

CHAPTER 3: THE AFFECTED ENVIRONMENT

INTRODUCTION

This chapter describes the existing conditions of the physical, biological, cultural, and socioeconomic resources in the study area. The resources that are addressed here were identified during the scoping process or interdisciplinary team review as having the potential to be affected.

Critical elements of the human environment (USDI, BLM 1988, 1999) that could potentially be affected by the proposed actions include air quality, cultural resources, native American religious concerns, T&E species, hazardous or solid wastes, water quality, wetlands/riparian zones, invasive, nonnative species (noxious weeds), and environmental justice. Five other critical elements (areas of critical environmental concern, prime and unique farmland, floodplains, wild and scenic rivers, and wilderness) are not present in the project area and are not addressed further. In addition to the critical elements that are potentially present in the project area, this EIS discusses the status and potential effects of mining the proposed lease exchange tract on topography and physiography, geology and minerals, geologic hazards, water quantity, alluvial valleys floors, soils, vegetation, wildlife, paleontological resources, visual resources, soils, land use and recreation, and socioeconomics.

GENERAL SETTING

The proposed lease exchange tract is within a region which has been evaluated by numerous environmental analyses that describe the existing and affected environment in the area of the recently issued and currently proposed leases-by-application. These documents contain analyses of the impacts to be expected as a result of surface coal mining and other mineral development activity in this area. They are available for viewing at the Casper Field Office of the BLM. The relevant federal publications are as follows:

- *Part 1: Regional Analysis, Final Environmental Impact Statement, Eastern Powder River Coal Basin of Wyoming, Volumes I and II* (USDI, BLM 1974).
- *Final Environmental Statement, Proposed Development of Coal Resources in the Eastern Powder River Basin Wyoming* (USDI, BLM 1979).
- *Final Environmental Impact Statement, Federal Coal Management Program* (USDI, BLM 1979a).
- *Amendment to Wyoming Land Use Decisions: Eastern Powder River Basin Area Management Framework Plan: Gillette Review Area* (USDI, BLM 1980).

- *Final Powder River Regional Coal Environmental Impact Statement* (USDI, BLM 1981).
- *Powder River Coal Tract Summaries* (USDI, BLM 1983).
- *Draft Environmental Impact Statement for Round II Coal Lease Sale in the Powder River Region* (USDI, BLM 1984).
- *Buffalo Resource Management Plan/Record of Decision* (USDI, BLM 1985).
- *Final Environmental Impact Statement Supplement, Federal Coal Management Program* (USDI, BLM 1985a).
- *Coal Bed Methane Environmental Assessment, Eastern [sic] Campbell and Western [sic] Johnson Counties, Wyoming.* (USDI, BLM 1990).
- *Environmental Assessment of the Jacobs Ranch Coal Lease Application for Kerr-McGee Coal Corporation* (USDI, BLM 1991).
- *Final Environmental Assessment for the West Black Thunder Coal Lease Application* (USDI, BLM 1992a).
- *Final Environmental Assessment for the North Antelope and Rochelle Coal Lease Applications for Powder River Coal Company* (USDI, BLM 1992b).
- *Final West Rocky Butte Coal Lease Application Environmental Impact Statement* (USDI, BLM 1992).
- *American Oil and Gas Marquiss Field Coal Bed Methane Project Environmental Assessment* (USDI, BLM 1992c).
- *Exxon Pistol Point Coal Bed Methane Project Environmental Assessment* (USDI, BLM 1992d).
- *Final Environmental Assessment of the Eagle Butte Coal Lease Application* (USDI, BLM 1994).
- *Lighthouse Coal Bed Methane Project Environmental Assessment* (USDI, BLM 1995a).
- *Final Environmental Impact Statement for the Antelope Coal Lease Application,* (USDI, BLM 1995).

- *Final Environmental Impact Statement for the North Rochelle Coal Lease Application* (USDI, BLM 1997).
- *Final Environmental Impact Statement for the Powder River Coal Lease Application and Thundercloud Coal Lease Application* (USDI, BLM 1998).
- *Gillette North Coal Bed Methane Project Environmental Assessment* (USDI, BLM 1996).
- *Wyodak Coal Bed Methane Project Draft Environmental Impact Statement* (USDI, BLM 1999a).

