Illegal access could occur because many of the access points are not physically controlled (e.g., locked gates).
- Hunters generally use motorized vehicles and are required to travel on designated roads;
- Hunting inside the WSA is by foot or on horseback. Access to the WSA is restricted by private landowners surrounding the WSA and hunters must gain permission to cross private land. In recent years, fewer landowners have been granting permission to cross their land for hunting.
- Elk hunting statistics from WGFD represent recreation visitor-days in the FCPA. Deer hunting statistics are not available for the FCPA because the deer hunt unit is much larger than the FCPA. Based on 2008 WGFD data and the area of the associated hunt unit in the FCPA, BLM estimated that there are about 202 recreation visitor-days annually in the FCPA as shown in Table 4-27.

Table 4-27 Estimated Number of Recreation Use Days in the FCPA

Permit	Hunter Days 2008
Elk Hunt Unit #2	
Resident	177
Nonresident	25
TOTAL	**202**

- The PRB O&G FEIS (BLM 2003a) anticipates that most recreational activities will increase by 5 percent every five years. In FCPA hunt units, between 2001 and 2006, total hunt-days dropped in half for Elk Hunt Unit #2. The elk hunter days have decreased primarily because of access difficulty.
- A recent survey of deer hunters in Wyoming found that, “Hunters more commonly look for social and naturalistic things in a quality hunt (an outdoor experience, an opportunity to spend time with family/companions, recreation, and solitude) than for utilitarian things (harvest success and large-antlered bucks)” (WGFD 2006b).
- Access to local hunting areas is also important. The deer hunter survey found that the leading reason for selecting a hunting area among Wyoming residents is that the area is close to home (WGFD 2006b).

Based on these findings, changes to hunting areas, particularly surface disturbance, are assumed to decrease the quality of a hunting experience. Some of the potential impacts of CBNG development on recreation in the FCPA are based on findings from the PRB O&G FEIS (BLM 2003a), and include:

- The primary effect of the CBNG development on recreational opportunities would be the alteration of the experience on lands used for hunting. Direct effects occur when recreational opportunities are enhanced, limited, or curtailed within an area; when recreational uses are created, displaced, or eliminated by proposed CBNG facilities; or if objectives for recreation cannot be met. Effects on recreational resources occur if recreational facilities undergo substantial change or degradation.
- Direct effects to recreational uses would occur because additional wells would add new industrial features to the landscape and new sources of noise that could diminish the recreational experience and affect the rural ambience sought by recreationists. Construction and operation of the CBNG facilities also could affect recreation by changing access opportunities and by directly disrupting recreational activities. New roads would provide access for vehicles and promote an increase in human activity. Additional development could adversely affect hunting, viewing of wildlife, and fishing. Development of certain facilities, such as reservoirs for impounding produced water, could enhance some wildlife-related recreational opportunities by providing areas for viewing wildlife and hunting waterfowl.
- Indirect effects to recreation would occur if the CBNG development resulted in a change in the level of visitation to the area or would alter growth in the affected counties, thereby changing the use of existing recreational facilities and uses.
- Construction disturbance could affect the existing landscape character by adding noise and dust. Construction activities could conflict with recreational uses because they would be visually and audibly apparent to the recreational experience. The loss of solitude and the natural experience would affect local users in the particular area of construction. Pipeline installation and other activities along road corridors are likely to inconvenience recreationists who use the roads to gain access to recreation in the area.

Evaluation criteria include the following:

- Actions that improve or protect wildlife habitat have a beneficial impact on recreation because they could increase and diversify game within the FCPA for hunting or viewing.
- Surface disturbance is to be used as proxy for changes in recreation use and quality of experience. Actions with the least total amount of surface disturbance have the lowest level of adverse impact on recreation.
- Road density is also used as a proxy for changes in recreation use and quality of experience. Actions with the lowest road density have the lowest level of adverse impact to recreation. Current CBNG disturbance is estimated in Table 4-28.

Table 4-28 Estimated Total Surface Disturbance from CBNG Development			
	Alternative I	**Alternative II**	**Alternative III**
Initial disturbance (acres)	3,536	2,249	2,092
Long term (acres)	1,141	709	635

The following definitions will be used for recreation impacts:

- *Negligible* – Total amount of initial and long-term disturbance is changed by less than 5 percent of existing disturbance and road density is unchanged.
- *Minor* – Total amount of initial and long-term disturbance is changed by more than 5 percent and less than 10 percent from existing disturbance and road density.
- *Moderate* – Total amount of initial and long-term disturbance is changed by more than 10 percent and less than 25 percent from existing disturbance and road density.
- *Major* – Total amount of initial and long-term disturbance is changed by more than 25 percent from existing disturbance and road density.

4.4.2.2. Alternative Assessment

Recreation impacts may differ in extent and severity, depending on specific management actions proposed under each alternative for different resource uses. The following sections describe the impacts under each alternative resulting from the recreation management as well as those anticipated to result from the management actions proposed for wildlife and special status species and fluid minerals.

Alternative I (No Action Alternative)

Recreation Management

Alternative I, the No Action Alternative, would continue current management goals and objectives. Proposed management actions require SRPs for commercial competitive and large-scale nonprofit organized recreational events on a case-by-case basis. Recreation in the WSA would be limited by access and permission required to cross private land surrounding this part of the FCPA. There would be no impact from these management actions.

Wildlife and Special Status Species Resources Management

Wildlife resources management goals and objectives include specific elk management actions designed to promote and protect elk habitat and the Fortification Creek elk herd. Because wildlife management actions are also fluid minerals management actions, the impacts of these actions are discussed under Fluid Minerals Management and will not be addressed here.

Fluid Minerals Management

The BLM goal for CBNG management is to facilitate the extraction of CBNG and minimize the effects to the landscape that would impact the resource values in the FCPA. Associated objectives are to identify stipulations, BMPs, and COAs for exploration, development,

production, and reclamation to ensure that activities would not impact resource values in the FCPA. Current wildlife management actions under Alternative I include restrictions and limitations such as TLs in elk crucial winter range between November 15 and April 30 and elk parturition range from May 1 through June 30. While the TLs have potential to limit the timing of CBNG development, they do not restrict the extent of development. Under Alternative I, there are no restrictions on well metering and visitation, water management facility locations, or elk security habitat. Estimated surface disturbance under Alternative I would almost double. Therefore, the CBNG management actions under Alternative I would have minor adverse impacts on recreation.

Alternative II

Recreation Management

Alternative II would continue current management goals and objectives. Proposed management actions require SRPs for commercial, competitive, and large-scale nonprofit organized recreational events on a case-by-case basis. Recreation in the WSA and proposed ACEC would be limited by access and permission required to cross private land surrounding these parts of the FCPA. There are no impacts from this alternative.

Wildlife and Special Status Species Resources Management

Wildlife resources management goals and objectives include specific elk management actions designed to promote and protect elk habitat and the Fortification Creek elk herd. Because wildlife management actions are also fluid minerals management actions, the impacts of these actions are discussed under Fluid Minerals Management and will not be addressed here.

Fluid Minerals Management

Management actions specific to Alternative II include a phased approach to CBNG development that may include grazing deferment after interim reclamation before development can occur in other areas. Management actions for wildlife resources under Alternative II include restrictions and limitations such as TLs prohibiting surface disturbance and disruptive activity in elk crucial ranges. While the TLs have the potential to limit the timing of CBNG development, they do not restrict the extent of development. Well metering and all POD monitoring and maintenance activities would be allowed based on an acceptable work activity. Water management facilities would be located outside the elk crucial winter and parturition ranges. Summer water sources would be provided by CBNG projects. There would be a 25 percent decrease in elk security areas in non-overlapping crucial winter and parturition ranges and a 50 percent decrease in habitat in the elk yearlong range outside of the crucial ranges. Estimated surface disturbance for Alternative II is 2,249 acres. Therefore, CBNG management actions under Alternative II would have minor adverse impacts to recreation.

Alternative III – Proposed Action

Recreation Resources

Alternative III, the Proposed Action would continue current management goals and objectives. Proposed management actions require SRPs for commercial, competitive, and large-scale nonprofit organized recreational events on a case-by-case basis. Recreation in the WSA and proposed ACEC would be limited by access and permission required to cross private land surrounding these parts of the FCPA. There are no impacts from this alternative.

Wildlife and Special Status Species Resources Management

Wildlife resources management goals and objectives include specific elk management actions designed to promote and protect elk habitat and the Fortification Creek elk herd. Because wildlife management actions are also fluid minerals management actions, the impacts of these actions are discussed under Fluid Minerals Management and will not be addressed here.

Fluid Minerals Management

Management actions specific to the Proposed Action include a phased approach to CBNG development that includes interim reclamation before development can occur in other areas. Well metering and POD visitations and the location of ancillary and water treatment facilities for CBNG development would be based on performance. There would be surface disturbing TLs in elk crucial ranges. While these restrictions have potential to limit the timing of CBNG development, they do not restrict the extent of development. Summer water sources would be provided by CBNG projects. There would be up to a 20 percent change in elk security areas. Estimated surface disturbance under the Proposed Action would be approximately 2,092 acres. Therefore, the CBNG management actions under the Proposed Action would have minor adverse impacts on recreation.

Summary

The summary of impacts to recreation resources is shown in Table 4-29.

Table 4-29 Summary of Impacts to Recreation Resources

Land Use or Management Action	Alternative I (No Action)	Alternative II	Alternative III (Proposed Action)
Recreation Management	No Impact	No Impact	No Impact
Wildlife and Special Status Species Resources Management	See Fluid Minerals Management		
Fluid Minerals Management	Minor (-) 3,536-acres of disturbance	Minor (-) 2,249-acres of disturbance	Minor (-) 2,092-acres of disturbance

4.4.2.3. Cumulative Impacts

Cumulative impacts to recreation resources were evaluated for the entire PRB, including the FCPA, in the PRB O&G FEIS (BLM 2003a). Increased CBNG development outside the FCPA and development on non-Federal mineral estate within the FCPA would create more roads and potentially increase access to the FCPA that could expand access for hunters and the general public. There are currently 299 miles of road in the FCPA on non-BLM surface, which provides access to interior portions of the FCPA. Increased development results in impacts to visual resources, the isolated nature of the area, and the elk herd. Taken together, these impacts reduce the recreational value of the FCPA.

4.4.3. Transportation

The primary goal for transportation infrastructure in the FCPA is to manage access to CBNG leases to ensure that the BLM non-impairment standard is met. The management actions related to this goal include:

- Long-term occupancy of the public lands for roads, power lines, pipelines, communication sites, and irrigation ditches is authorized by granting a ROW. ROWs are to be removed and reclaimed upon termination of the grant.
- Transmission lines and transportation facilities will be located within identified corridor areas to the extent feasible.

These management actions are common to all alternatives. The following alternative analysis considers adverse and beneficial impacts, direct and indirect impacts, as well as short- and long-term impacts to transportation infrastructure inside the FCPA and to traffic patterns and density on the roads and highways inside and surrounding the FCPA.

4.4.3.1. Evaluation Criteria

The existing roads inside and surrounding the FCPA are shown on Figure 3-12. Two county roads, Echeta Road (Campbell County Road 29) and Fortification Creek Road (Campbell County Road 36) provide the primary access to the FCPA. The rest of the roads in the FCPA are BLM or private roads providing access for ranching and CBNG development. The existing road network in the FCPA totals about 299 miles and is detailed in Table 4-30. Historic roads inside the WSA are not used or maintained and have returned to a natural state.

Table 4-30 Existing Transportation Network in Fortification Creek Planning Area

Area	Miles of Road
Fortification Creek Planning Area	299
Elk Crucial Ranges	64

Transportation impacts are managed by BLM through ROWs. BLM has granted about 60 ROWs through the FCPA, including:

- 17 road ROWs;
- 8 power line ROWs;
- 35 oil and gas pipeline ROWs; and
- 1 railroad ROW along the eastern boundary of the FCPA.

As part of ROW authorization, impacts specific to the proposed route are evaluated and mitigation measures recommended. Roads, power lines, and pipelines associated with fluid mineral development are generally authorized as part of the POD for the unit or project.

The estimated number of new wells, well pads, roads, overhead power lines, and pipelines associated with each alternative are shown in Table 4-31.

