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 (µg/m^3)

Air Pollutant	Monitoring Interval	Primary NAAQS	Secondary NAAQS	Wyoming Standards	PSD Class I Increments	PSD Class II Increments
Carbon Monoxide	1-hour	3,500	40,000	40,000	–	–
	8-hour	1,500	10,000	10,000	–	–
Lead	Quarterly	–	1.5	1.5	–	–

Table 3-1 Assumed Background Air Pollutant Concentrations, Applicable Ambient Air Quality Standards, and PSD Increment Values (µg/m^3)

Air Pollutant	Monitoring Interval	Primary NAAQS	Secondary NAAQS	Wyoming Standards	PSD Class I Increments	PSD Class II Increments
Nitrogen dioxide	Annual	16.5	100	100	2.5	25
Ozone	8-hour	130	157	157	–	–
PM_{10}	24-hour	42	150	150	4	30
	Annual	17	–	50	8	17
$PM_{2.5}$	24-hour	19	35	65	–	–
	Annual	7.6	15	15	–	–
Sulfur dioxide	3-hour	8	1,300	1,300	25	512
	24-hour	8	365	260	5	91
	Annual	3	80	60	2	20

Key:
µg/m^3 = Micrograms per cubic meter.
– = Not applicable.

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.

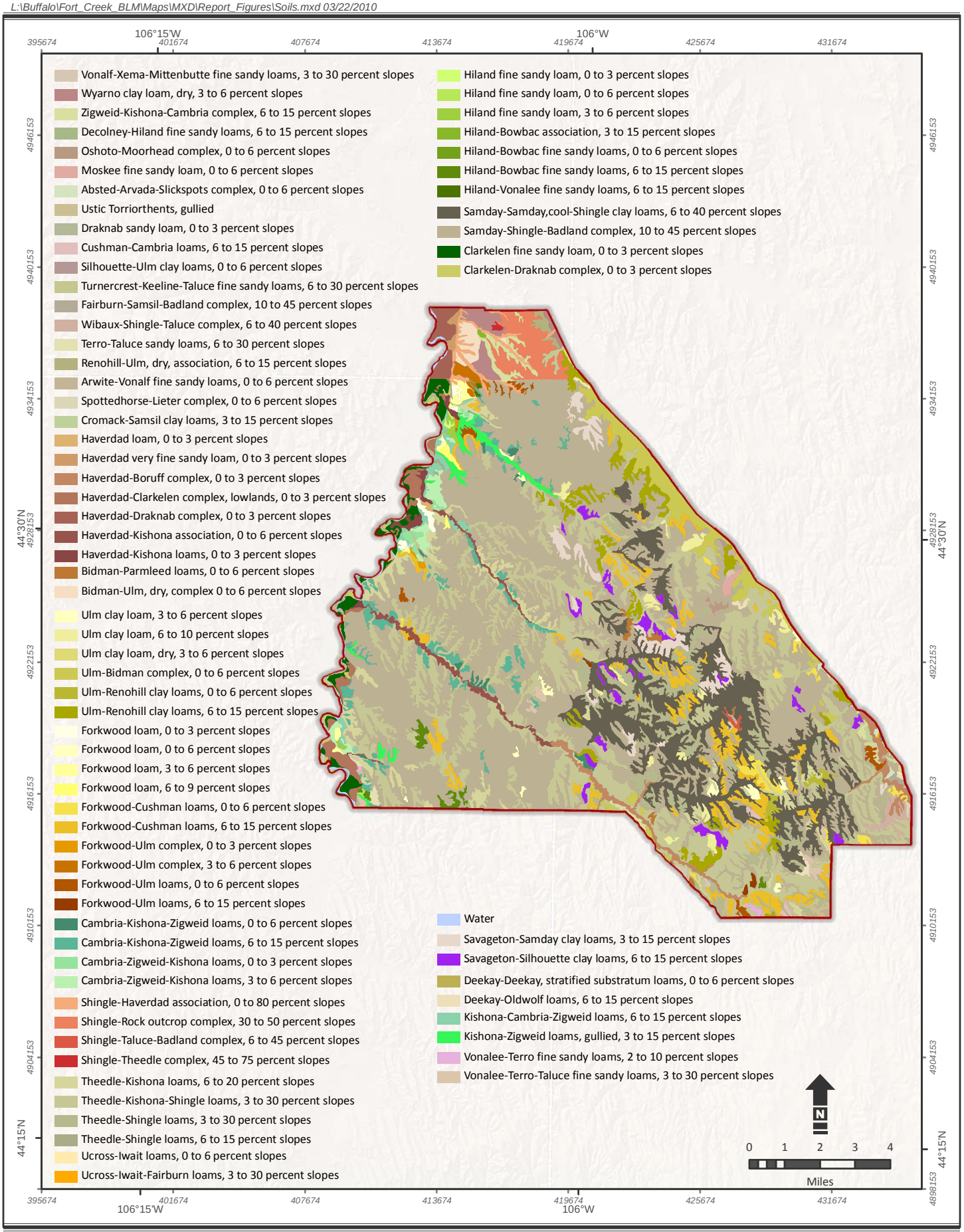
3.1.2. Soil Resources

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



Source:
Soils - SSURGO, USDA

Figure 3-1

Soil Classification

Campbell, Johnson, and Sheridan Counties, Wyoming

infiltration to provide for optimal plant growth and minimal surface runoff. The following factors contribute to soil stability.