The Buckskin Mine permit area has been specifically evaluated in several federal and state environmental analyses. These documents contain analyses of the impacts to be expected as a result of surface coal mining at the Buckskin Mine. The relevant publications are as follows:

- "Proposed Mining and Reclamation Plan, Buckskin Mine, Campbell County, Wyoming" is included as a site-specific EIS in the final EIS for Eastern Powder River Coal (USDI, BLM 1979). This is available for viewing at the Casper Field Office of the BLM.
- *Coal Mine Permit Application, Buckskin Mine*, WDEQ, Permit 500-T4. This is available for viewing at the WDEQ in Sheridan and Cheyenne, or at the OSM in Casper.

The proposed lease exchange area is about 12 miles north of Gillette, in Campbell County, Wyoming, approximately 70 miles east of the Big Horn Mountains and roughly 30 miles west of the Black Hills (map 1-1 in chapter 1). The surface of the area is privately owned; coal is owned by the federal government. According to the oil and gas plat, the federal government owns the oil and gas rights on about 153 acres of the tract--the oil and gas rights on the rest of the tract are privately owned. Since the area is primarily grassland and grassland/sagebrush habitat, it is used for grazing, wildlife habitat, and some agriculture (hay fields).

Principal big game animals are antelope and mule deer. The proposed lease exchange area is drained by ephemeral tributaries of Hay Creek, which drains to the Little Powder River. The surface geology is dominated by the Wasatch Formation and the Tongue River Member of the Fort Union Formation, and is underlain by the Anderson and Canyon coal seams in this part of the PRB.

Long-term climatic information from Gillette shows a minimum monthly average air temperature of 21°F and a maximum monthly average air temperature of 60°F (Martner 1986). The average growing season is 111 days. Winds are predominantly

from the south-southeast to south-southwest, and wind speed exceeds 11.5 mph about 23% of the time. Average annual precipitation is approximately 15.8 inches whereas average annual snowfall is approximately 65.6 inches.

TOPOGRAPHY AND GEOLOGY

Topography/Physiography

The Hay Creek tract, which contains the proposed lease exchange area, is located in the northern PRB which lies within the Great Plains physiographic province. The landscape consists of eastward-dipping lowland plains that are dissected by north and east-flowing rivers. The PRB is bounded on the east by the Black Hills, on the south by the Laramie Range, and on the west by the Big Horn Mountains. The proposed lease exchange area is located on a topographic divide between the Powder River drainage to the west and the Little Powder River drainage to the east.

Topography is relatively flat to steep, with rolling plains interspersed with protruding rocky buttes. There are no named drainages in the proposed lease exchange area, but several ephemeral streams flow approximately 0.5 mile north into Hay Creek. Elevations range from 4,080 feet above mean sea level to 4,340 feet above mean sea level. All but the southeastern portion of the proposed lease exchange area is rolling (typically about 60 feet of relief) and slightly to moderately dissected, whereas the southeastern corner is characterized by steep topography (about 120 feet of relief) and is deeply dissected.

Geology and Minerals

Surface geology is dominated by the Tongue River Member of the Fort Union Formation and the Eocene Wasatch Formation. There may be quaternary deposits in the stream channels. The Wasatch Formation overlies the Tongue River Member which contains the targeted Anderson and Canyon coal seams. These formations dip gently (one to two degrees) to the southwest.

The Tongue River Member is approximately 800 feet thick and consists of interbedded light grey sandstone, siltstone, shale, and coal. The Anderson and Canyon coal beds are economically recoverable and would be mined under the Proposed Action. The Anderson coal is a subbituminous hard black coal typically 30 feet thick. It contains thin seams or fractures filled with pyrite and gypsum. The Canyon coal underlies the Anderson coal, separated by a thin parting in the south which thickens to about 18 feet in the north. The Canyon coal is typically 50 feet thick, but ranges from 10 feet to more than 100 feet thick. The two coal seams reach a combined thickness of 110 feet in some places.