Table 4-31 Projected New Wells, Roads, and Overhead Power Lines Fortification Creek Planning Area			
	Alternative I	**Alternative II**	**Alternative III**
Number of Wells	726	487	483
Miles of New Roads			
Improved	125	71	54
Two-track	54	30	23
Total Miles	179	101	77
Disturbance from Roads			
Initial (acres)	1,038	587	447
Long term (acres)	519	294	223
Disturbance from Overhead Electric			
Miles	9.3	2.5	1.6
Initial acres	33	9	6
Long term acres	5	1	1
Disturbance from Pipelines			
Miles	384	259	255
Initial (acres)	1,539	1,032	1,024
Long term (acres)	0	0	0

Assumptions used in analyzing transportation impacts include the following:

- All new roads in the FCPA will be constructed to the non-impairment standard from BLM Handbook H-8550-1, Interim Management Policy and Guidelines for Lands Under Wilderness Review (BLM 1995b).
- Public access to BLM routes in FCPA is based on the following assumptions:

  Surrounding landowners have legal access,

  Public with permission from surrounding landowners has legal access, and

  Illegal access could occur because many of the access points are not physically controlled (e.g., locked gates).
- Routes are not designated – use is limited to existing routes.

- The major uses of BLM routes in the FCPA are related to oil and gas development, livestock management, and elk hunting.

Transportation impacts were assessed for all the alternatives in term of short-term increases in daily traffic that were based on the daily travel of the average number of estimated workers for the peak activity year for all CBNG field activities. Because travel statistics are not available for the FCPA or the surrounding highways, current traffic conditions were estimated from existing CBNG activities.

Annual peak number of workers for CBNG activities was estimated using employment requirements developed for the PRB O&G FEIS (BLM 2003a). Each worker was assumed to make one round-trip per day. All visitation would occur during daylight hours. There would be three well visits per week for the initial six months, two well visits per month after the initial six months of production and continuing for 4.5 years, and three well visits per week for the rest of the well life (five more years, 10 years total).

Equipment needed for construction and installation of the proposed facilities for any of the alternatives would include heavy equipment (mobile drilling rig, bulldozers, graders, track hoes, trenchers, and front-end loaders), and heavy- and light-duty trucks. No new public roadways or new intersections would be built under any of the alternatives. Using these assumptions, the employment estimates from the PRB O&G FEIS (BLM 2003a), and the estimated CBNG development for each alternative, daily vehicle trips for the peak number of workers were calculated and are shown in Table 4-32. By using peak number of workers, the estimates of vehicle trips used in the transportation impact assessment represent a possible maximum impact.

Table 4-32 Estimated Daily Vehicle Trips for Peak Number of Workers (Alternatives are in addition to current conditions)

	Current Conditions	Alternative I	Alternative II	Alternative III
Peak Number of Workers in FCPA	60	104	66	64
Vehicle Trips per Day	80	291	224	220
Difference*		363%	280%	275%

* Current trips plus increase in trips/current trips

Currently, it is estimated that a maximum of 80 vehicle trips per day occur inside the FCPA on existing roads and contribute to local traffic on surrounding county roads. Because there has been little new Federal CBNG development in the FCPA recently, these vehicle trips are associated with well maintenance and operations (rather than drilling). Therefore, it is assumed that these vehicle trips will continue at least 10 years into the future. Daily vehicle trips associated with new CBNG development in the FCPA will be in addition to the existing 80 vehicle trips per day. Current CBNG development in the FCPA is concentrated in the

southeastern quadrant and traffic patterns are likely to change as CBNG development occurs in other parts of the FCPA.

CBNG development has already impacted county road maintenance by increasing traffic. According to the Johnson County Road and Bridge Department, "…traffic counts taken on roads in eastern Johnson County indicate that close to 850 vehicles per day likely travel there. That is about 500 times the traffic the roads were designed for. Needless to say, upkeep is difficult at best" (Johnson County 2008). These roads were not built to handle this volume of traffic, much of which is heavy, industrial traffic.

The following definitions will be used for transportation impacts:

- *Negligible* – Daily vehicle trips on roads inside and surrounding the FCPA change less than 10 percent.
- *Minor* – Daily vehicle trips on roads inside and on surrounding the FCPA change more than 10 percent and less than 25 percent.
- *Moderate* – Daily vehicle trips on roads inside and surrounding the FCPA change more than 25 percent and less than 50 percent.
- *Major* – Daily vehicle trips on roads inside and surrounding the FCPA change by more than 50 percent.

4.4.3.2. Alternative Analysis

Transportation impacts may differ in extent and severity, depending on specific management actions proposed under each alternative for different resource uses. The following sections describe the impacts under each alternative resulting from transportation management as well as those anticipated to result from the management actions proposed for fluid minerals and wildlife and special status species.

Alternative I (No Action Alternative)

Transportation Management

Alternative I, the No Action Alternative, would continue current management goals and objectives. Proposed management actions require ROW authorization for roads, power lines, pipelines, communication sites, and irrigation ditches. It is assumed that the ROW authorization would evaluate impacts specific to the proposed route and include mitigation measures to meet the BLM non-impairment standard (see BLM Handbook H-8550-1). No new public roadways or intersections would be built under this alternative and there would be no impacts.

Wildlife and Special Status Species Resources Management

Current management actions for wildlife resources under Alternative I include restrictions and limitations for wildlife values such as TLs for elk and special status species. These restrictions would limit development and access to some roads and transportation infrastructure such as pipelines and overhead power lines. However, these restrictions are not likely to change the total number of vehicle trips associated with Alternative I, only the seasonal pattern of travel inside the FCPA and the surrounding highway routes used to access the FCPA. There would be no impact from these management actions.

Fluid Minerals Management

The BLM goal for CBNG management is to facilitate the extraction of CBNG and minimize the effects to the landscape that would impact the resource values in the FCPA. Management actions specific to Alternative I include an unrestricted development pace and no restrictions on ancillary and water management facilities. Alternative I has the highest potential for unmitigated traffic growth on county roads and highways surrounding the FCPA serving as collector routes for traffic associated with CBNG development in the FCPA.

Daily vehicle trips are estimated to increase by almost four times (363 percent) as shown in Table 4-32. Therefore, transportation impacts would be major and adverse. It is likely that new roads and transportation infrastructure (pipelines and overhead power lines) would be managed under the POD for the CBNG project rather than ROW authorization. BLM recommends that CBNG operators work with the affected counties to address road maintenance and dust suppression concerns.

Alternative II

Transportation Management

Because the transportation management actions are common to all of the alternatives, Alternative II would continue current management goals and objectives. Proposed management actions require ROW authorization for roads, power lines, pipelines, communication sites, and irrigation ditches. It is assumed that the ROW authorization would evaluate impacts specific to the proposed route and include mitigation measures to meet the BLM non-impairment standard (see BLM Handbook H-8550-1). No new public roadways or intersections would be built under this alternative and there would be no impacts.

Wildlife and Special Status Species Resources Management

Current management actions for wildlife resources under Alternative II include restrictions and limitations for wildlife values such as TLs for elk and special status species and development limitations in elk crucial and yearlong ranges. These restrictions would limit development and access to some roads and transportation infrastructure, such as pipelines and overhead power lines. However, these restrictions are not likely to change the total number of vehicle trips associated with Alternative II, only the seasonal pattern of travel inside the FCPA and the surrounding highway routes used to access the FCPA. There would be no impact to transportation from these management actions.

Fluid Minerals Management

The BLM goal for CBNG management is to facilitate the extraction of CBNG and minimize the effects to the landscape that would affect the resource values in the FCPA. Management actions specific to Alternative II include requiring that ancillary and water treatment facilities for CBNG development to be located outside the elk crucial winter and parturition ranges. Daily vehicle trips are estimated to increase by more than two times (280 percent) from present use as shown in Table 4-32. Therefore, transportation impacts would be major and adverse. It is likely that new roads and transportation infrastructure (pipelines and overhead power lines) would be managed under the POD for the CBNG project rather than ROW authorization. BLM recommends that CBNG operators work with the affected counties to address road maintenance and dust suppression concerns. The phased CBNG development approach would give counties and other

local governments more time to prepare and respond to increases and changes to traffic patterns associated with CBNG development.

Alternative III – Proposed Action

Transportation Management

Because the transportation management actions are common to all of the alternatives, Alternative III, the Proposed Action, would continue current management goals and objectives. Proposed management actions require ROW authorization for roads, power lines, pipelines, communication sites, and irrigation ditches. It is assumed that the ROW authorization would evaluate impacts specific to the proposed route and include mitigation measures to meet the BLM non-impairment standard from BLM Handbook H-8550-1. No new public roadways or intersections would be built under this alternative and there would be no impacts.

Wildlife and Special Status Species Resources Management

The Proposed Actions for wildlife resources include restrictions and limitations for wildlife values such as TLs for elk and special status species. These restrictions would limit development and access to some roads and transportation infrastructure, such as pipelines and overhead power lines. However, these restrictions are not likely to change the total number of vehicle trips associated with the Proposed Action, only the seasonal pattern of travel inside the FCPA and the surrounding highway routes used to access the FCPA. There are no impacts from this alternative.

Fluid Minerals Management

The BLM goal for CBNG management is to facilitate the extraction of CBNG and minimize the effects to the landscape that would impact the resource values in the FCPA. Management actions specific to the Proposed Action include a performance-based approach to CBNG development that includes interim reclamation standards before development can occur in other areas. Well metering and POD visitations and the location of ancillary and water treatment facilities for CBNG development would be performance-based.

Daily vehicle trips are estimated to increase by more than two times (275 percent) from present use as shown in Table 4-32. Therefore, transportation impacts would be major and adverse. It is likely that new roads and transportation infrastructure (pipelines and overhead power lines) would be managed under the POD for the CBNG project rather than ROW authorization. BLM recommends that CBNG operators work with the affected counties to address road maintenance and dust suppression concerns. The phased CBNG development approach would give counties and other local governments more time to prepare and respond to increases and changes to traffic patterns associated with CBNG development.

Summary

The summary of impacts to transportation resources is shown in Table 4-33.

Table 4-33 Summary of Impacts to Transportation Resources			
Land Use or Management Action	**Alternative I (No Action)**	**Alternative II**	**Alternative III (Proposed Action)**
Transportation Management	No Impact	No Impact	No Impact
Wildlife and Special Status Species Resources Management	No Impact	No Impact	No Impact
Fluid Minerals Management	Major (-) Vehicle trips increase by 363%	Major (-) Vehicle trips increase by 280%	Major (-) Vehicle trips increase by 275%

4.4.3.3. Cumulative Impacts

Cumulative impacts to transportation resources were evaluated for the entire PRB, including the FCPA, in the PRB O&G FEIS (BLM 2003a). Approximately 17,754 miles of new roads would be needed for CBNG development in the PRB. The increase in roads would expand access to the FCPA, potentially resulting in wildlife disturbance, increased erosion, and destruction of cultural and paleontological resources. Increased traffic on new and existing roads will increase erosion, particulates, and noise potentially affecting air, water, soil, cultural, paleontological, wildlife, and vegetation resources.

The estimated number of roads for new development in the FCPA is between 66 and 179 miles of roadway. This is less than or approximately 1 percent of that required for the entire PRB. The number of vehicle trips per day in the FCPA is expected to rise by 275 to 363 percent in response to CBNG development. Approximately 7,627 vehicle trips throughout the entire PRB as a result of new CBNG roads would be expected. This level of traffic would result in traffic-related accidents and the affected counties experiencing a greater need for road upkeep. The affected counties have already seen an increase in upkeep of about 25 percent.

4.4.4. Lands and Realty

4.4.4.1. Evaluation Criteria

Under all of the alternatives, BLM would continue current management. New ROW grants would be considered for corridors and access roads for CBNG development that is “off lease,” consistent with other aspects of this PRMPA/EA. Access roads that are fully within a lease tract would be permitted as part of the POD. No lands are considered for acquisition or disposal as part of this PRMPA/EA. Any direct impacts to the lands and realty program would be administrative in nature; there would be no direct environmental impacts.

4.4.4.2. Alternative Analysis

Fluid Minerals Management

Given that the State mineral lease on the State land within the WSA expired in November 2008, no mineral exchange is anticipated. It is not known how much CBNG would have been extracted from the leased area. However, the lease was acquired with the full understanding that the tract was difficult to access because of the WSA designation. An assessment of the impacts to fluid minerals management, therefore, would be speculative.