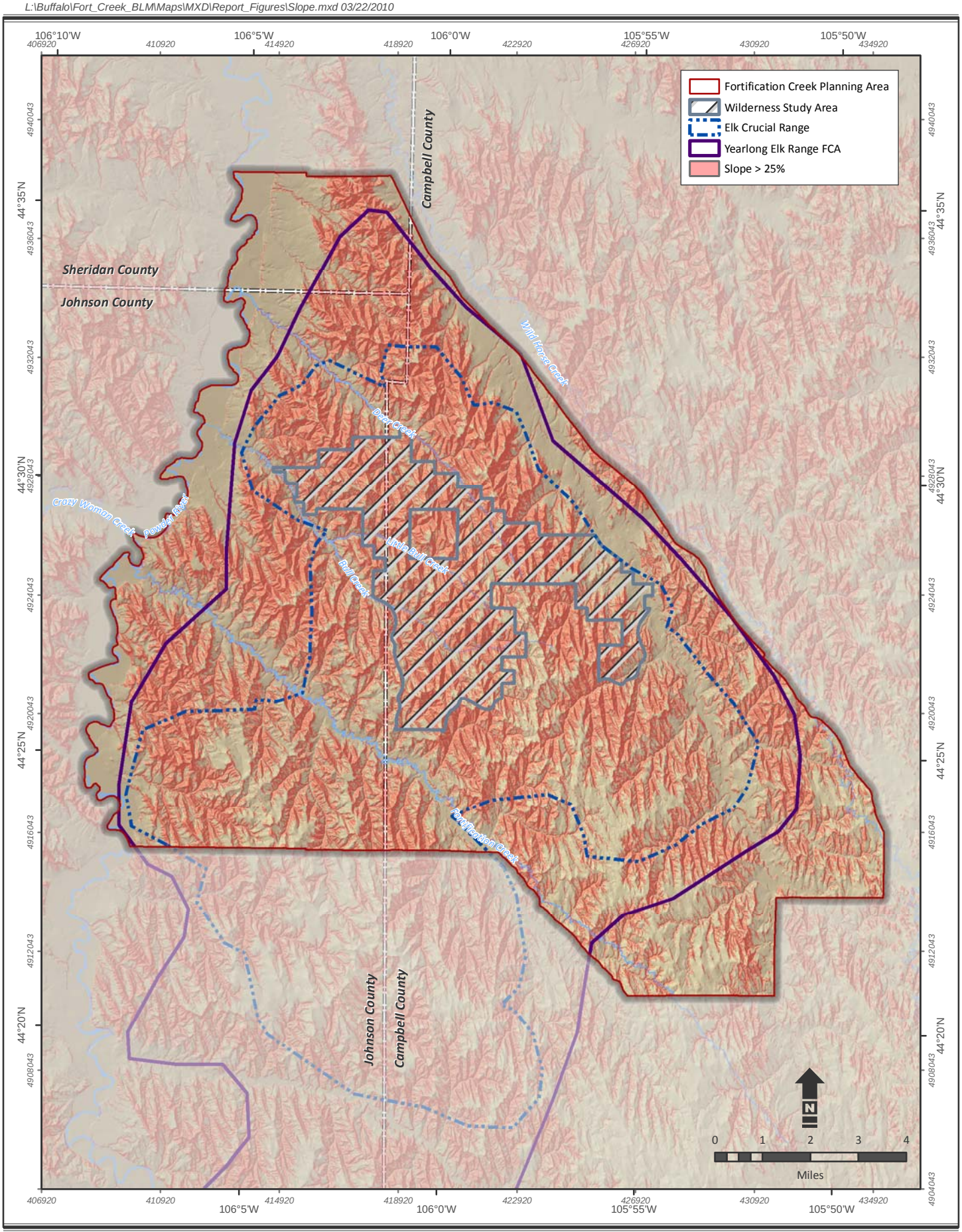
Slope Hazard

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

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).



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

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 potential in the FCPA is shown on Table 3-4.

Table 3-4 Reclamation Potential 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 stipulation. 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 suitable 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.

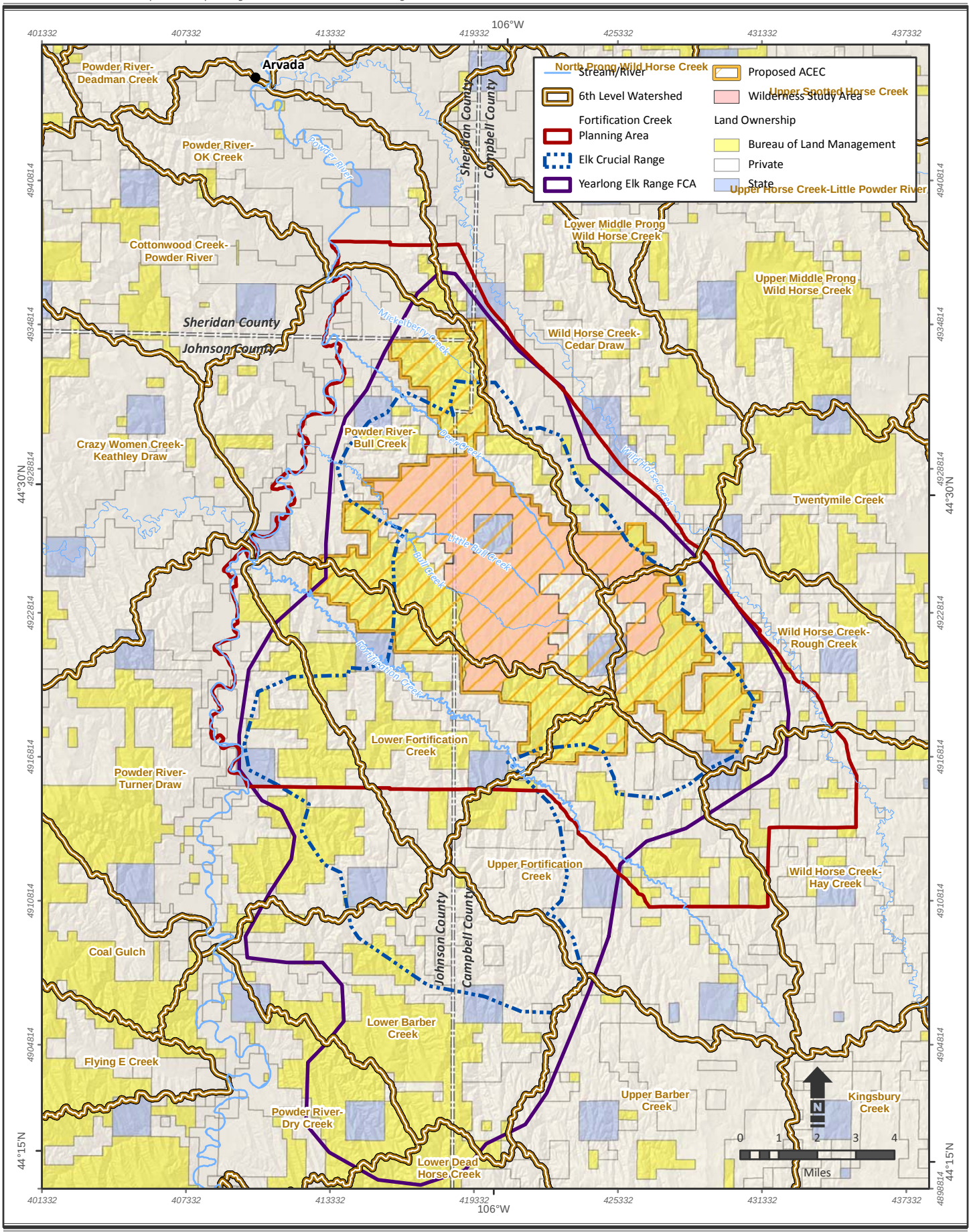
3.1.3. Water Resources

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.



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

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.