Coal in the proposed exchange lease tract is classified as subbituminous and is low in sulfur (table 3-1).

**TABLE 3-1
SELECTED COMPONENTS OF THE ANDERSON/CANYON COALS**

Component	Content
Heat content	8,120 Btus/pound
Ash	5.11%
Moisture	30.87%
Total sulfur	0.51%

Overburden (the material that must be removed in order to mine the coal) in the proposed lease exchange area would be the Wasatch Formation, which is composed of interbedded sandstone, siltstone, shale, and claystone with minor coal beds. Coal is a minor component of the Wasatch Formation, where the best seam is the Rider coal, which can be up to 50 feet thick. However, the low quality and unpredictable quantities of the Rider coal limit its economic value. Wasatch strata may also contain scoria or clinker--baked and fused rock created by the natural combustion of underlying coal. Scoria is relatively resistant to erosion and outcrops as knobs or rocky buttes.

As part of the Buckskin Mine permit application, overburden and interburden samples were analyzed to identify their physical and chemical properties and the extent of any materials which could have an adverse effect on the environment. The study also identified any material that could adversely affect reclamation or revegetation success (in the root zone), or the quality or quantity of groundwater (aquifer restoration). Overburden within the current Buckskin Mine permit area, which borders the proposed lease exchange area on the south, typically meets the suitability criteria for both root zone and aquifer restoration, although some overburden samples had unsuitable levels of certain parameters. The major problems identified were high concentrations of selenium and poor textures (table 3-2).

Although suitability criteria were exceeded at least once for each parameter, the Wasatch overburden is mixed during mining. The adjoining Buckskin Mine operations have determined that all exceedences except selenium are diluted to within root zone and aquifer restoration standards. Weighted averages computed for each parameter in each stratum sampled were within WDEQ Guideline No. 1 (1996) standards.

The Wasatch overburden in the proposed lease exchange area would likely have similar chemical and physical characteristics as in the adjoining Buckskin Mine permit

area. Some strata are likely to contain unsuitably high or low concentrations of one or more of the other parameters. Overall overburden/interburden characteristics should be suitable for root zone and aquifer restoration material. As part of the mine permitting process, the mines develop management plans to ensure that this unsuitable material is not placed in areas where it may affect groundwater quality or revegetation success. This plan is in place for the existing Buckskin Mine and would be developed for the proposed lease exchange tract if it is leased.

**TABLE 3-2
EXCEEDED WDEQ PARAMETERS FOR ROOT ZONE OR AQUIFER
RESTORATION CRITERIA: BUCKSKIN MINE PERMIT AREA**

Compound/Parameter	Number of Samples with Exceedences	Measured Concentration	Suitable Range
pH	2	5.0-5.5	5.0-8.5
Conductivity	1	9.38	0-8
Saturation percentage	7	23.1-103.5	25-80
Texture	33	clay, silty clay, and sand	clay, silty clay, and sand textures are marginally suitable
Sodium adsorption ratio	1	10.11	0-10
Selenium	na ²	>0.3 ppm	<0.3 ppm
Boron	3	6.9-11.9 ppm	<5.0 ppm
Nitrate as nitrogen	3	54-117 ppm	<50 ppm
Acid base potential	7	-6 to -45	> -5 tons CaCO ₃ /1,000 tons of material
Organic carbon	1 ¹	12.1%	<10%
Molybdenum	nm ³	nm ³	<1.0 ppm
Arsenic	nm ³	nm ³	<2.0 ppm

¹Samples from the Rider and Swartz coals also exceeded this suitability criterion.
²The selenium standard was changed from <0.1 ppm to <0.3 ppm since the Buckskin permit was prepared, so the number of exceedences under the current standard is not available.
³Not measured.

Geological Hazards

No landslides are known to occur in the area (Case 1999). Historically, there have been earthquakes in the Gillette area. There were two earthquakes of magnitudes 5.0 and 5.1 on the Richter scale with epicenters just west of Gillette in 1984. There is potential for random earthquakes with magnitudes of up to 6.25 on the Richter scale in the proposed lease exchange area. There are no known abandoned underground mines in the area. Section 20 contains a large windblown deposit (map 3-1).