4.4.4.3. Cumulative Impacts

There are no cumulative impacts to lands and realty management.

4.4.5. Fluid Minerals

The goal of fluid mineral management is to facilitate the extraction of CBNG while minimizing effects to the landscape that would adversely impact the resource values in the FCPA. Management actions would be implemented through revised stipulations, COAs, and BMPs for CBNG development. This section presents the environmental consequences on development of these CBNG reserves resulting from implementation of the alternative management actions.

4.4.5.1. Evaluation Criteria

The principal adverse impact to the CBNG fluid minerals resource would be a reduction in recoverable reserves resulting from the imposition of additional costs that make new CBNG development uneconomical or shorten the economic life of existing individual wells or areas.

The ultimate recoverable reserves from wells within the FCPA are shown in Table 4-34.

Table 4-34 Estimated Recoverable CBNG Reserves within the FCPA for Each Alternative

Reserve Scenario	Alternative I	Alternative II	Alternative III
Number of CBNG Wells[1]	726	487	483
High – 0.50 bcf	363	243.5	241.5
Moderate – 0.35 bcf	254.1	170.45	169.05
Low – 0.20 bcf	145.2	97.4	96.6

[1] Includes Federal mineral estate within the FCPA.

4.4.5.2. Alternative Analysis

The following definitions will be used for impacts to fluid mineral resources:

- *Negligible* – The effect on fluid minerals resources is barely detectable. Less than 10 percent of the access to the minerals resources is restricted.
- *Minor* – The effect on fluid minerals resources is slight but detectable; there would be a small change in accessing the resource. This could include restrictions and stipulations that restrict access to more than 10 percent of the resource, or there is a major impact, but on a short-term or highly localized basis.
- *Moderate* – The effect on fluid minerals resources is readily apparent; there would be a measurable change in accessing the resources that could result in a long-term or permanent change to the ability to access the resources. This could include restrictions and stipulations that restrict access to more than 20 percent of the resource.
- *Major* – The effect on fluid minerals resources is large; there would be a highly noticeable, long-term or permanent measurable change in accessing the mineral resource. This could

include restrictions and stipulations that restrict access to more than 30 percent of the resource.

The following sections describe the anticipated impacts to fluid minerals from each alternative for fluid minerals management, wildlife and special status species resources management, and other resources management.

Alternative I (No Action Alternative)

Fluid Minerals Management

Alternative I, the No Action Alternative, would continue current management goals and objectives, including managing multiple-use activities, to preserve fluid mineral rights and access to CBNG. Management actions for Alternative I include an unrestricted development pace, no development restrictions, and no restrictions on ancillary and water management facilities. There would continue to be no CBNG development within the WSA. These management actions would result in no impact to the fluid mineral resource.

Wildlife and Special Status Species Resources Management

Current management actions for CBNG development under Alternative I include restrictions and limitations for certain wildlife values. Those that most directly affect CBNG development within the FCPA include TLs for crucial elk ranges, surface-disturbing restrictions for sharp-tailed grouse leks and nesting areas, and raptor nesting areas.

No surface disturbance or disruptive activities may be implemented within elk crucial winter range between November 15 and April 30 and the elk parturition range from May 1 through June 30. Additionally, there are buffers around raptor nests, sage-grouse leks, and other special status species habitats. These TLs and distance restrictions would result in minor adverse impacts to fluid minerals because they may delay development within a portion of the FCPA and impose minor additional costs on development.

Other Resources Management

Soil Resources

Under this alternative, limited development may be authorized on highly erosive soils and slopes greater than 25 percent under the following conditions:

- Surface disturbance will not be authorized on slopes greater than 35 percent.
- Only linear features (roads, pipelines, electric lines, etc.) will be considered.
- An engineered reclamation plan acceptable to the authorized officer must be submitted with the project proposal.

This management action would have minor beneficial impacts because access to minerals would be maintained.

Water Resources

Discharge of water to drainages would be permitted without downstream monitoring or mitigation. This would be a minor beneficial impact, as it is the lowest cost approach to water resource management.

Alternative II

Fluid Minerals Management

Alternative II would limit the pace of development in the short term through a phased development approach (Figure 4-4). There would be no loss of elk security habitat within the overlapping crucial winter and parturition ranges. In crucial areas, where the two areas do not overlap, only 25 percent habitat loss will be allowed. Habitat loss in the yearlong range outside of crucial ranges would be restricted to 50 percent. These restrictions on impacts to crucial and yearlong ranges would be a major adverse impact on the fluid mineral resource, because approximately 32 percent of the available surface locations for roads and well pads could not be constructed. This would result in the elimination of up to 239 wells and between 48 billion cubic feet (bcf) and 119 bcf of CBNG reserves. The elimination of available reserve would impact both operators and the Federal government by reducing operator revenue and Federal royalties. However, lease purchasers were aware there might be additional restrictions identified by BLM at the APD/POD stage to prevent significant impacts to other resources such as elk. Leases within the crucial and yearlong ranges are shown on Figure 4-7 and listed in Table 4-35. The table and figure also display leases with slopes greater than 25 percent. Lease stipulation and COA language has changed over the years, although the intent has remained the same. Stipulations for each lease are included in Appendix G.

Because the price of CBNG fluctuates, it is not possible to calculate the dollar value of the decrease in revenue and royalties; however, 32 percent reduction in the number of wells would equate to a 32 percent reduction in revenue and royalties. Federal royalties are paid for each well producing from Federally-owned oil and gas mineral estate. After administrative costs are deducted, half of the royalties are retained by the Federal government and half are distributed to the State. Federal royalties are further discussed in Economic Impacts, Section 4.6.1.

Additionally, these actions would collectively greatly reduce operating flexibility and increase costs. Flexibility for siting roads and wells would be limited, drainage from nearby wells could occur in some areas, and costs would increase because development could not be implemented efficiently.

Wildlife and Special Status Species Resources Management

Management actions for CBNG development under Alternative II include additional restrictions and limitations for the elk ranges. No surface disturbance or disruptive activities would be allowed for elk crucial winter range between November 15 and April 30 and elk parturition range from May 1 through June 30. Well metering and POD visitation would require an approved work activity management plan including operations and maintenance and the locations of ancillary facilities would be restricted to areas outside of the elk crucial winter and parturition ranges. These TLs and restrictions would result in minor adverse impacts to fluid minerals because they may delay development within a portion of the FCPA and impose minor additional costs on such development. Other restrictions would result in minor adverse impacts to fluid minerals because they may delay development within a portion of the FCPA and limit the ability of the operator to restore production from wells that require servicing. Exceptions would apply for emergencies.

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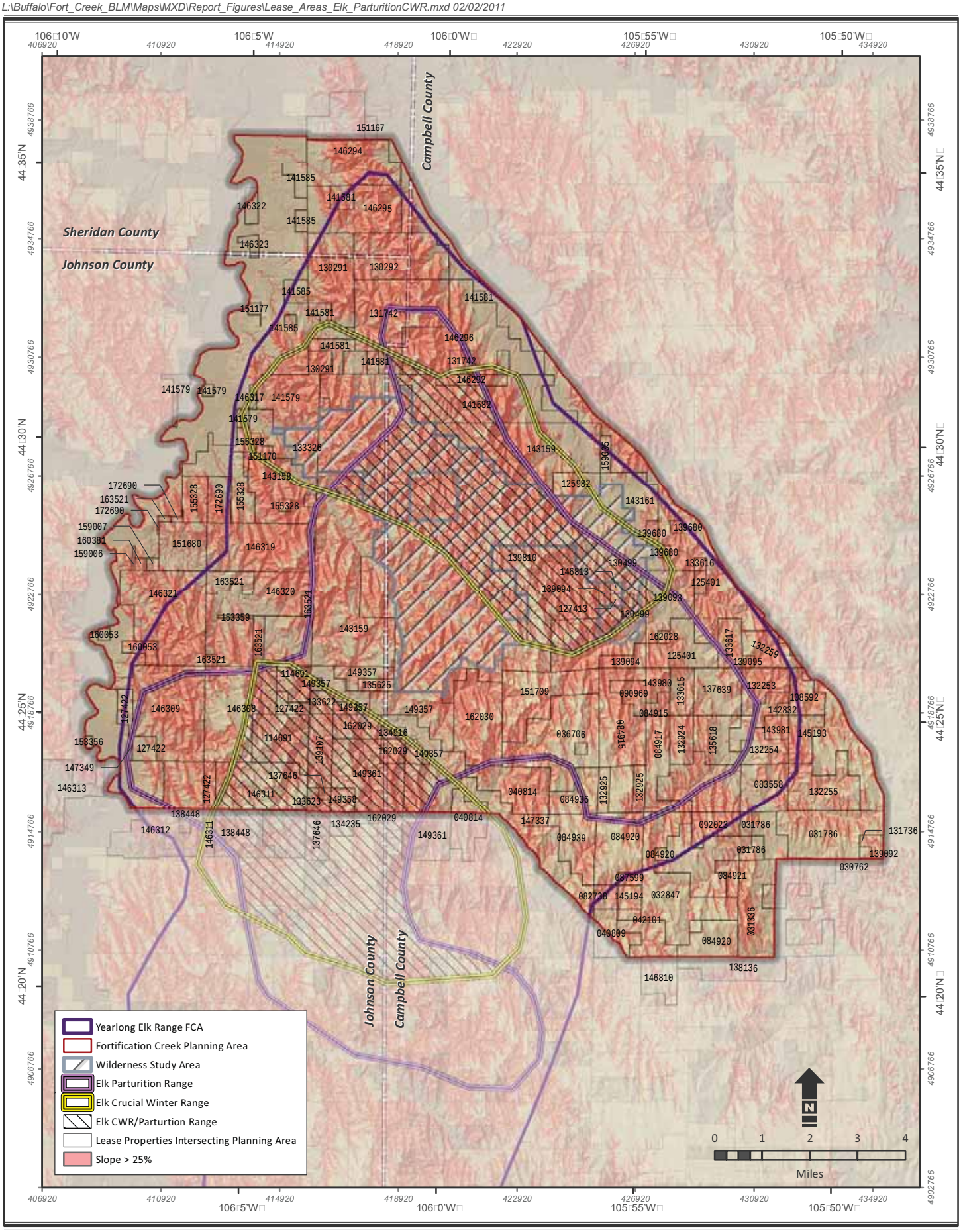

Source:
Boundaries/Lease Properties - Bureau of land Management 2009
Topography - United States Geological Survey 2005

Figure 4-7

Leases, Elk Crucial and Yearlong Ranges and Areas with Slopes Greater than 25 Percent

Campbell, Johnson, and Sheridan Counties, Wyoming

Table 4-35 Leases in Elk Crucial and Yearlong Ranges and in Areas with Slopes Greater than 25 Percent					
Lease	**Yearlong Range**	**Crucial Parturition Range**	**Crucial Winter Range**	**Overlapping Crucial Ranges**	**Slopes Greater than 25%**
030762					X
031336					X
031786	X				X
032847	X	X			X
036706	X	X			X
040809					X
040814	X	X	X		X
042101					X
082738	X				X
083558	X				X
084915	X	X			X
084917	X	X			X
084920	X	X			X
084921					X
084936	X	X			X
084939	X	X			X
087599	X				X
090969	X	X			X
092023	X				X
108592	X				X
114691	X	X	X	X	X
125401	X	X			X
125982	X		X		X
127413	X	X	X	X	X
127422	X	X	X	X	X
130291	X	X			X
130292	X				X
130499	X	X	X	X	X

Table 4-35 Leases in Elk Crucial and Yearlong Ranges and in Areas with Slopes Greater than 25 Percent

Lease	Yearlong Range	Crucial Parturition Range	Crucial Winter Range	Overlapping Crucial Ranges	Slopes Greater than 25%
131736					X
131742	X	X	X		X
132253	X	X			X
132254	X	X			X
132255	X				X
132259	X				X
132924	X	X			X
132925	X	X			X
133326	X	X	X	X	X
133615	X	X			X
133616	X				X
133617	X	X			X
133622	X	X	X	X	X
133623	X	X	X	X	X
134235					X
134916	X	X	X	X	X
135618	X	X			X
135625	X	X			X
137639	X	X			X
137646	X	X	X	X	X
138136					X
138448	X	X			X
139092					X
139093	X	X	X	X	X
139094	X	X	X	X	X
139094	X	X			X
139095	X				X
139107	X	X	X	X	X
139680	X		X		X