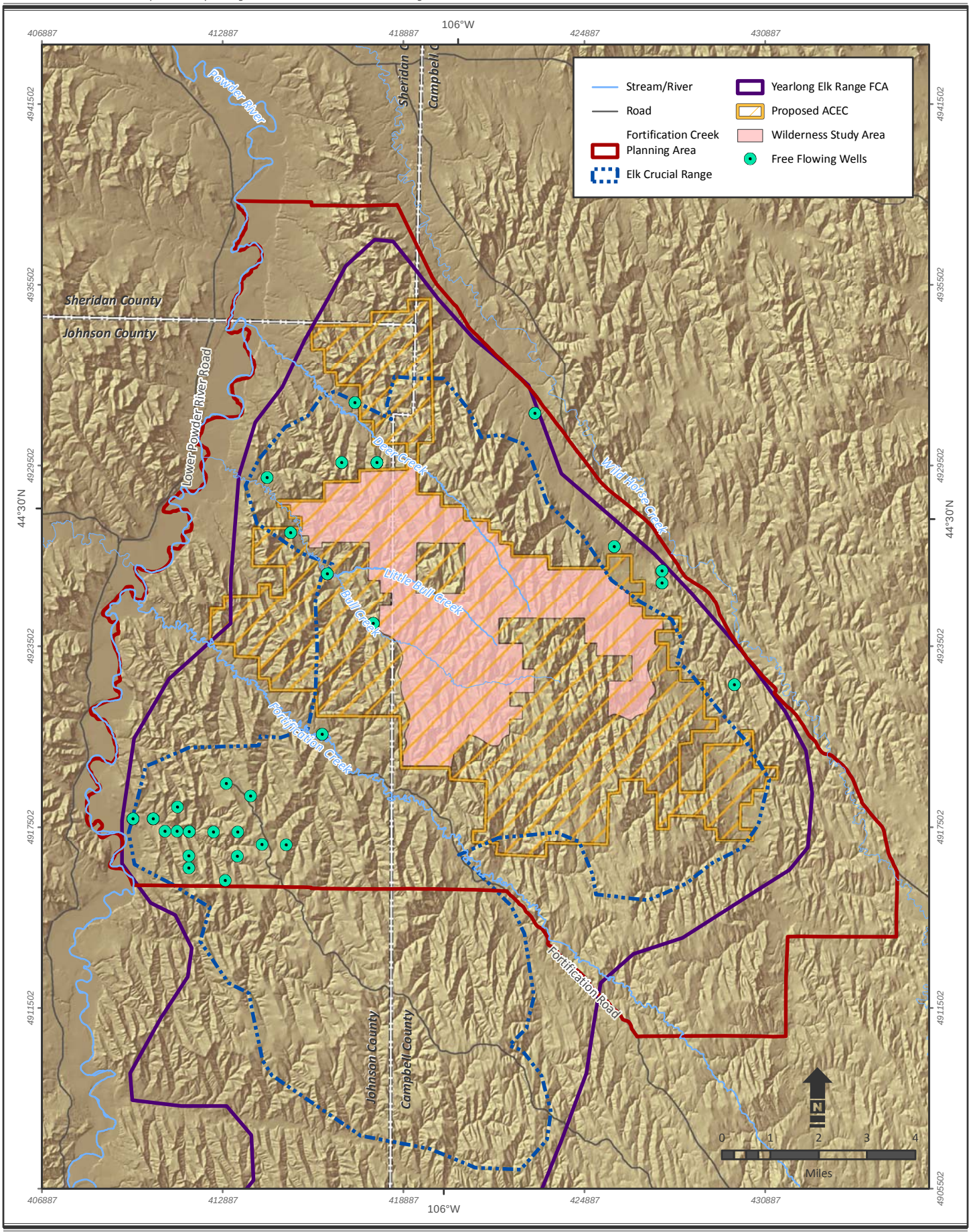
Groundwater

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).

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



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

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 RMPA/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.

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 Minerals Management Systems (MMS) 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).

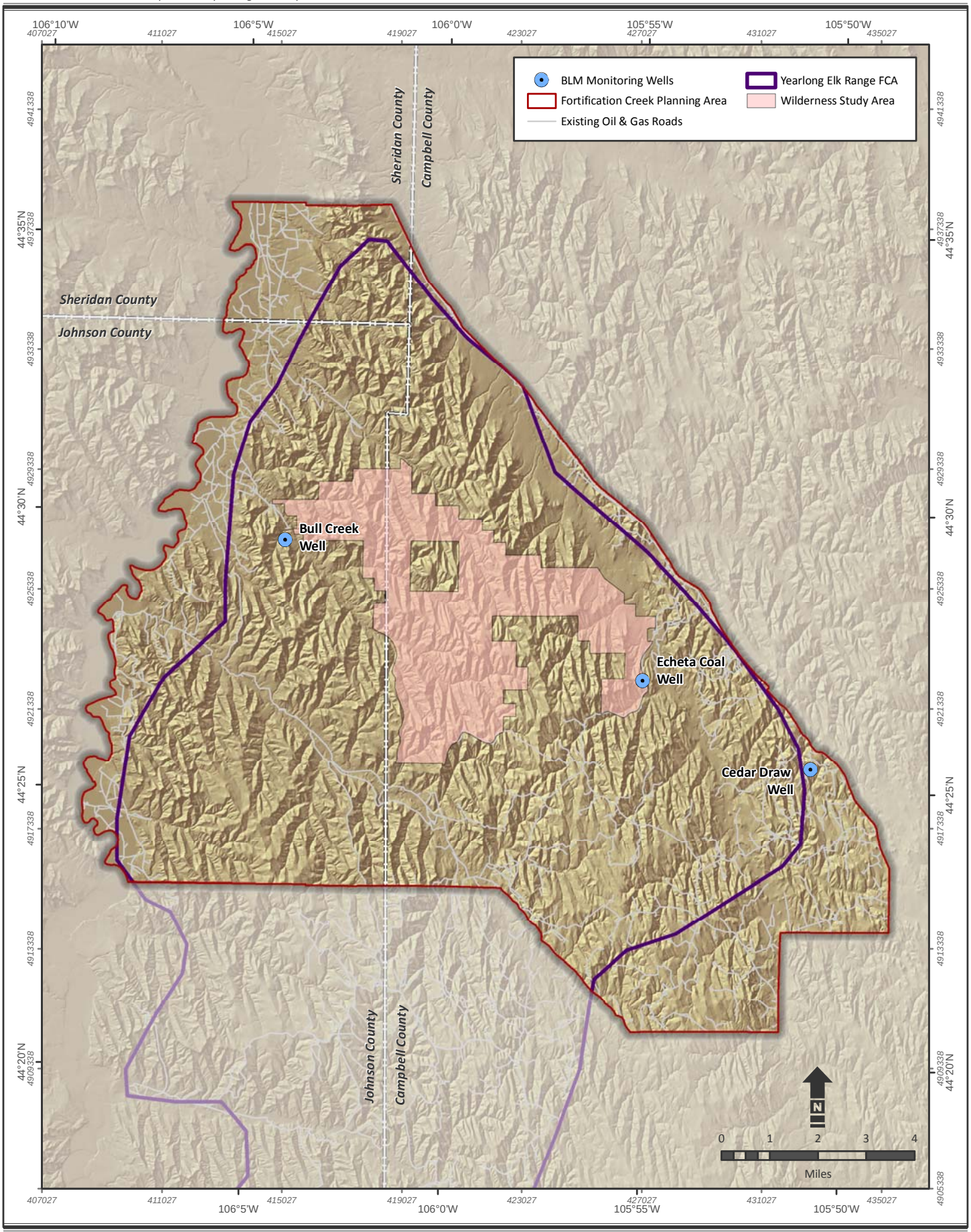
Pumping at existing CBNG wells that dewaters or depressurizes the coal aquifers to stimulate gas desorption from the coal has possibly moved waters with different chemistry from overlying units into the coal aquifer through leakage. However, no quantitative estimate of changes in groundwater chemistry 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 (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 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.



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

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.

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.