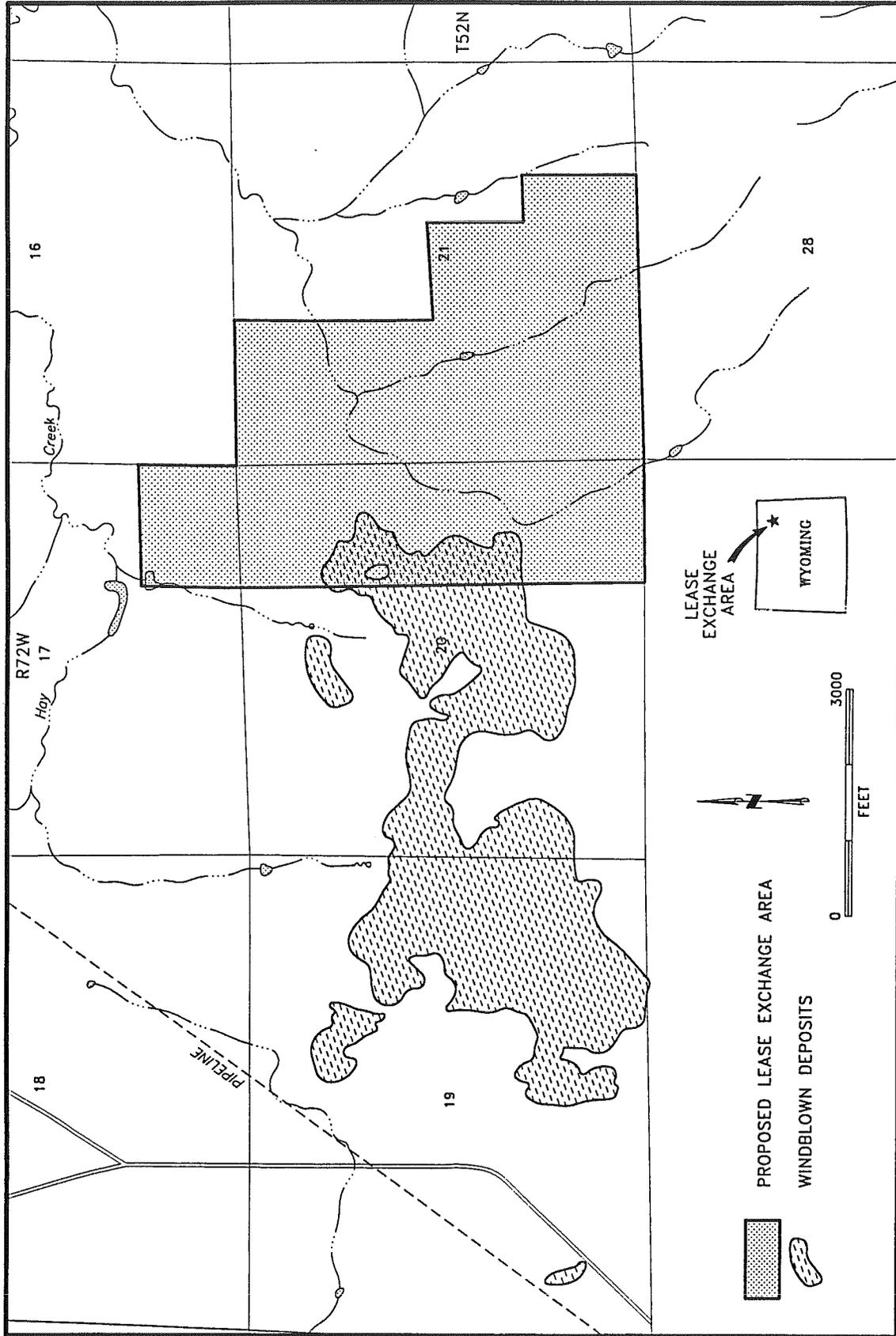
WATER RESOURCES

Groundwater

The Wyodak coal bed aquifer, which includes the Anderson coal seam, Canyon coal seam, interburden, and overlying overburden is the only regional shallow aquifer underlying the proposed lease exchange area. The aquifer is generally unconfined near the coal outcrop. As the coal dips westward, the aquifer becomes progressively more confined between the overlying sediments of shale and siltstone with occasional interbedded sandstones lenses (Martin et al. 1988).