Table 4-35 Leases in Elk Crucial and Yearlong Ranges and in Areas with Slopes Greater than 25 Percent

Lease	Yearlong Range	Crucial Parturition Range	Crucial Winter Range	Overlapping Crucial Ranges	Slopes Greater than 25%
139810	X	X	X	X	X
141579	X		X		X
141581	X		X		X
141582	X	X	X	X	X
141585	X				X
142832	X	X	X	X	X
143158	X	X	X		X
143159	X	X	X		X
143161	X		X		X
143980	X	X			X
143981	X				X
145193	X				X
145194	X				X
146292	X	X	X	X	X
146294	X				X
146295	X				X
146296	X	X	X	X	X
146308	X	X	X	X	X
146309	X	X			X
146311	X	X	X	X	X
146312					X
146313					X
146317	X		X		X
146319	X	X			X
146320	X	X			X
146321	X				X
146323					X
146810					X
146813	X	X	X	X	X

Table 4-35 Leases in Elk Crucial and Yearlong Ranges and in Areas with Slopes Greater than 25 Percent					
Lease	**Yearlong Range**	**Crucial Parturition Range**	**Crucial Winter Range**	**Overlapping Crucial Ranges**	**Slopes Greater than 25%**
147337	X	X			X
147349	X	X			X
149357	X	X	X	X	X
149358	X	X	X	X	X
149361	X	X	X	X	X
151170	X		X		X
151680	X				X
151709	X	X			X
151167					X
151177					X
153356					X
153359	X				X
155328	X	X			X
159005	X				x
159006					X
159007					X
160053	X				X
160381					X
162028	X	X			X
162029	X	X	X	X	X
162030	X	X			X
163521	X	X	X	X	X
172690	X				X

Other Resources Management

Soil Resources

Under Alternative II there would be no exceptions to the slope restrictions for soil resources. This stipulation is currently included in many CBNG leases and because the impact was already evident, there are no additional impacts.

Water Resources

Water discharge to ephemeral drainages would be reduced under this alternative. Additionally, water management facilities would be restricted to areas outside the elk crucial winter and parturition ranges. These actions would have a minor adverse impact on CBNG development because of increased cost and reduced flexibility.

Alternative III – Proposed Action

Fluid Minerals Management

Alternative III is the performance-based Proposed Action. Under this alternative, gas development would be implemented geographically with additional development dependent on achieving performance-based goals for elk and reclamation (Appendix B). The operator would be required to submit a disturbance and reclamation plan. The disturbance and reclamation plan would take into account the performance-based standards for reclamation (Appendix B) and the operator would be required to meet these standards.

Metering and well visitation and the location of water management facilities and other ancillary facilities would be required to meet performance-based standards. Minimization of visitation would be a component of the POD because disruptive activities can alter daily or seasonal elk movement patterns and lead to effective habitat loss. The benefit of limited visitation would be that the POD could remain as effective habitat and may remain as security habitat. Maintaining the elk performance objectives for population, survival, production, and range fidelity would retain effective and security habitat.

Operators are encouraged to incorporate strategies for limiting visitation and metering by the following:

- Developing central metering facilities;
- Limiting metering and monitoring visitation to the minimum necessary;
- Coordinating visitation among operators; and
- Using similar vehicles (type, size, and color) for all metering and monitoring visitation, to encourage elk habituation with a familiar vehicle.

The phased development approach provides for gas development in each geographic phase while maintaining elk security habitat. Elk security habitat in each phase is shown on Figure 4-8. Approximate acreage of security habitat in each phase is listed in Table 4-36.

If all performance standards (Elk and Reclamation – Appendix B) are achieved within the current phase and BLM analysis indicates that an exception to the phasing will meet the performance standards, an exception may be granted.

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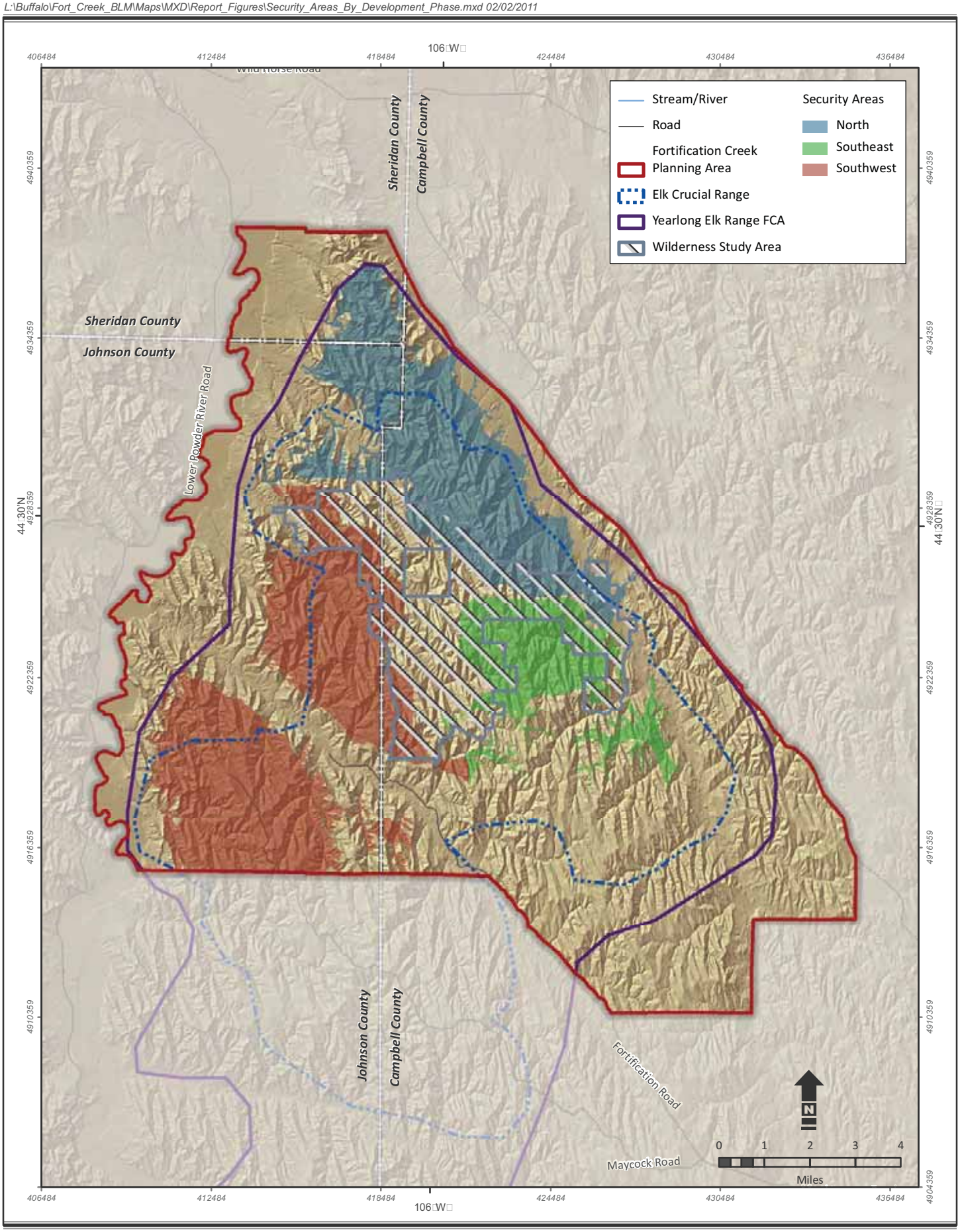

Source:
Topography - United States Geological Survey 2005
Hydrography - National Hydrography Dataset 2003

Figure 4-8

Security Habitat by Geographic Phase

Campbell, Johnson, and Sheridan Counties, Wyoming

Table 4-36 Security Habitat (including off-lease) by Geographic Phase				
	Security Habitat (acres)	**% of Total (acres)**	**80% Retention of Security Habitat (acres)**	**20% Loss of Security Habitat (acres)**
Total Security Habitat				
North	12,225	35	9,780	2,445
Southeast	5,642	16	4,514	1,128
Southwest	167,83	49	13,427	3,357
Total	34,650	100	27,720	6,930
Crucial Range				
North	7,486	28	5,989	1,497
Southeast	5,642	21	4,514	1,128
Southwest	13,462	51	10,770	2,693
Total	26,591	100	21,272	5,318
Yearlong Only				
North	4,739	59	3,791	948
Southeast	0	0	0	0
Southwest	3,321	41	2,657	664
Total	8,060	100	6,448	1,612

Proposed Phase I development in the FCPA is shown on Figure 4-9. To date, only the first three years of development have been proposed. This development includes developing BLM's southeastern phase along with and exception for limited development in the northern phase during year one. BLM anticipates that once this PRMPA/EA and associated Finding of No Significant Impact (FONSI) are approved, the CBNG companies will evaluate their development options and propose additional PODs.

Eighty percent of elk security habitat of the baseline would be retained. This would result in a major adverse impact to the fluid mineral resource, because without managing disruptive activities (i.e., metering and well visitation) approximately 33 percent of the available surface locations for wells could not be constructed. This may result in the elimination of up to 243 wells and between 49 bcf and 121 bcf of CBNG reserves. The elimination of available reserves would impact both operators and the Federal government by reducing operator revenue and Federal royalties. Refer to Figure 4-7 and Table 4-35 for leases within elk crucial and yearlong ranges. Because the price of CBNG fluctuates, it is not possible to calculate the dollar value of the decrease in revenue and royalties; however, a 33 percent reduction in the number of wells would

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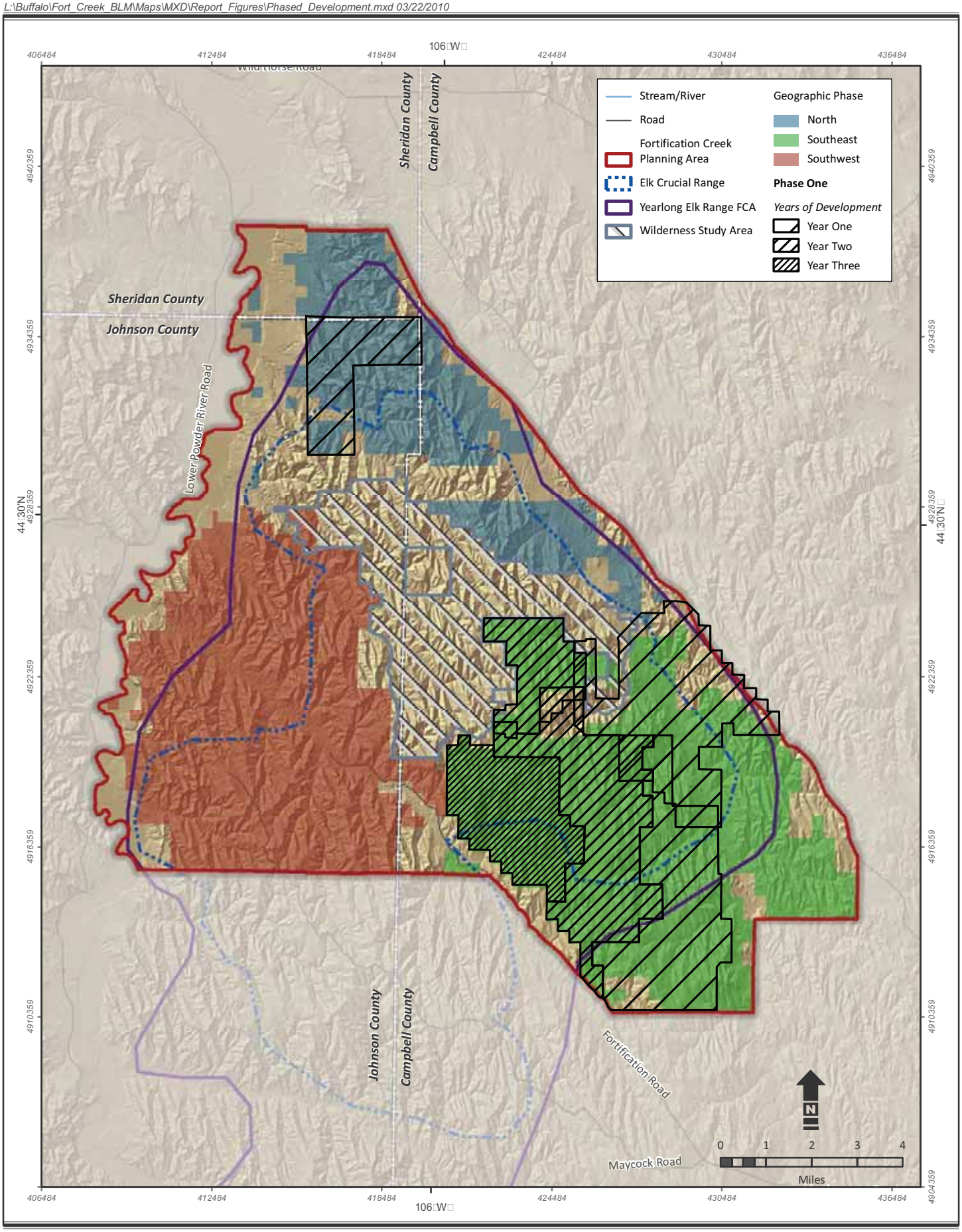

Source:
Topography - United States Geological Survey 2005
Hydrography - National Hydrography Dataset 2003

Figure 4-9

Alternative III Proposed Phase One Development

Campbell, Johnson, and Sheridan Counties, Wyoming

equate to a 33 percent reduction in revenue and royalties (see Section 4.6.1). However, lease purchasers were aware that there could be additional restrictions identified by BLM at the APD/POD stage to prevent significant impacts to other resources such as elk.