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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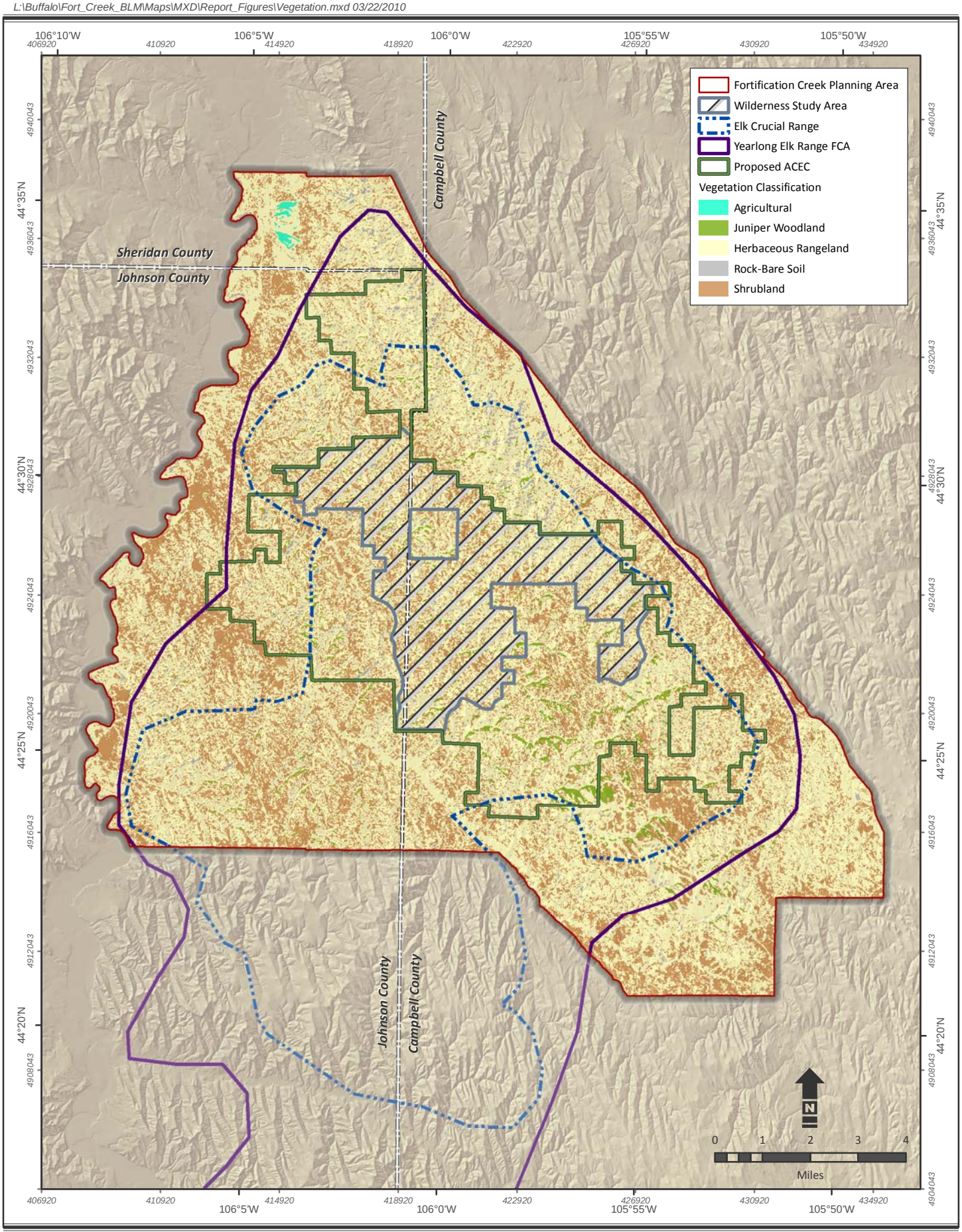


Source:
Boundaries/Lease Properties - Bureau of land Management 2009
Vegetation - NLCD 2001

Figure 3-6

Vegetation Classification

Fortification Creek Planning Area

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
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
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

Table 3-8 Wildlife Species Likely to Occur in the Fortification Creek Planning Area		
Common Name	**Scientific Name**	**Habitat**
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
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

Table 3-8 Wildlife Species Likely to Occur in the Fortification Creek Planning Area		
Common Name	**Scientific Name**	**Habitat**
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. 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. The overall population size for pronghorn is increasing. 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.

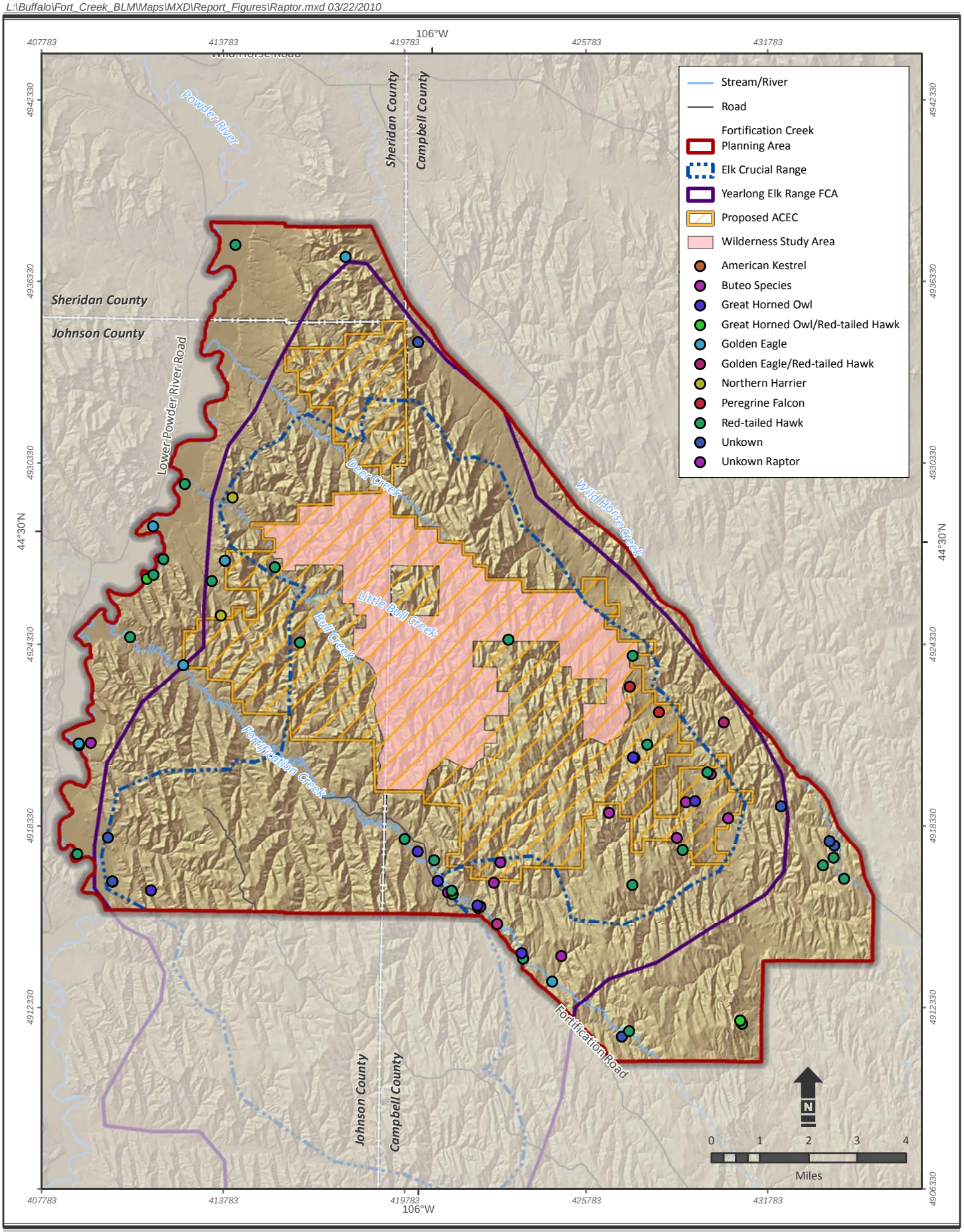
A wide variety of neotropical migrant birds use the FCPA during migration or breeding season. Few population data are available locally for these birds. Migratory birds are attracted by nesting availability and food sources, both of which are important habitat characteristics. All habitat types in the 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.