Solid, undisturbed coal is basically impermeable; therefore, the hydraulic properties of the coal are functions of the amount of fracturing which has occurred (faulting and flexing). As a result, aquifer properties are highly variable. Transmissivity in the coal formation is typically less than 1,000 gallons per day per square feet, and wells completed in the coal generally yield 10 to 50 gallons per minute (gpm) (Martin et al. 1988). Water wells in the vicinity of the proposed lease exchange area completed in the Wyodak coal aquifer typically yield less than 25 gpm, although yields of more than 100 gpm could be obtained from wells 1,000 to 2,000 feet deep that are perforated for all water-bearing zones. Based on extensive water quality samples collected from the nearby Buckskin Mine, groundwater quality in the Anderson, Canyon, interburden, and overburden is highly variable. Groundwater in the overburden (Wasatch sands) exhibits many of the same quantity and quality characteristics found in the underlying coal seams and can provide a limited quantity and quality of groundwater (Triton 1996). It does not meet WDEQ/Water Quality Division (WQD) drinking water or agricultural standards due to high total dissolved solids (TDS) and sulfate concentrations. However, it is generally acceptable for livestock and wildlife watering (Triton 1996; WDEQ/WQD 1993).

Field observations show a total of six potential springs on or adjacent to the proposed lease exchange area. Five of the six springs in the area discharge from the bottom of stream channels where thick sandstone beds crop out. The sixth discharges from a clinker formation.



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MAP 3-1
WINDBLOWN DEPOSITS IN THE PROPOSED LEASE EXCHANGE AREA

None of the discharges meet WDEQ/WQD drinking water standards; however the discharges do yield fair to good quality water for use by livestock and wildlife. Yields range from less than 1 gpm to more than 10 gpm, and according to the Wyoming State Engineers Office (WSEO) records, none of these springs have been permitted.

Records from the WSEO indicate that there are 21 valid groundwater rights within the immediate proposed lease exchange area. All of the wells have been drilled within the last 20 years and were established for groundwater monitoring (Triton 1996). In addition, 108 valid water rights have been identified within 2 miles of the proposed lease exchange area. One hundred and four of these water rights are for monitor wells, two are for domestic use and two are for livestock watering (Triton 1996). There are no known water rights that currently use the overburden groundwater within 2 miles of the proposed lease exchange area, except for monitor wells established by the Buckskin Mine. The two wells used for livestock belong to Charles R. Oedekoven; the two wells for domestic use belong to Charles R. Oedekoven and Cecle L. and Laverne L. Cook (TRC 1999).