Additionally, these management actions would collectively reduce operating flexibility and increase costs. Flexibility for siting roads and wells would be limited, drainage from nearby wells could occur in some areas, and costs would increase because development could not be implemented efficiently.

Wildlife and Special Status Species Resources Management

No surface disturbance or disruptive activities would be allowed within the elk crucial winter range from November 15 to April 30 and in elk parturition range from May 1 through June 30. Metering and well visitation and the location of water management facilities and other ancillary facilities would be required to meet performance-based standards. Summer water sources would be provided if current sources are lost as a result of CBNG development. These restrictions would result in minor adverse impacts to fluid minerals because they may delay development within a portion of the FCPA and limit the ability of the operator to restore production from wells that require servicing. Exceptions would apply for emergencies.

Other Resources Management

Soil Resources

Under the Proposed Action, no surface disturbance would be allowed on badlands, rock outcrop, slopes susceptible to mass failure, and slopes greater than 25 percent. There would be exceptions if the operator proposed an acceptable disturbance and reclamation plan. This stipulation is currently included in many CBNG leases, and because the impact was already evident, there are no additional impacts.

Water Resources

The location of water discharge to drainages, permitted by the State of Wyoming, and the location of water management facilities would be required to meet performance-based objectives. These actions would have a minor adverse impact on CBNG development because of increased costs and reduced flexibility.

Summary

The summary of impacts to fluid minerals is shown in Table 4-37.

Table 4-37 Comparison of Impacts to Fluid Minerals

Land Use or Management Action	Alternative I (No Action)	Alternative II	Alternative III (Proposed Action)
Fluid Mineral Resources	No Impact 726 potential new wells	Major (-) 487 potential new wells	Major (-) 483 potential new wells
Wildlife and Special Status Species Resources Management	Minor (-) Elk crucial range TLs,	Minor (-) Elk crucial range TLs,	Minor (-) Elk crucial range TLs,

Table 4-37 Comparison of Impacts to Fluid Minerals			
Land Use or Management Action	**Alternative I (No Action)**	**Alternative II**	**Alternative III (Proposed Action)**
	No visitation restrictions	Visitation restrictions	Visitation based on performance-based standards
Other Resource Management			
Soil Resources	No Impact Stipulations already in leases	No Impact Stipulations already in leases	No Impact Stipulations already in leases
Water Resources	Minor (+) Stream discharge without impact monitoring	Minor (-) Reduced discharge facilities outside crucial ranges	Minor (-) Stream discharge allowed, Facility locations based on performance-based standards

4.4.5.3. Cumulative Impacts

Cumulative impacts to fluid mineral resources were evaluated for the entire PRB, including the FCPA, in the PRB O&G FEIS (BLM 2003a). CBNG development would result in an increase of approximately 39,367 wells over a 10-year period in the PRB. Approximately 483 to 726 new well locations would be constructed in the FCPA. Impacts from CBNG development outside the FCPA may degrade air quality and visibility through emissions from generators associated with a large number of wells. Particulate matter from travel on new unpaved roads needed to support CBNG development will reduce visibility throughout the area. Offsite water sources would be affected from increased erosion and sedimentation while development in the FCPA would affect the downstream reaches of streams and the Powder River. Wildlife in the FCPA would be impacted as a result of increased disturbance from CBNG activities, which could degrade habitats and further reduce available habitat for wildlife. Habitat reduction and increased noise from well development and production would result in wildlife avoiding areas and concentrating in the more protected portions of the FCPA, further stressing wildlife. Scenic values would diminish across the landscape.

4.5 Special Designations

The primary goals for special designations management in the FCPA are: (1) to ensure continued public use and enjoyment of recreational activities while protecting and enhancing natural and cultural values; improve opportunities for high-quality outdoor recreation; and improve visitor services related to safety, information, interpretation, and facility development and maintenance; and (2) allow orderly development of mineral resources while protecting wildlife habitat and watershed areas, and maintaining wilderness values (naturalness, solitude, and primitive and unconfined recreation). The management actions related to these goals include the following:

- The WSA will be managed according the Interim Management Plan (BLM 1995b), to maintain wilderness characteristics.
- Vehicle travel is limited to designated roads and vehicle routes.

Important resources identified by BLM include an isolated elk herd and its habitat; high visual quality; the 12,419-acre Fortification Creek WSA; steep slopes with erosive soils; and cultural, historic, and paleontological values (BLM 2007b).

4.5.1.1. Evaluation Criteria

The following definitions will be used for special designation impacts:

- *Negligible* – The values for designation are changed by less than 1 percent.
- *Minor* – The values for designation are changed by 1 to 10 percent.
- *Moderate* – The values for designation are changed by 10 to 20 percent.
- *Major* – The values for designation are changed by greater than 20 percent.

4.5.1.2. Alternative Analysis

Impacts to special designations are those that affect public use and enjoyment, orderly development of mineral resources, wildlife habitat, watershed areas, and wilderness values. Impacts to special designations may differ in extent and severity, depending on specific management actions proposed under each alternative for different resource uses. The following sections describe the impacts under each alternative resulting from special designation management, as well as those anticipated to result from the management actions proposed for wildlife and special status species and fluid minerals.

Alternative I (No Action Alternative)

Special Designation Management

Alternative I, the No Action Alternative, would continue current management goals and objectives for the WSA. Current management actions for the proposed ACEC would be maintained and no WHMA would be designated in the FCPA.

A relevance and importance evaluation was conducted by BLM (Appendix H; BLM 2002b). The proposed ACEC met the relevance criteria for scenic values and wildlife and the importance criteria for wilderness characteristics, wildlife (isolated elk herd), and minimal impacts from man. However, the proposed ACEC boundaries are already essentially within the elk yearlong and most of the proposed ACEC is within elk crucial ranges. Proposed management prescriptions for the proposed ACEC are the same as current management prescriptions and an ACEC designation would be a name change not a change in management. There would be no impacts from this management action.

Wildlife and Special Status Species Resources Management

Current management actions for wildlife resources under Alternative I include restrictions and limitations for wildlife values. These management actions would not have any impact on special designation management.

Fluid Minerals Management

Current management actions for CBNG development under Alternative I include the potential for approximately 726 wells with associated infrastructure. CBNG development is not allowed in the WSA and all roads associated with CBNG development would be outside of the WSA. Under this alternative, approximately 179 miles of new roads could be constructed.

Because CBNG development would occur all around the WSA, development would result in a number of impacts. There would be a minor adverse impact to special designations because the increase in roads and workers around the WSA could increase illegal motorized travel (off-highway vehicles [OHVs] and trucks) into the WSA with the associated noise and erosion impacts. These impacts would degrade the wilderness character of the WSA.

CBNG development in the area of the proposed ACEC would be higher than in the WSA. The proposed ACEC meets the relevance criteria for scenic value and wildlife and the importance criteria for local significant qualities; has circumstances that make it fragile and unique (isolated elk herd and minimal impacts from man (Appendix G; BLM 2002b); and has been recognized as warranting protection to satisfy national priority concerns (BLM 2003a). Under this alternative, the ACEC would not be designated. Roads and development would be allowed in all portions of the proposed ACEC that are outside of the WSA. With the increase in development and roads, the values for which the ACEC was proposed would be degraded, resulting in minor adverse impacts.

Alternative II

Special Designation Management

Alternative II would continue current management goals and objectives, including managing multiple-use activities to preserve the values of the WSA. Under this alternative, BLM would establish an ACEC within the citizen proposed boundaries (33,757 acres) and identify management prescriptions. Management prescriptions would include no loss of elk security habitat within the overlapping crucial winter and parturition ranges. In crucial areas, where the two areas do not overlap, only 25 percent habitat loss would be allowed. Habitat loss in the yearlong range outside of crucial ranges will be restricted to 50 percent. Well visitation would be allowed with an approved work activity management plan including operations and maintenance. Water management and ancillary facilities would be located outside of elk crucial winter and parturition ranges. The elk crucial ranges (52,069 acres) would be designated a WHMA. These management actions would result in a major beneficial impact to special designations because the area of special designations would increase by more than 20 percent.

Wildlife and Special Status Species Resources Management

Management actions for wildlife resources under Alternative II include restrictions and limitations for wildlife values. These management actions would not have any impact on special designation management.

Fluid Minerals Management

Management actions for CBNG development under Alternative II include the potential for approximately 487 wells with associated infrastructure. Because CBNG development would occur all around the WSA, development would result in a number of impacts. Additionally there would be impacts in the area of the proposed ACEC and WHMA. There would be a minor

adverse impact to special designations because the increase in roads and workers around the WSA could increase illegal motorized travel (OHVs and trucks) into the WSA with the associated noise and erosion impacts. These impacts would degrade the wilderness character of the WSA.

Alternative III – Proposed Action

Special Designation Management

Alternative III, the Proposed Action, would continue current management goals and objectives, including managing multiple-use activities to preserve the values of the WSA. Under this alternative, BLM would not designate an ACEC based on the proposed boundaries (33,757 acres) (Figure 1-2) for the elk herd, erosive soils, and scenic values. The proposed ACEC would not be designated because performance-based standards for elk and reclamation would be sufficient to protect resource values.

Eighty percent of elk security habitat from the baseline would be maintained. The elk parturition and crucial winter ranges (52,069 acres) would not be designated a WHMA. These management actions would result in no impact to special designations because the resource values are protected by performance-based standards.

Wildlife and Special Status Species Resources Management

Management actions for wildlife resources under the Proposed Action include restrictions and limitations for wildlife values. These management actions would not have any impact on special designation management.

Fluid Minerals Management

Management actions for CBNG development under the Proposed Action include the potential for approximately 483 wells with associated infrastructure. Because CBNG development would occur all around the WSA, development would result in a number of impacts. Additionally, there would be impacts in the area of the proposed ACEC and WHMA. There would be a minor adverse impact to special designations because the increase in roads and workers around the WSA could increase illegal motorized travel (OHVs and trucks) into the WSA with the associated noise and erosion impacts. These impacts would degrade the wilderness character of the WSA.

Summary

The summary of impacts to special designations is shown in Table 4-38.

Table 4-38 Summary of Impacts to Special Designation

Land Use or Management Action	Alternative I (No Action)	Alternative II	Alternative III (Proposed Action)
Special Designation Management	No Impact	Major (+) Increase protected areas by 57,855 acres	No Impact
Wildlife and Special Status	No Impact	No Impact	No Impact

Table 4-38 Summary of Impacts to Special Designation			
Land Use or Management Action	**Alternative I (No Action)**	**Alternative II**	**Alternative III (Proposed Action)**
Species Resources Management			
Fluid Minerals Management	Minor (-) 726 new wells	Minor (-) 487 new wells	Minor (-) 483 new wells

4.5.1.3. Cumulative Impacts

There are no cumulative impacts from special designations management.