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



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

Figure 3-7

Raptor Nests

Campbell, Johnson, and Sheridan Counties, Wyoming

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). 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

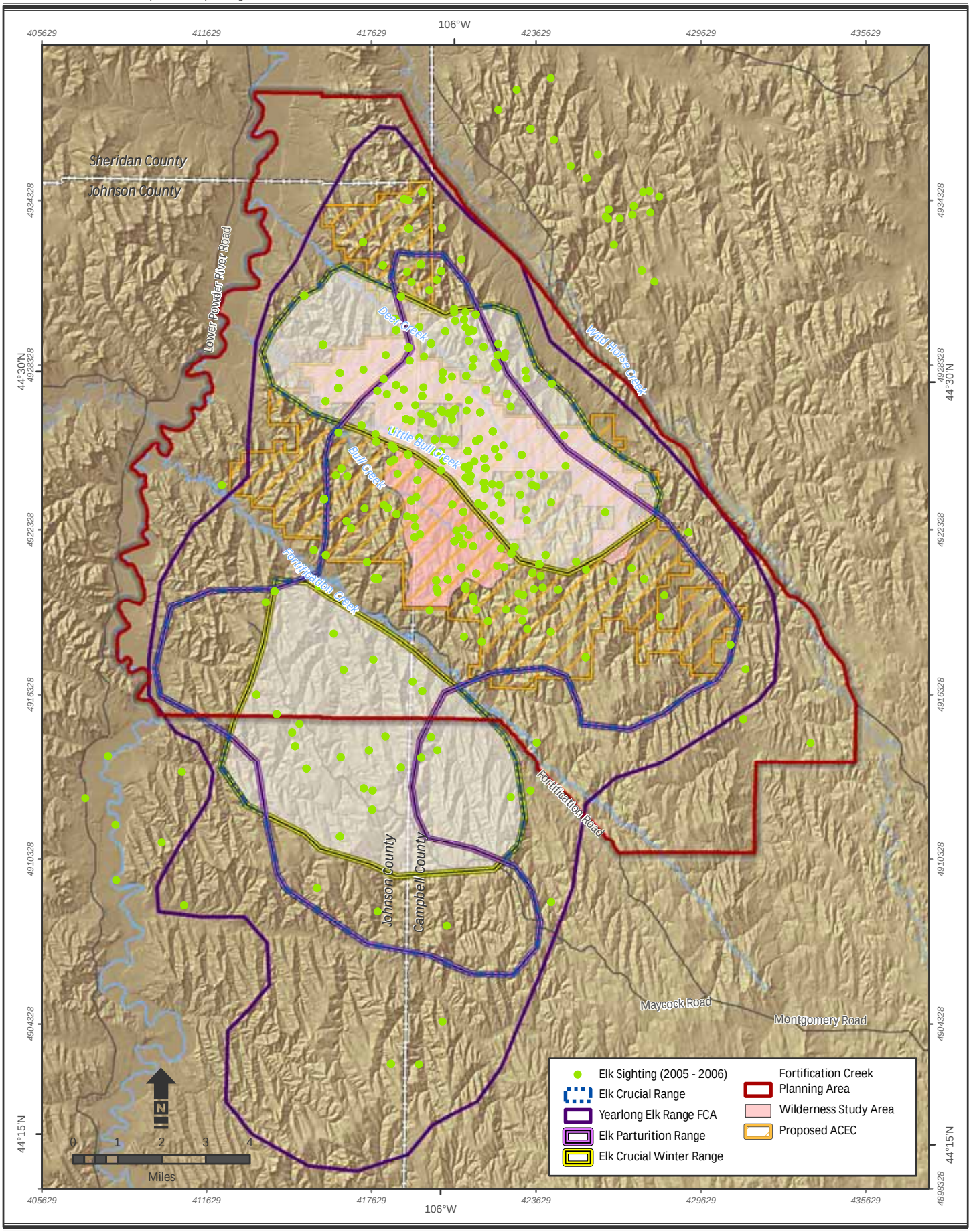
Currently there are an estimated 219 elk in the Fortification Creek herd (WGFD 2009a). The productivity of a big-game herd is often used as an indicator of the overall health and welfare of a population. Relatively high herd productivity is closely associated with good nutritional resources resulting 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 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.



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

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 has since been determined to not be warranted and was withdrawn (USFWS 2007b). 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.

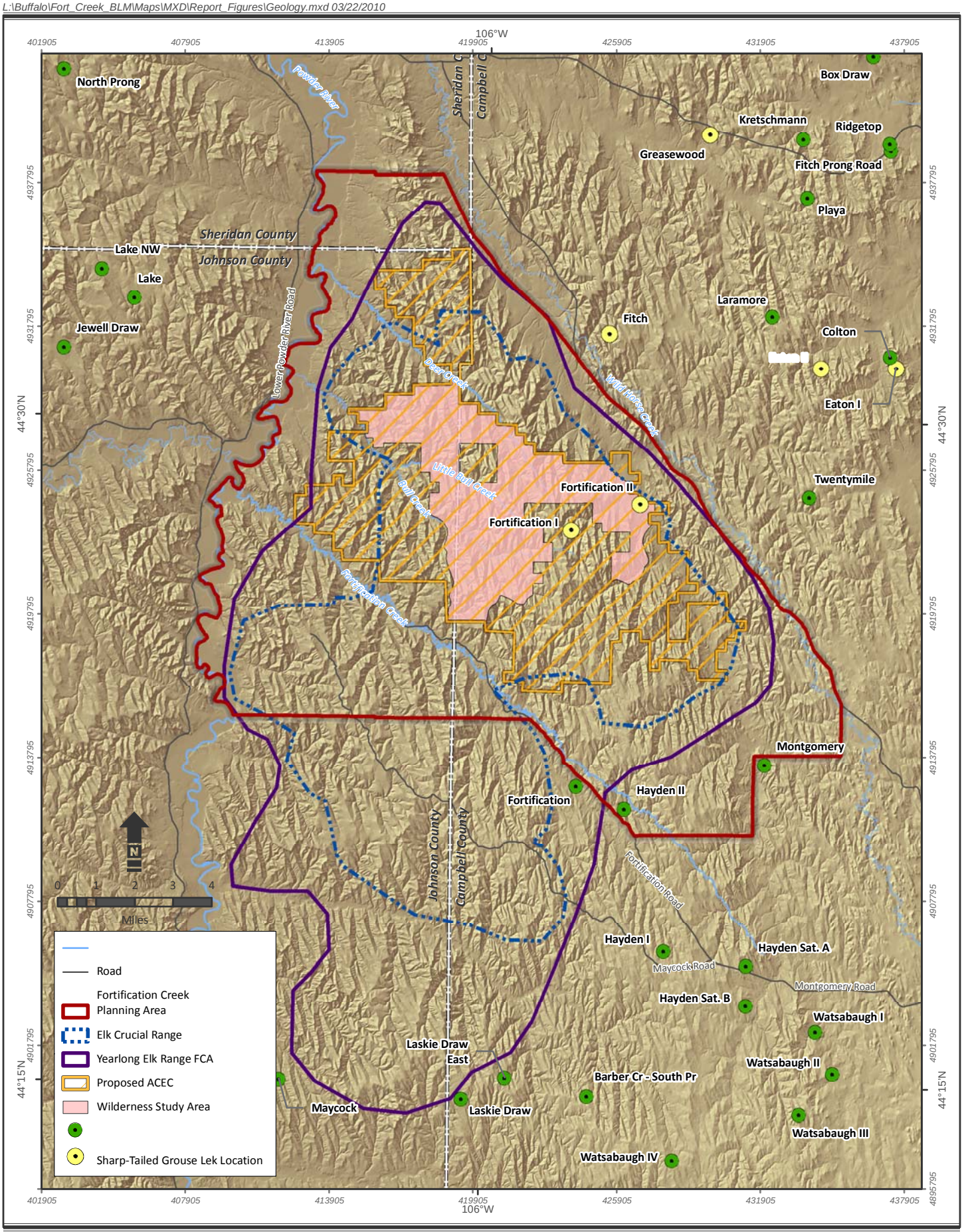
The special status species potentially present in the FCPA are based on appropriate habitat types. Specific surveys for many of these species have not been conducted in the FCPA and their presence is unknown.