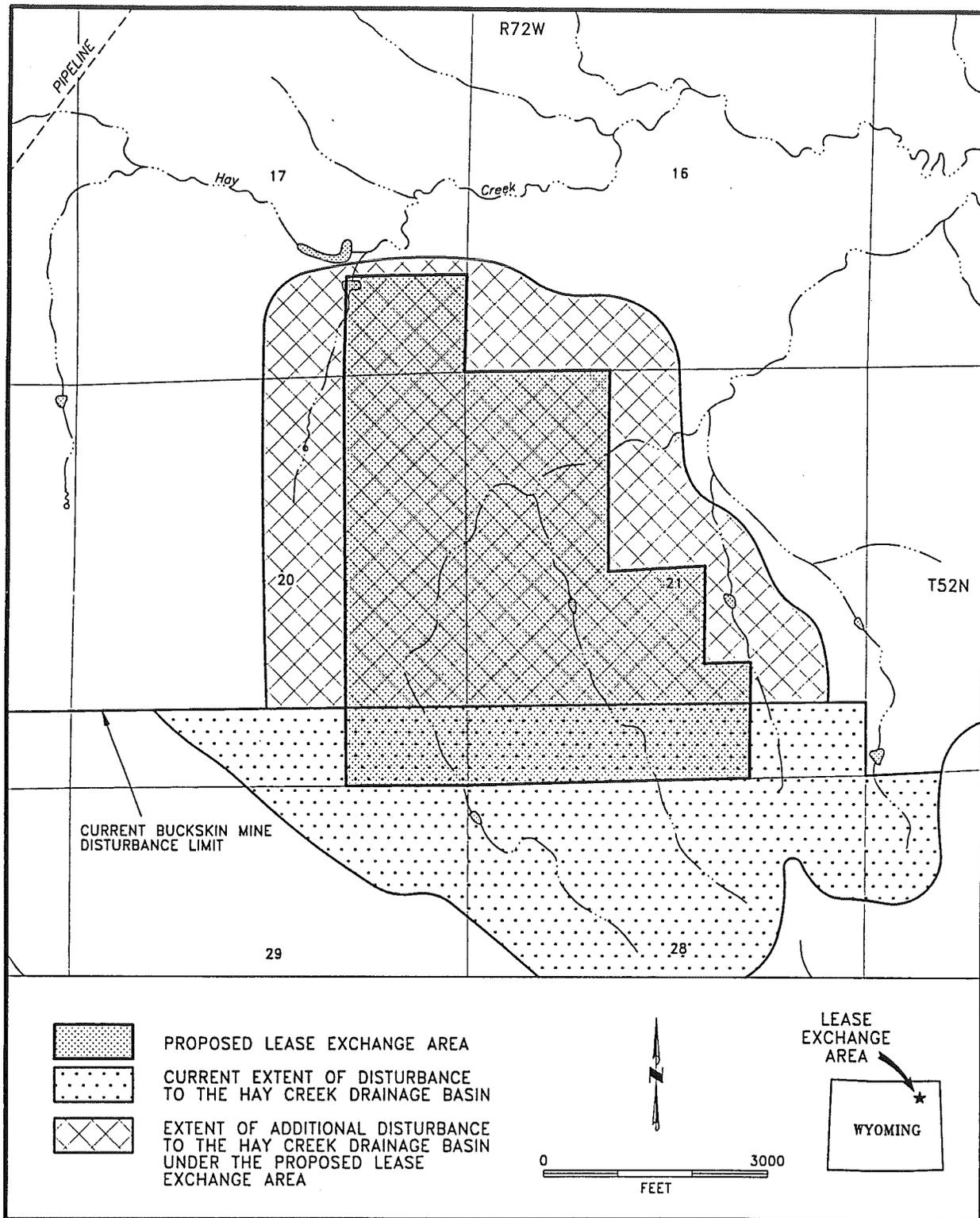
Water quality in the alluvial aquifer underlying the proposed lease exchange area is fair to poor for use by livestock and wildlife.

Surface Water

The land included in the Proposed Action lies entirely within the Hay Creek drainage basin (map 3-2). All of the tributary channels potentially affected by the proposed project are ephemeral--the channels flow only in direct response to precipitation and snowmelt. These ephemeral drainages flow north and east to Hay Creek which then flows approximately 1 mile eastward to the confluence with the Little Powder River, and on to the Powder River, the Yellowstone River, and the Missouri River.

The ephemeral tributary channels potentially affected by the proposed project are meandering grass-lined swales that are dry the majority of the year. When runoff events occur they are normally of high intensity and short duration. Typically, more than 75% of annual runoff occurs during May, June, and July in response to snowmelt. Peak discharges usually occur in June; however, some may occur as early as January and as late as September. Annual peak discharges are generally associated with thunderstorm activity, and streams in the project area experience three to five runoff events during a typical year (Triton 1996).

Hay Creek originates about 3 miles west of the proposed lease exchange area. Hay Creek is an intermittent stream that may have perennial flow for short reaches near its confluence with the Little Powder River. The stream channel drains eastward to where the tributary drainages potentially affected by the proposed project intercept Hay Creek. Hay Creek does not flow through the proposed lease exchange area and would not be directly affected by the Proposed Action.