4.6 Socioeconomics and Environmental Justice

The areas that could experience economic and social impacts from BLM management actions in the FCPA include Campbell, Johnson, and Sheridan counties. These counties comprise the affected area for economic and social impacts. Despite the recent drop in gas prices, BLM assumes that gas prices will rebound in the near future.

The economic impact assessment focuses on changes to employment, income, and government revenues that would be generated by proposed management actions. The resource management actions in the FCPA that are expected to have the most significant economic impacts are fluid minerals. Wildlife, special status species, and special management areas are likely to have smaller economic impacts. Non-market values for elk, sage-grouse, and sagebrush steppe ecosystem existence are also considered in the assessment.

The social impact assessment considers potential changes to social cohesion and quality of life. The estimated rate of change to population and personal income as a result of proposed BLM management actions is used to measure social impacts.

4.6.1. Economic Impacts

4.6.1.1. Evaluation Criteria

The area that could be economically impacted by management actions in the FCPA includes Campbell, Johnson, and Sheridan counties. Population estimates for 2005 through 2020 for these counties and major towns is shown in Table 4-39.

Table 4-39 Population Estimates				
Location	**2005**	**2010**	**2015**	**2020**
Campbell County	37,000	43,100	47,650	52,600
Gillette	22,700	26,100	28,800	31,800
Wright	1,400	1,700	1,850	2,000
Johnson County	7,700	8,800	9,500	10,350

Table 4-39 Population Estimates				
Location	**2005**	**2010**	**2015**	**2020**
Buffalo	4,300	4,900	5,300	5,750
Kaycee	270	310	340	365
Sheridan County	27,200	28,800	29,700	30,700
Sheridan	16,300	17,100	17,700	18,300
Clearmont	117	120	130	130
State of Wyoming	506,500	540,000	559,200	579,100
Source: WY EAD 2006a				

Employment and Income

Changes to employment and income in the affected area would depend on the number of jobs associated with fluid minerals development and increased recreation/tourism in the FCPA as well as the wages for these jobs. Total employment in the affected area and employment in key sectors likely to be affected by FCPA management actions are shown in Table 4-40.

Average annual wages for Campbell County are $47,795. Annual wages for mining sector jobs (which includes oil and gas) are almost six times wages for leisure and hospitality sector jobs as shown in Table 4-39. It should be noted that in Campbell County almost three-quarters of the mining sector jobs are related to coal mining, not oil and gas development. In Johnson County, average annual wages are $45,800 and mining jobs pay almost four times that of tourism jobs. In Sheridan County, average annual wages are $32,400 and mining jobs pay about five times more than tourism jobs.

Table 4-40 Employment and Average Wages in Key Sectors for 2006			
Sector	**Employment**	**% of Total Employment**	**Average Annual Wage**
Campbell County	25,611	100%	$47,795
Mining	7,673	30%	$69,051
Leisure and Hospitality	1,917	7%	$12,511
Agriculture, Forestry, and Hunting	50	0%	$34,883
Johnson County	3,344	100%	$30,336
Mining	279	8%	$45,800
Leisure and Hospitality	474	14%	$12,195
Agriculture, Forestry, and	53	2%	$20,899

Table 4-40 Employment and Average Wages in Key Sectors for 2006			
Sector	**Employment**	**% of Total Employment**	**Average Annual Wage**
Hunting			
Sheridan County	12,847	100%	$32,416
Mining	474	4%	$66,333
Leisure and Hospitality	1,594	12%	$12,954
Agriculture, Forestry, and Hunting	280	2%	$25,641
Source: Headwaters Economics, 2009a,b,c,d			

Because of high mining sector wages, this sector contributes a relatively large share to total county income. For example, in Campbell County in 2006, the mining sector comprised 30 percent of non-farm labor employment and 44 percent of non-farm labor income (Headwaters Economics 2009b). In Johnson County where mining wages are about 1.5 times the average wage, the mining sector comprised six percent of non-farm labor employment and 8 percent of non-farm labor income in 2006 (Headwaters Economics 2009c). Similarly, in Sheridan County, the mining sector comprised 4 percent of non-farm labor employment and 11 percent of non-farm labor income in 2006 (Headwaters Economics 2009d).

In all three counties in 2006, farm income comprised 2 percent or less of total personal income. Therefore, potential impacts to farm income related to FCPA management actions, specifically rangeland management, are not considered because they are unlikely to have a large impact on total personal income in the affected area.

New tourism jobs (leisure and hospitality sector) would be primarily related to elk hunting in the FCPA, the major recreation activity. Because elk hunting is highly seasonal, it does not support year-round employment, although elk hunting provides support for the tourism industry in a key shoulder season between summer and winter. Additionally, elk hunting in the FCPA supports about five local outfitters.

Overall, elk hunting in the FCPA is not expected to have a measurable impact on employment or income in the affected area. Furthermore, it has been found that much of the lodging tax increase in other counties in Wyoming with natural gas development (such as Sublette, Sweetwater, and Carbon counties) was not attributed to typical tourists, but to out-of-state mining workers who occupied blocks of lodging spaces on a regular basis during recent years of energy development. Therefore, the fluid mineral management activities in the FCPA are the only management activities that are anticipated to have measurable employment and income impacts on the affected area.

The number of mining sector jobs associated with fluid mineral development in the FCPA was estimated using assumptions from Table 2-16 of the PRB O&G FEIS (BLM 2003a) for employment requirements and the estimated number of new wells and associated facilities for the proposed management alternatives (see Table 4-1). Estimates for direct and indirect employment for each management alternative are shown in Table 4-41.

Table 4-41 Estimated Employment				
Parameter	**Current Conditions**	**Alternative I**	**Alternative II**	**Alternative III**
Number of new wells	480	726	487	483
Peak number of workers in FCPA	60	91	61	60
New mining sector jobs in affected area	0	100	67	67
Indirect employment (2.4 multiplier)	0	240	161	160
Total employment (Direct + Indirect)	0	340	229	227
% Change to 2006 employment in affected area (41,800)	0	1%	1%	0.5%

Based on the current availability of labor in the affected area (unemployment rates in the three counties are below state and national levels) and that the CBNG development proposed in the FCPA is part of a much larger development plan for the entire PRB, it is assumed that there are no new jobs associated with the proposed development. This is consistent with the assumptions in the PRB O&G FEIS (BLM 2003a), which assumes most workers would be drawn from the surrounding area. In this case, it is assumed that development in the FCPA would retain jobs that may have been eliminated without further mining sector development. These jobs for peak workers conducting well construction, operations, maintenance, and deconstruction would have a duration of about 10 years from 2010 and 2020.

Indirect employment associated with these mining sector jobs is estimated using a multiplier of 2.4 (PRB O&G FEIS; BLM 2003a). This multiplier represents the number of jobs created by purchases and expenditures made by mining sector employees within and outside the affected counties. The impact on total employment from these jobs is relatively small. Because it is difficult to predict where workers will reside, the change to employment is estimated from total employment for 2006 in Campbell, Johnson, and Sheridan counties (almost 42,000 jobs). The effect on total employment from FCPA fluid minerals management actions would amount to less than 1 percent for direct and indirect employment. The mining sector jobs (100) would amount to less than 1 percent of mining sector employment (8,400 jobs), as well.

Government Revenues

The payments related to CBNG development in the FCPA that are most likely to have a measurable economic impact on Campbell, Johnson, and Sheridan counties are Federal mineral royalties, state severance taxes, and county ad valorem or property taxes. Other payments such as sales and use taxes are estimated to impact total sales tax in these counties by less than 1 percent.

Federal royalties are paid for each well producing from Federally-owned oil and gas mineral estate. After administrative costs are deducted, half of the royalties are retained by the Federal

government and half are distributed to the State of Wyoming and used for schools, roads, and other public works. For this analysis, royalties are estimated as a percentage of the total project yield for each well multiplied by the market price for the product. For this analysis, Federal royalties as a result of CBNG activity have been estimated using 12.5 percent of the estimated sales value for each well. In fiscal year 2005, over $850 million in Federal mineral royalties was distributed in Wyoming, almost three times more than what was distributed in fiscal year 2000 (Coal Bed Natural Gas Alliance [CBNGA] 2008). Table 4-42 shows total Federal royalty distributions to towns and cities within each county for fiscal year 2006 (WY EAD 2006b).

Table 4-42 Property Tax Assessed Value and Rates

Location	Federal Mineral Royalty Distribution	State Severance Tax Distribution	Property Tax Revenue
Campbell County	$1,400,000	$1,335,000	$46,700,000
Johnson County	$279,000	$322,000	$31,600,000
Sheridan County	$837,000	$1,133,000	$37,800,000

Source: State Treasurers Report 2005 and CBNGA 2008

State severance taxes in Wyoming are collected on oil, gas, and other minerals produced in the state. Currently, the tax rate for natural gas production is 6 percent. These severance taxes are distributed back to the counties, cities, and towns throughout the state. Table 4-42 shows state severance tax distributions to Campbell, Johnson, and Sheridan counties in 2006.

County ad valorem taxes are dependent on CBNG equipment and property values as well as natural gas sales. This assessed valuation is the foundation for determining property tax revenues each year. In Johnson County, county valuation went from $210 million, in tax year 2005, to $446 million, for the 2006 tax year because of increased CBNG production. Similarly, property tax revenues more than doubled, increasing from $14 million in fiscal year 2005 to almost $32 million in fiscal year 2006. CBNG ad valorem revenue contributed 60 percent of total property tax revenue in Johnson County in 2006 (CBNGA 2008). Table 4-42 shows property tax revenues for fiscal year 2006 for the counties in the affected area.

Table 4-43 outlines estimated natural gas production, sales, and tax from CBNG development in the FCPA. The number of new wells for each alternative is allocated according to FCPA land area inside each county as follows: 58 percent of FCPA in Campbell County, 37 percent in

Johnson County, and 5 percent in Sheridan County. Based on assumptions from the PRB O&G FEIS (BLM 2003a), natural gas production for each new CBNG well is estimated at 400,000 thousand cubic feet (mcf) over a seven-year lifetime, or an average of 57,000 mcf annually. The Energy Information Administration projected that natural gas prices would fall sharply in 2009 from the recent spike in prices that began in 2003 and culminated in 2008. Prices are then expected to begin a gradual and linear rise from $3.99 per tcf (2007 dollars) in 2009 to $8.01 per tcf in 2030 (BLM 2009d).

Table 4-43 Estimated Natural Gas Production, Sales, Tax Revenues			
Location	**Alternative I**	**Alternative II**	**Alternative III**
Campbell County			
New Wells	421	282	280
Total Gas Production (400,000 mcf/well) (million mcf)	168	113	112
Total Gas Sales ($4.00 per mcf) ($ million)	$674	$452	$448
Federal Mineral Royalty Revenue @12.5% ($ million)	$84	$56	$56
State Severance Tax Revenue @6% ($ million)	$40	$27	$27
County Ad Valorem Tax Revenue @7% ($ million)	$47	$32	$31
Annual County Ad Valorem Tax Revenue ($ million)	$7	$5	$4
Johnson County			
New Wells	269	180	179
Total Gas Production (400,000 mcf/well) (million mcf)	107	72	71
Total Gas Sales ($4.00 per mcf) ($ million)	$430	$288	$286
Federal Mineral Royalty Revenue @12.5% ($ million)	$54	$36	$36
State Severance Tax Revenue @6% ($ million)	$26	$17	$17
County Ad Valorem Tax Revenue @7% ($ million)	$30	$20	$20
Annual County Ad Valorem Tax Revenue ($ million)	$4	$3	$3
Sheridan County			
New Wells	36	24	24
Total Gas Production (400,000 mcf/well) (million mcf)	15	10	10
Total Gas Sales ($4.00 per mcf) ($ million)	$58	$39	$39
Federal Mineral Royalty Revenue	$7	$5	$5

Table 4-43 Estimated Natural Gas Production, Sales, Tax Revenues			
Location	**Alternative I**	**Alternative II**	**Alternative III**
@12.5% ($ million)			
State Severance Tax Revenue @6% ($ million)	$3	$2	$2
County Ad Valorem Tax Revenue @7% ($ million)	$4	$3	$3
Annual County Ad Valorem Tax Revenue ($ million)	$0.6	$0.4	$0.4

Comparing estimated annual government revenue to recent county budgets, assuming that half of the Federal mineral royalty, 75 percent of the state severance tax, and all of the county ad valorem tax is sent to the counties, CBNG development in the FCPA is estimated to impact total county revenues by less than 10 percent annually.