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 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



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

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%)

Table 3-10 Historic Site Types within the FCPA		
Site Type	**Number of Sites**	**Number of Eligible Sites**
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

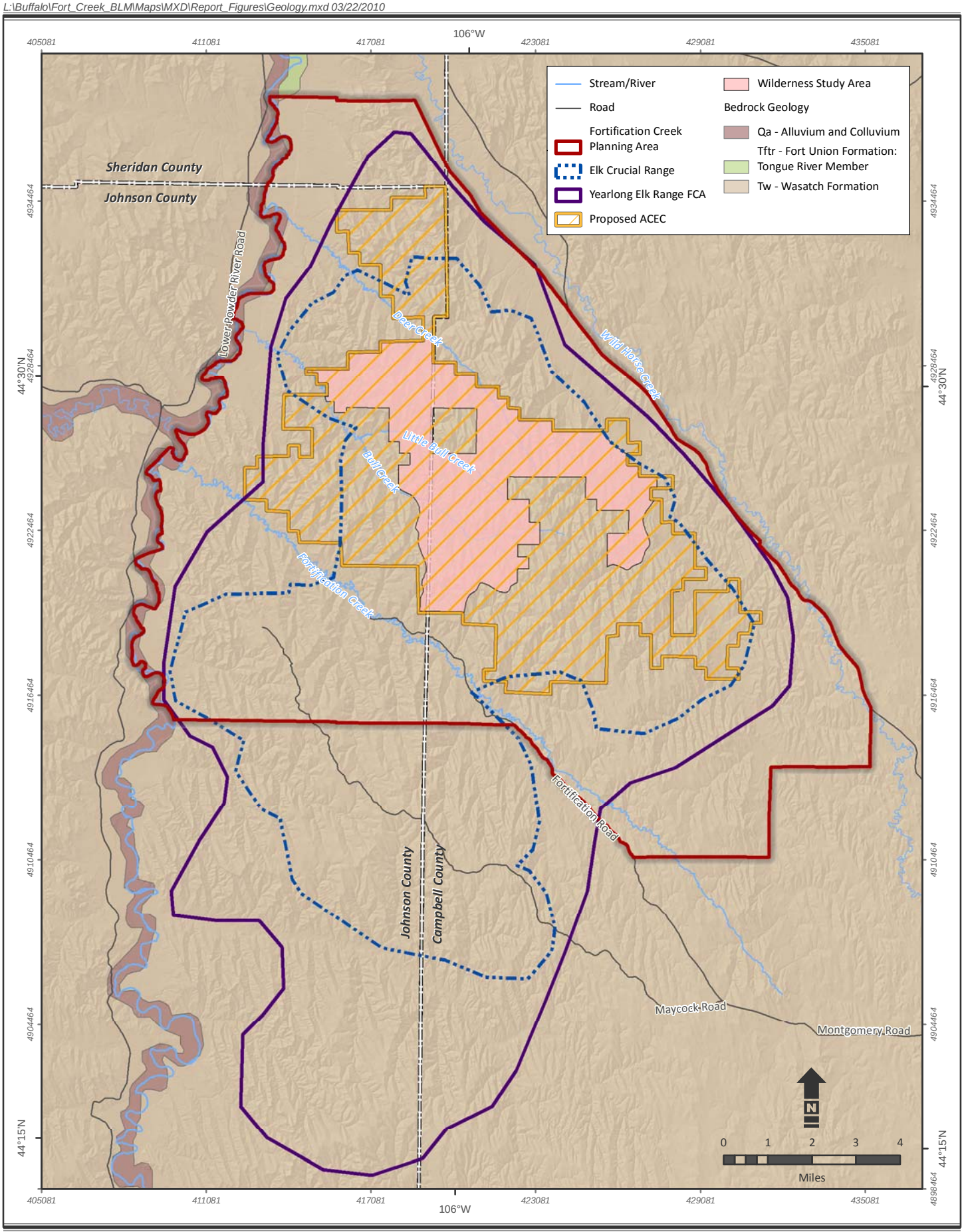
There is no information on landslides in the FCPA. While Wyoming is considered to have a high potential for earthquakes, relatively few earthquakes with a magnitude greater than 2.5 have been reported near the FCPA (WSGS 2007). The number of new conventional oil and gas wells is decreasing in the FCPA,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



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 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 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.