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**MAP 3-2
DRAINAGE AREA OF THE PROPOSED LEASE EXCHANGE AREA**

The Hay Creek drainage above the confluence with the Little Powder River is approximately 15.2 square miles. There are no stream gaging stations located on Hay Creek, and no site-specific hydrologic data are known to exist. Hay Creek flows approximately 5.9 miles from the watershed divide (4,300 feet above mean sea level) to the confluence with the Little Powder River (4,010 feet above mean sea level), a drop of 290 feet. The average channel slope from the divide to the confluence is 0.93%, and the mean basin slope is 48.99 feet per mile.

Surface water quality in nearby drainages varies with stream discharge--the higher the discharge, the lower the TDS concentrations and the higher the suspended solids concentrations. Surface water in the vicinity of the proposed lease exchange area is typically calcium-sodium-sulfate based and generally contains more than 1,500 milligrams per liter (mg/l) of TDS (Triton 1996). This makes it unsuitable for domestic use, marginal for irrigation, but suitable for livestock and wildlife watering (WDEQ/WQD 1993). Water quality in a single grab sample collected from Hay Creek approximately 2 miles upstream (west) of the proposed lease exchange area (NWNW of section 18, T. 52 N., R. 72 W.) on March 14, 1985 by BLM officials following a snowmelt event is presented in table 3-3.

**TABLE 3-3
HAY CREEK WATER QUALITY SAMPLE RESULTS**

Parameter	Concentration (mg/l unless otherwise indicated)
Water temperature (C)	0.50
Electrical conductivity (µmhos/cm)	76.00
TDS	310.00
Total suspended solids	104.00
Calcium	33.90
Magnesium	13.00
Potassium	6.50
Sodium	11.20
Chlorine	4.40
Carbonate	0.00
Bicarbonate	20.20
Sulfate	133.00
pH (standard units)	6.40