As shown in Table 4-43, county property tax revenues amount to much more than severance and Federal royalty tax distributions to the counties. Therefore, the economic impacts to government finances are estimated using changes to property tax revenues. Because county tax revenues are linked to natural gas production, such as in Johnson County where 60 percent of the total property taxes are from CBNG ad valorem taxes, the estimated annual tax revenues from CBNG development in the FCPA will only occur for a relatively short period of seven years. This could lead to some county finance problems, even though total revenues are increasing, the timing of revenues does not coincide with budget requirements. For example, during CBNG well construction, counties would experience increased traffic to access well locations. But the tax revenues that could be used to maintain or improve county roads to handle this increased traffic will not be realized for one or two years after the wells have been completed and begin production.

Non-Market Values Relevant to the FCPA

Stakeholders have revealed that there is more value to the FCPA than what can be measured by market values for natural gas and associated jobs and tax revenues. Federal and public lands are becoming increasingly popular with recreationists, retirees, and businesses all vying to extract benefits from these natural resources. Therefore, this section on non-market values is included to balance the economic assessment.

Some recent findings relevant to the FCPA include the following:

- Living near public lands offers benefits and amenities to the local residents and communities. Understanding what local residents value in a public land is accomplished by measuring the benefits associated with public land use. Two studies by Blevins and Jenkins have attempted to do this. These studies were carried out by University of Wyoming researchers in conjunction with a plan revision for the Bighorn National Forest and the Medicine Bow National Forest. Surveys (Blevins and Jenkins 2004) were used in these studies to obtain an overview of how residents value their national forest. The Social Assessment of the Four-County Area (SAFCA) of the Bighorn National Forest included Big Horn, Johnson, Sheridan, and Washakie counties (Blevins and Jenkins 2002). Respondents were asked to

rank possible U.S. Forest Service (USFS) missions on a scale of one (most important) to nine (least important). Results for Johnson and Sheridan counties showed that residents strongly agreed that providing and protecting sources of water for human use was a priority (most important), as was making sure the forests were available for future use and providing a home for wildlife (University of Wyoming [UWYO] 2007).

- Researchers applied a general bio-economic model for charismatic wildlife that includes the notion of a minimum viable population and hunting and preservation values to determine desirable sizes for sage-grouse populations in Nevada. Using this model, they found that desirable population of sage-grouse depends on: (1) the minimum viable population; (2) the ecosystem carrying capacity for sage-grouse; and, most importantly, (3) the functional form of the marginal non-use benefits function. These are important findings because all three of these factors tend to be quite uncertain. The most sensitive variable was carrying capacity, and the desirable population values were in the range of 50 to 60,000 birds (Van Kooten and Eiswerth 2007).
- A survey of Teton County, Wyoming residents on open space preservation options estimated a mean willingness-to-pay of about $10 for 100 acres of land being kept in public management (Nahuelhual et al. 2004).
- In a recent study of the value of the 42 million acres of roadless lands in the U.S., researchers estimated that these lands could provide almost $600 million in recreation benefits each year, more than $280 million in passive use values, and nearly 24,000 jobs. As for environmental benefits, they estimated these lands annually provide between $490 million and $1 billion in carbon sequestration services and $490 million in waste treatment services. Extrapolating these results to the roadless portion of the FCPA, the passive use value, defined as a combination of keeping the land available for visits in the future (option value), or simply knowing that natural areas exist (existence value) and that their protection today sustains them for future generations (bequest value), was about $7 per acre annually for roadless western lands (Loomis and Richardson 2000).
- A recent analysis estimated the value of ecological function in shrub-steppe dryland habitat similar to the FCPA. The values that these researchers found are summarized in Table 4-44. Soil stabilization function was found to have the highest values. The Fortification Creek area contains one of the few elk herds occupying a prairie environment, which increase the value of the FCPA. Additionally, the prairie breaks/badlands landscape is underrepresented in protected public lands and is also of high value.

Table 4-44 Summary of Selected Values Estimated for Shrub-Steppe Habitat ($/acre/year)

Parameter	Measurement Technique	Annual Value Per Acre ($)
Function		
Soil Stabilization	Contingent Valuation: benefits transfer to reduce PM_{10}	4 to 14
	Cost of Conservation Reserve	47

Table 4-44 Summary of Selected Values Estimated for Shrub-Steppe Habitat ($/acre/year)		
Parameter	**Measurement Technique**	**Annual Value Per Acre ($)**
	Program Land Acquisition Program	
	Cost of Soil Stabilization Program with Farming (analog)	6 to 21
	Expected Cost of Traffic Accidents and Road Closures	15 to 50
	Extra Cleaning and Maintenance	48 to 169
Recreation	Hunting Club Annualized Rental (analog)	75
Species Diversity	Annualized Restoration Costs, adjusted for productivity	52 to 75
Opportunity Costs		
Grazing	Annualized Value of Grazing Land	3.35
Farming	Annualized Value of Farmland (Dry)	12.40
	Annualized Value of Farmland (Irrigated)	74.20
Urban	Annualized Value of Building Sites	460.40

- A relatively recent biological function of the FCPA is carbon sequestration achieved through plant growth and soil function. Recent market prices for carbon emissions reduction for biological carbon sequestration projects are in the range of $5 to $10 per metric ton of carbon dioxide (California Climate Action Registry [CCAR] 2008). The carbon sequestration capacity of the lands in the FCPA would have to be determined before a more precise value ($/acre) could be estimated.

Economic impact valuation criteria include the following:

- *Negligible* – Total employment or total county revenues are changed by less than 10 percent from current levels.
- *Minor* – Total employment or total county revenues are changed by 10 percent to less than 25 percent from current levels.
- *Moderate* – Total employment or total county revenues are changed by 25 percent to less than 50 percent from current levels.
- *Major* – Total employment or total county revenues are changed by 50 percent or more from current levels.

4.6.1.2. Alternative Assessment

Alternative I (No Action Alternative)

Wildlife and Special Status Species Resources Management

Wildlife resources management goals and objectives include specific elk management actions designed to promote and protect elk habitat and the Fortification Creek elk herd. There are no restrictions on well metering and visitation, water management facility locations, or elk security habitat. There would be negligible economic impacts associated with these management actions.

Fluid Minerals Management

The BLM goal for CBNG management is to facilitate the extraction of CBNG and minimize the effects to the landscape that would affect the resource values in the FCPA. Associated objectives are to identify stipulations, BMPs, and COAs for exploration, development, production, and reclamation to ensure that activities would not affect resource values in the FCPA. Under Alternative I, there are no restrictions on well metering and visitation, water management facility locations, or elk security habitat. Estimated total employment in the affected area associated with actions in the FCPA under this alternative would be retention of 340 jobs; amounting to 1 percent of current levels. Annual ad valorem revenues from CBNG development over the seven-year production period would amount to a 15 percent increase from 2006 property tax revenues in Campbell and Johnson counties. In Sheridan County, ad valorem taxes would amount to a less than 10 percent change from 2006 property tax revenues; therefore, economic impacts from fluid minerals management in the FCPA under this alternative would be minor and beneficial.

Alternative II

Wildlife and Special Status Species Resources Management

Wildlife resources management goals and objectives include specific elk management actions designed to promote and protect elk habitat and the Fortification Creek elk herd. There would be negligible economic impacts associated with these management actions.

Fluid Minerals Management

The BLM goal for CBNG management is to facilitate the extraction of CBNG and minimize the effects to the landscape that would affect the resource values in the FCPA. Associated objectives are to identify stipulations, BMPs, and COAs for exploration, development, production, and reclamation to ensure that activities would not affect resource values in the FCPA. Management actions specific to Alternative II include a phased approach to CBNG. Estimated employment under this alternative would be retention of 229 jobs in the affected area amounting to 0.5 percent of current employment. Annual ad valorem revenues from CBNG development over the seven-year production period would amount to an increase of less than 10 percent of 2006 property revenues for Campbell, Johnson, and Sheridan counties. Therefore, economic impacts from fluid minerals management in the FCPA under this alternative would be negligible.

Alternative III – Proposed Action

Wildlife and Special Status Species Resources Management

Wildlife resources management goals and objectives include specific elk management actions designed to promote and protect elk habitat and the Fortification Creek elk herd. There would be negligible economic impacts associated with these management actions.

Fluid Minerals Management

The BLM goals for CBNG management are to facilitate the extraction of CBNG and to minimize the effects to the landscape that would affect the resource values in the FCPA. Associated objectives are to identify stipulations, BMPs, and COAs for exploration, development, production, and reclamation to ensure that activities would not affect resource values in the FCPA. Management actions specific to the Proposed Action include a performance-based approach to CBNG development. Estimated employment under this alternative would be the retention of 227 jobs amounting to 0.5 percent of current employment in the affected area. Annual ad valorem tax revenues from CBNG development over the seven-year production period would amount to an increase of about 10 percent of 2006 property tax revenues for Campbell, Johnson, and Sheridan counties. Therefore, economic impacts from fluid minerals management in the FCPA under this alternative would be negligible.

Summary

The summary of economic impacts is shown in Table 4-45.

Table 4-45 Summary of Economic Impacts

Land Use or Management Action	Alternative I (No Action)	Alternative II	Alternative III (Proposed Action)
Wildlife and Special Status Species Resources Management	Negligible Elk herd protection	Negligible Elk herd protection	Negligible Elk herd protection
Fluid Minerals Management	Minor (+) Supports 340 jobs in surrounding counties. Increase of federal, state, and local revenues of $307 million.	Negligible Supports 229 jobs in surrounding counties. Increase of federal, state, and local revenues of $206 million.	Negligible Supports 227 jobs in surrounding counties. Increase of federal, state, and local revenues of $204 million.

4.6.2. Social Impacts

Social impacts caused by management actions in the FCPA could include:

- Social instability caused by rapid changes to a community such as an influx of temporary workers and their families especially if these workers are a different race or culture than existing society.
- Changes in quality or quantity of social services such as health, education, and infrastructure. Counties and municipal governments use tax revenues to fund these services; however, rapid increase in demand can exceed the capacity of existing facilities and programs.
- Changes from a rural agricultural landscape to a rural industrial landscape.

Most of these impacts can be signs of a vibrant growing society; however, it is the rapid rate of change (boom or bust) that can cause social instability and social impacts. The management actions in the FCPA that are anticipated to have social impacts are fluid minerals management

because of the potentially rapid increase in population, employment, and income associated with CBNG development.

One measure of social stability is the net migration rate. In Wyoming, this is generally measured by the net of surrendered or exchanged drivers' licenses (Wyoming Housing Database Partnership 2008). In a recent housing needs analysis, it was reported that, "Driver's license exchange data indicated the net in-flow of migrants remains strong, increasing from 5,810 in 2006 to 6,002 in 2007. This is an all-time high. These data indicate that those in the age group from 26 to 45 are flocking to the State." The northeastern region of Wyoming (including Campbell, Crook, Johnson, Sheridan, and Weston counties) is experiencing the same pattern as Wyoming overall with a substantive increase in net in-migration between 2004 and 2006, with an annual rate of about 300 in 2004 to 1,400 in 2006 (Wyoming Housing Database Partnership 2008). In addition to the number of migrants moving into the affected area (Campbell, Johnson, and Sheridan counties), these migrants are generally younger than the existing population. In Sheridan County, for example, where there was a net in-migration of 1,320 persons between 2000 and 2007 the median age of county residents was 40.6 and the median age of the migrants was about 35 (Sheridan County 2008). This age difference can create stress in demand for county services with young families moving into the area and demanding more education and youth services, while the existing older population is looking toward retirement and is less willing or able to pay for these services.