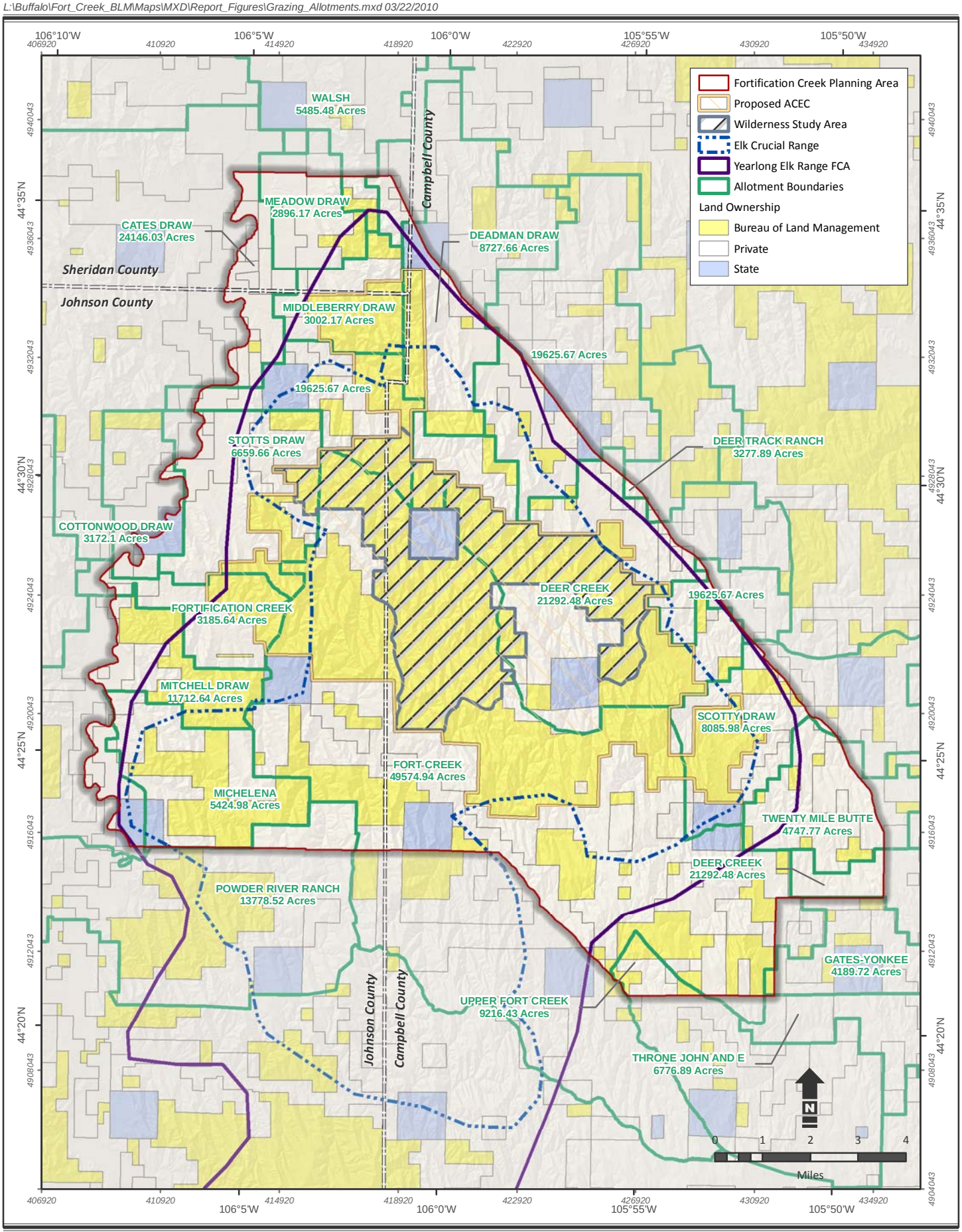
The goal for rangeland management is sustaining viable populations and a diversity of native plant and animal species appropriate to the habitat that could support threatened, endangered, species of special concern, or sensitive species to be maintained or enhanced. Indicators include the following:

- 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



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 public access to the Fortification Creek WSA; access into the WSA is through private landowners.

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.

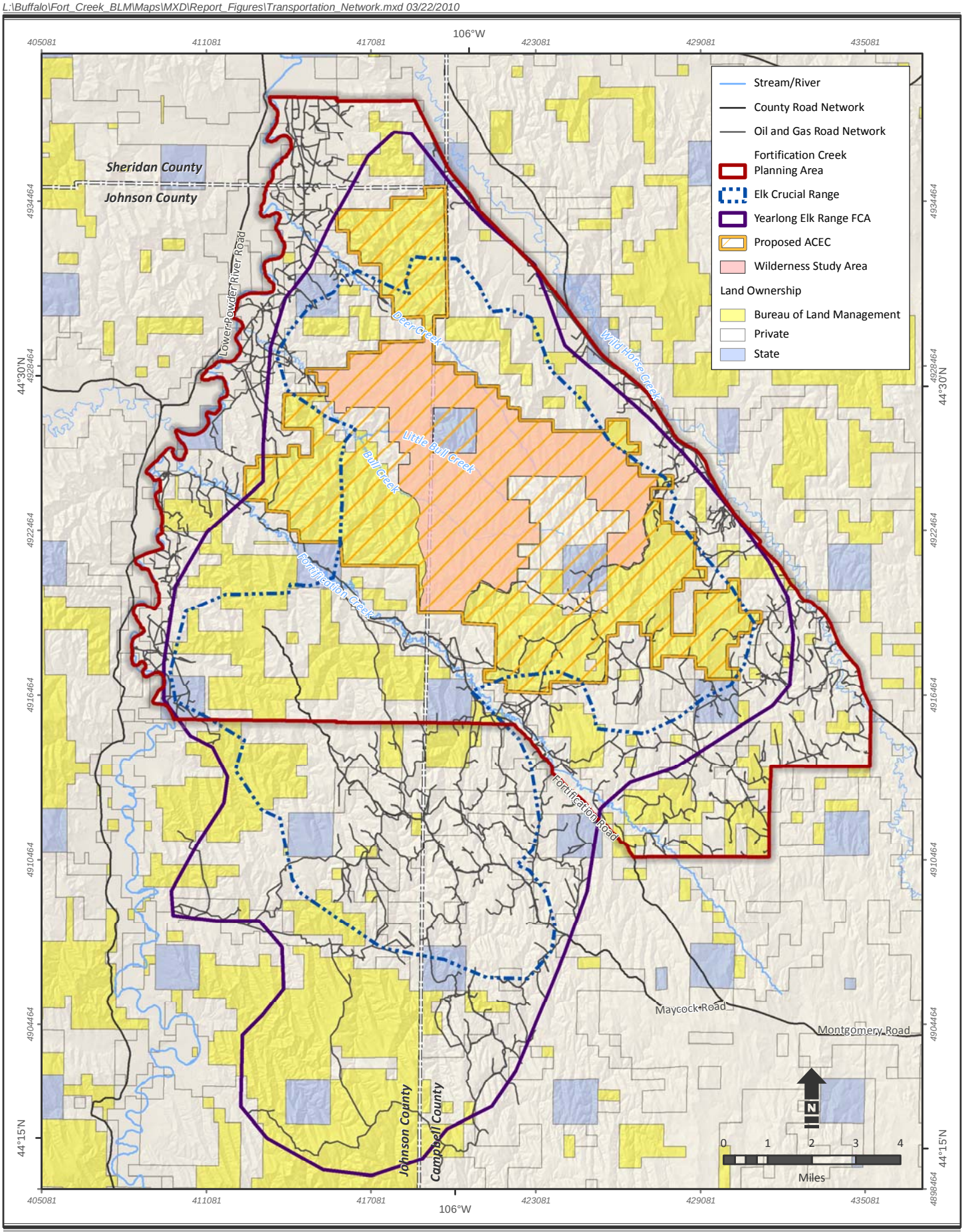
3.2.3.1. Regional Setting and Regulatory Framework

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



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 28 trillion cubic feet (tcf) of CBNG may be recoverable from the coal beds in the Wyoming portion of the PRB. 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 (BLM 2003a). 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 (bcf) in the Powder River Basin

County	Low	Moderate	High
Campbell	7,644	9,945	12,258
Johnson	6,722	8,741	10,773
Sheridan	2,928	3,810	4,703