A recent survey in Sheridan County highlights some of the reasons why people are moving into the area. In response to one of the survey questions designed to identify what respondents currently like and value about their county, over 80 percent of the respondents identified opportunities for wildlife viewing, solitude, scenic beauty, and air and water quality, as well as the friendliness of the residents as important attributes of the county (Sheridan County 2008). These amenities can be threatened by development, whether it is residential development to provide new housing for the migrants or industrial development such as CBNG development. Social stress can occur when development comes in conflict with "the reasons people live here."

Many of these social stresses can be alleviated if the changes creating the stresses occur slowly or at a steady pace giving local governments and social institutions time to respond. However, Wyoming has been experiencing a population and income boom over the last decade as a result of energy development. Because the Wyoming economy is not well diversified and is highly dependent on energy development, it is vulnerable to a bust when the coal, oil, or gas is depleted or if energy prices drop drastically (WY EAD 2007b). Therefore, the social impact analysis focuses on the rate of change in population and income related to fluid mineral management actions, because these most likely would be the major drivers in creating social stresses in the affected area.

4.6.2.1. Evaluation Criteria

Social impacts are measured in terms of rate of change in population and income in the counties that would be affected by the FCPA management actions including Campbell, Johnson, and Sheridan counties. Table 4-46 shows the average rate of change in population and personal income by decade from 1970 to 2020.

Table 4-46 Average Rate of Change of Population and Personal Income					
Location	**1970-1980**	**1980-1990**	**1990-2000**	**2000-2010**	**2010-2020**
Campbell County Population Personal Income	93% 688%	17% 52%	16% 71%	27% n/a	23% n/a
Johnson County Population Personal Income	20% 225%	-9% 58%	15% 69%	24% n/a	18% n/a
Sheridan County Population Personal Income	40% 300%	6% 62%	11% 37%	8% n/a	7% n/a
State of Wyoming Population Personal Income	42% 326%	-4% 47%	9% 72%	9% n/a	7% n/a
Source: BEA 2000 and WY EAD 2006a					

Rate of change in population and personal income are used as indicators because they measure the rate at which people are entering or leaving a community as well as the change in overall standard of living in the community. If both population and income are increasing rapidly (as they did in Wyoming in 1970s), the resulting boom can be very destabilizing to a small community as demands and costs for housing, health services, and education skyrocket. If the boom is followed by a bust (Wyoming in the 1980s), then the remaining community members are left with empty schools, oversized community facilities, and worthless homes that must be supported by a decreasing tax base. Currently, Sheridan County is experiencing a boom of retirees as noted in the county's comprehensive plan (2008), "The arrival of these newcomers has had significant implications for Sheridan County; housing and land prices have outstripped growth in income and employment."

The changes to population and personal income associated with CBNG development in the FCPA are estimated as follows:

- A population increase would be related to peak workers and their families associated with an alternative. This assumes that regional workers would relocate closer to the FCPA (in Campbell, Johnson, and Sheridan counties) for the duration of the CBNG development in the FCPA. If the total number of peak workers for the alternative was estimated at 100 and assuming 1.5 additional persons per peak worker, then the maximum population increase in the three counties would be 250. This population increase would probably occur in a one-to two-year period and last for at least seven years. With a total population in the counties of approximately 88,000, this increase would be negligible.
- Personal income would increase in proportion to the difference between the wages for new mining jobs and the average wage. Overall, mining jobs pay about 50 percent more than the average wage in the affected counties. However, the number of mining jobs (100) associated with CBNG development in the FCPA is relatively small (total employment [42,000] compared to mining jobs [7,300]). The change to personal income would be negligible.

Social impact evaluation criteria include the following:

- *Negligible* – Rate of change of population or personal income is less than 5 percent from current levels.
- *Minor* – Rate of change of population or personal income is at least 5 percent but less than 10 percent more than current levels.
- *Moderate* – Rate of change of population or personal income at least 10 percent but less than 20 percent more than current levels.
- *Major* – Rate of change of population or personal income is 20 percent or more than current levels.

4.6.2.2. Alternative Assessment

Alternative I (No Action Alternative)

Wildlife and Special Status Species Resources Management

Wildlife resources management goals and objectives include TLs designed to promote and protect crucial elk habitat for the Fortification Creek elk herd. There are no restrictions on well metering and visitation, water management facility locations, or elk security habitat. There would be negligible social impacts associated with these management actions.

Fluid Minerals Management

The BLM goal for CBNG management is to facilitate the extraction of CBNG and minimize the effects to the landscape that would impact the resource values in the FCPA. Associated objectives are to identify stipulations, BMPs, and COAs for exploration, development, production, and reclamation to ensure that activities would not impact resource values in the FCPA. Under Alternative I, there are no restrictions on well metering and visitation, water management facility locations, or elk security habitat. The estimated maximum increase in population would be 250 (in Campbell, Johnson, and Sheridan counties), which would occur over a two- to 10-year period. The rate of change in population and income, and, therefore, the social impacts, would be negligible.

Alternative II

Wildlife and Special Status Species Resources Management

Wildlife resources management goals and objectives include specific elk management actions designed to promote and protect elk habitat and the Fortification Creek elk herd. There would be negligible social impacts associated with these management actions.

Fluid Minerals Management

The BLM goal for CBNG management is to facilitate the extraction of CBNG and minimize the effects to the landscape that would affect the resource values in the FCPA. Associated objectives are to identify stipulations, BMPs, and COAs for exploration, development, production, and reclamation to ensure that activities would not affect resource values in the FCPA. The estimated maximum increase in population is 153 (in Campbell, Johnson, and Sheridan counties), which would occur over a two- to 10-year period. The rate of change in population and income, and therefore, the social impacts, would be negligible.

Alternative III – Proposed Action

Wildlife and Special Status Species Resources Management

Wildlife resources management goals and objectives include specific elk management actions designed to promote and protect elk habitat and the Fortification Creek elk herd. There would be negligible social impacts associated with these management actions.

Fluid Minerals Management

The BLM goal for CBNG management is to facilitate the extraction of CBNG and minimize the effects to the landscape that would impact the resource values in the FCPA. Associated objectives are to identify stipulations, BMPs, and COAs for exploration, development, production, and reclamation to ensure that activities would not impact resource values in the FCPA. The estimated maximum increase in population in the three counties is 150, which would occur over a two- to 10-year period. The rate of change in population and income, and therefore the social impacts, would be negligible.

Summary

The summary of social impacts is shown in Table 4-47.

Table 4-47 Summary of Social Impacts

Land Use or Management Action	Alternative I (No Action)	Alternative II	Alternative III (Proposed Action)
Wildlife and Special Status Species Resources Management	Negligible Elk herd protection	Negligible Elk herd protection	Negligible Elk herd protection
Fluid Minerals Management	Negligible Population increase of 250 and an additional 340 jobs in the surrounding counties	Negligible Population increase of 153 and an additional 229 jobs in the surrounding counties	Negligible Population increase of 150 and an additional 227 jobs in the surrounding counties

4.6.3. Environmental Justice

Executive Order 12898 on Environmental Justice in Minority and Low-Income Populations, issued on February 11, 1994, identifies and addresses, as appropriate, disproportionately high and adverse human health and environmental effects of programs, policies, or activities on minority or low-income populations. Conclusions reached in the PRB O&G FEIS (BLM 2003a) indicated that, "Implementing the Proposed Action would not have significant disproportionate adverse affects on the social, cultural, and economic well being, and health of minorities and low-income groups."

The area that would be affected by environmental justice impacts related to management actions in the FCPA includes Campbell, Johnson, and Sheridan counties. In these counties, potential minority and low-income populations are summarized in Table 4-48. Generally, the affected area has the same racial profile and poverty rate as the rest of Wyoming. The minority and low-

income populations in the affected area would not be disproportionately impacted by management actions in the FCPA. Therefore, there would be no environmental justice impacts.

Table 4-48 Environmental Justice Indicators - 2005

Location	Percentage Population White by Race	Median Household Annual Income	Average Poverty Rate	Average Poverty Rate in Children
Campbell County	96%	$61,000	7%	8%
Johnson County	97%	$42,000	9%	12%
Sheridan County	96%	$41,000	9%	14%
State of Wyoming	92%	$45,500	11%	14%

Source: Headwaters Economics 2007 a, b, c; U.S. Census Bureau 2008

5.0 CONSULTATION AND COORDINATION

This document was prepared in consultation and coordination with interested public individuals and organizations, Federal and State of Wyoming agencies, and local municipal and county governments. Involvement and input from all of these entities is a vital component of the Resource Management Plan Amendment (RMPA) process and Environmental Assessment (EA) preparation.

Public involvement for the Fortification Creek RMPA/EA was conducted in two phases:

- Public scoping; and
- Public review and comment on the Draft RMPA/EA.

A summary of the public scoping process is available in Chapter 1 and is not reproduced here. This chapter summarizes and responds to public comments submitted on the Draft RMPA/EA as well as information on the extended Cooperating Agency consultation process.

5.1 AVAILABILITY OF THE DRAFT RMPA/EA

The BLM released the Draft Fortification Creek RMPA/EA on September 17, 2010. The Draft RMPA/EA was made available for public comment for 60 calendar days. The comment period started on September 17, 2010 and ended on November 19, 2010. Three informational public meetings were held in the vicinity of the FCPA. These informational meetings were announced on the project website and in local papers and were held in the communities of Gillette, Buffalo, and Sheridan, Wyoming October 19, 20, and 21 of 2010, respectively. Major points for the Draft RMPA/EA were presented at these meetings and questions regarding the planning process and the FCPA were answered by BLM representatives.

5.2 Public Comment Collection and Analysis

Only written comments on the Draft RMPA/EA were accepted. No verbal comments were accepted at the informational meetings, although BLM provided attendees the opportunity to clarify their understanding of the planning process and the project area. Attendees were also provided with information on how to submit written comments to the BLM.

The majority of comments were submitted electronically. Hard copy comments that were received by the BLM BFO were converted to an electronic format and entered into the comment database. Comments from the National Resource Defense Council (NRDC) were delivered to BLM in spreadsheet format. Names, addresses, and comments were imported into word processing and PDF formats for entry into the comment database.

A total of 22,571 comment submissions were received by BLM at the close of the extended public comment period on midnight, November 19, 2010. The large majority of these submissions were received via e-mail. Less than 1 percent of the comment submissions were received via the U.S. Postal Service as hard copy letters.

The number of comment letters by interest group are summarized in Table 5-1.

Table 5-1 Number of Comments by Interest Group	
Interest Group	**Number of Comments**
Individuals	22,553
Federal Government Agencies	2
State Government Agencies	1
County and Local Government Agencies	0
Civic Groups	1
Non-governmental Organizations	7
Other	3

All substantive comments were entered into a comment database. Comments were assigned to an issue category. BLM responded to all substantive comments. All comment submissions are available for public review at the BLM BFO and are registered into the project Administrative Record (AR).

Comment submissions are summarized by type of comment in Table 5-2. Because the form letters covered a number of topics (ACECs, EIS, elk, overhead power lines, steep slopes, and WSA) they are counted in Protection of Fortification Creek.

Table 5-2 Public Comment Issues	
Issue	**Number of Comments**
ACECs	34
Air Quality	5
Alternatives	176
CBNG	1
Complete EIS	17
Cultural Resources	1
Cumulative Impacts	5
Editorial	5
Elk	120
Endorses Development	80
Energy and Minerals	7
Geology	1
Land Owner Rights	8

Table 5-2 Public Comment Issues	
Issue	**Number of Comments**
Land Use	10
Mitigation	7
NEPA	4
Noise	1
Overhead Power Lines and VRM	26
Phased Drilling	31
Protection of Fortification Creek	22,288
Purpose and Need	5
Reclamation	65
Recreation	1
Regulatory Process/Public Involvement	3
Socioeconomics	19
Steep Slopes	40
Transportation	6
Water	29
Wildlife	31
WSA	22

Concerns included how the phased approach would work, protection of the elk herd, and socioeconomic impacts. Restricting or eliminating hunting of the FCPA elk herd was suggested during the comment period. However, this was not analyzed in this RMPA/EA.

5.3 Other Outreach and Consultation

Following closure of the public comment period, BLM met with several interested parties including landowners, development companies, and NGOs. These groups had attended the public meetings and had provided written comments on the FCPA Draft RMPA/EA during the comment period.

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