bcf = billion cubic feet

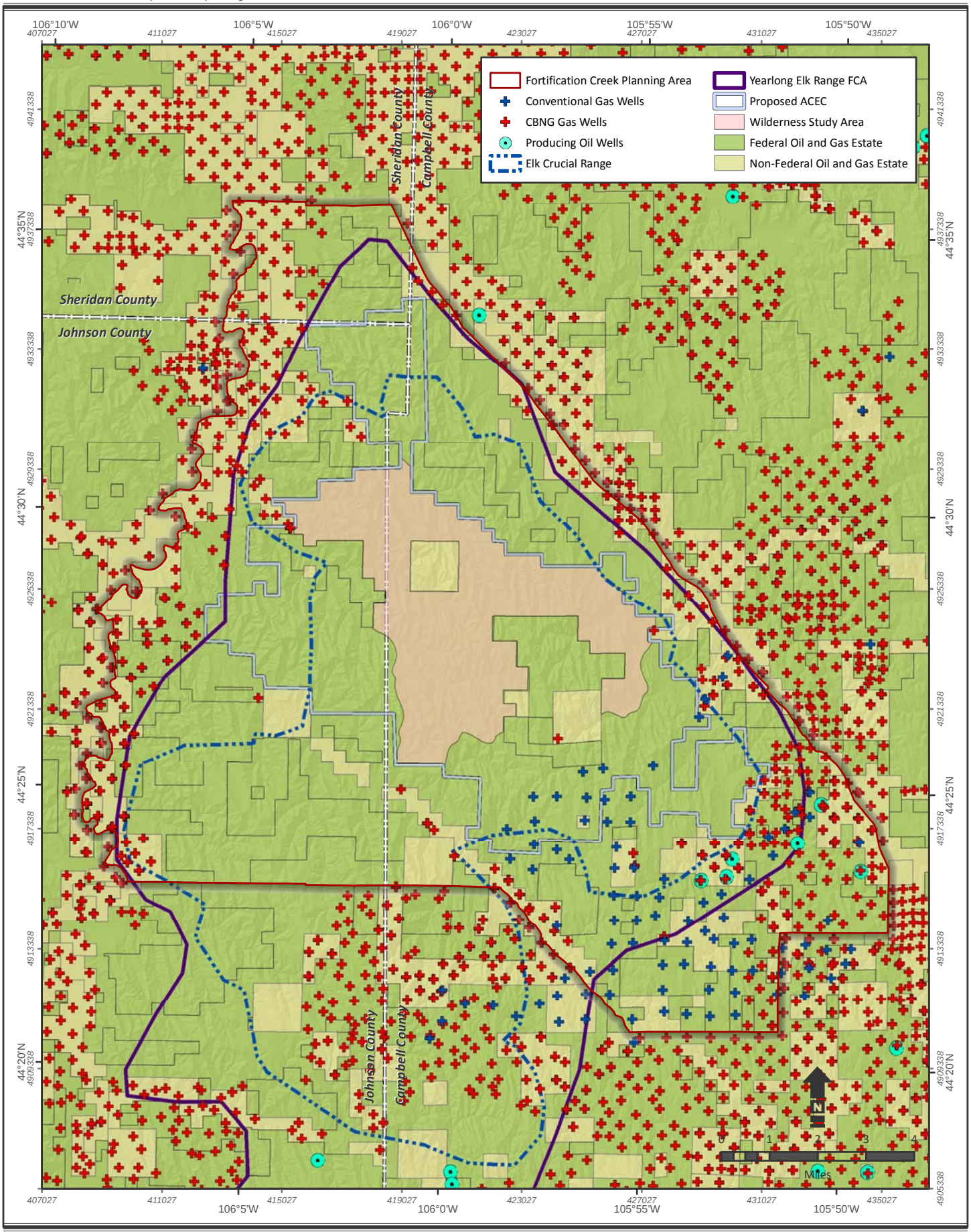
Cumulative CBNG production, from 1981 to the end of December 2007 was 1.9 billion cubic feet (bcf) in Campbell County, 0.4 bcf in Johnson County, and 0.3 bcf in Sheridan County (WOGCC 2008).

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



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

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.

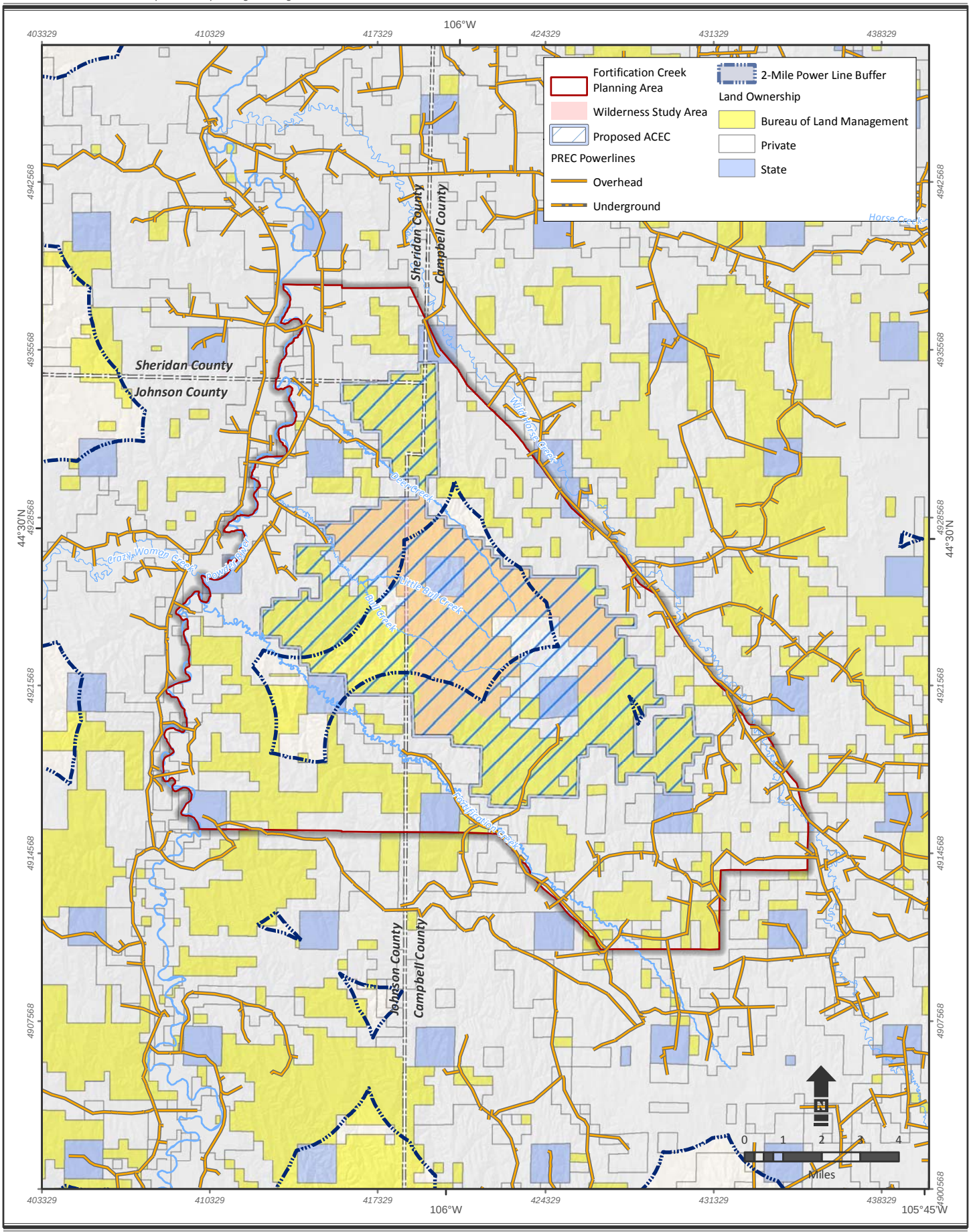
The BLM BFO identified special resource values in the FCPA when it delineated the area in the Buffalo Resource Area (BRA) Oil and Gas Environmental Assessment (EA) (BLM 1980) and the BRA Oil and Gas Surface Protection Plan (BLM 1982). The BRA RMP (BLM 1985a) incorporated decisions and management actions 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, but it is against BLM policy to do so. These areas are shown on Figure 1-2.



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. Development within the WSA requires a BLM ROW.

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).