Wetlands

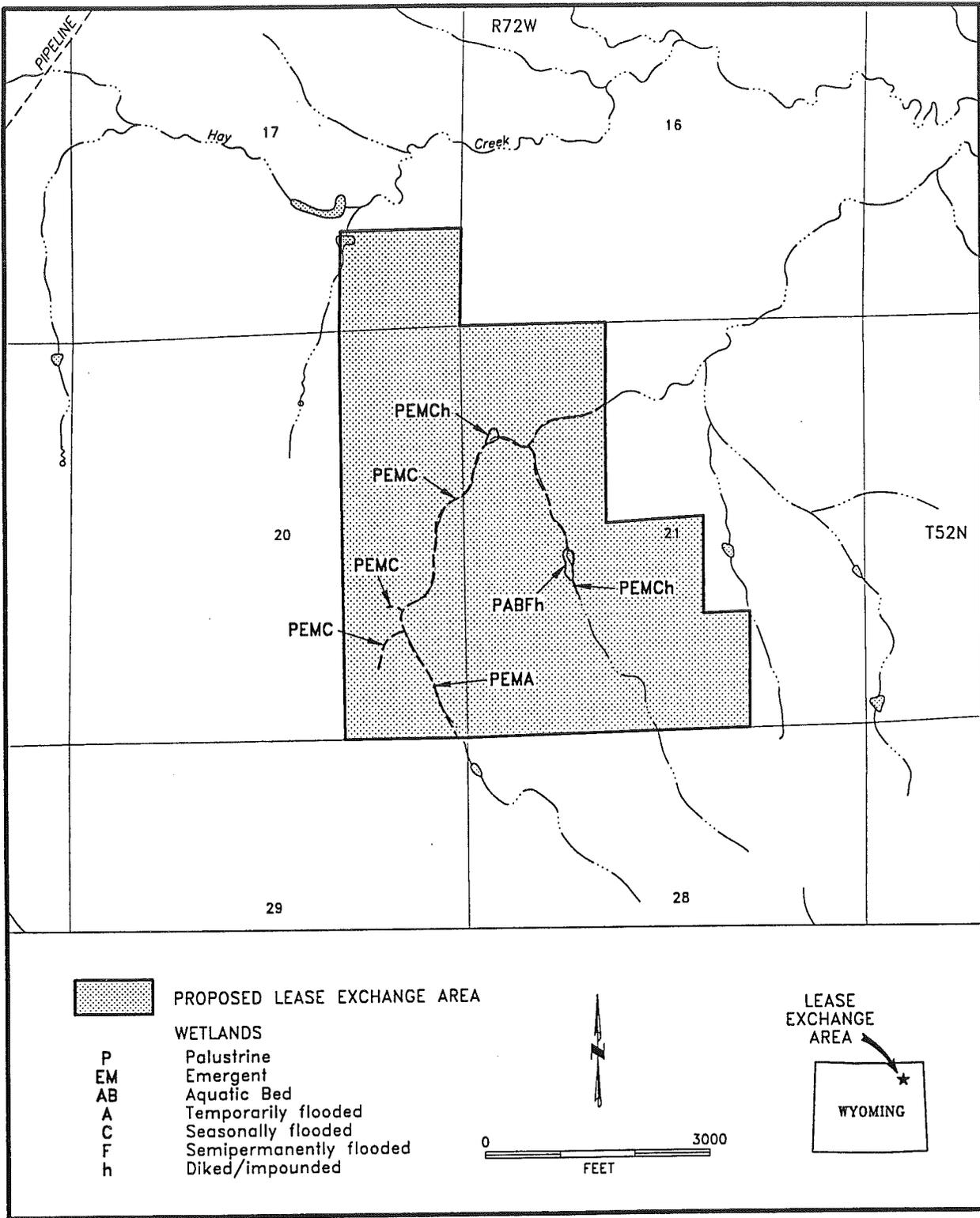
Waters of the US is a collective term for all areas subject to regulation by the US Army Corps of Engineers (COE) under section 404 of the Clean Water Act. *Waters of the US* include *special aquatic sites*, wetlands, and jurisdictional wetlands. *Special aquatic sites* are large or small geographic areas that possess special ecological characteristics of productivity, habitat, wildlife protection, or other important and easily disrupted ecological values (40 CFR 230.3). Wetlands are a type of *special aquatic site* which include "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas" [33 CFR 328.3(a)(7)(b)]. Jurisdictional wetlands are defined by 33 CFR 328.1 and 2 as "those wetlands which are within the extent of COE regulatory review." They must contain three components: hydric soils, a dominance of hydrophytic plants, and wetland hydrology. Many wetland scientists consider areas that contain only one of the three criteria listed above as functional wetlands. The USDI, Fish and Wildlife Service (FWS) used this categorization in producing the national wetlands inventory maps. These maps are produced using aerial photo interpretation with limited field verification.

The presence of wetlands on a mine property does not preclude mining. Jurisdictional wetlands must be identified and special permitting procedures are required to assure that after mining there will be no net loss of wetlands. A wetland delineation must be completed according to approved procedures (COE 1987) and submitted to the COE for verification as to the amounts and types of jurisdictional wetlands present. In Wyoming, once the delineation has been verified, it is made a part of the mine permit document. The reclamation plan is then revised to incorporate at least an equal type and number of jurisdictional wetlands. Section 404 does not cover functional wetlands. They may be restored as required by the surface managing agency (on public land), or by the private landowner.

Numerous wetlands, including three ponds, occur on the ephemeral tributary to Hay Creek that crosses the proposed lease exchange area (map 3-3). Assuming that the tributary is approximately 2.0 miles long and 20 feet wide within the proposed lease exchange area, it supports approximately 4.8 acres of wetlands. These wetlands are classified as palustrine emergent or palustrine aquatic bed and are temporarily, seasonally, or semi-permanently flooded. Three wetlands are dammed or diked.

Alluvial Valley Floors

Alluvial valley floors (AVFs) are unconsolidated stream-laid deposits where water availability is sufficient for subirrigation or flood irrigation agriculture. The presence of an AVF can only be substantiated following a detailed evaluation of the area using



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MAP 3-3
WETLANDS IN THE PROPOSED LEASE EXCHANGE AREA

procedures specified in chapter 3, section 2 of the WDEQ/Land Quality Division (LQD) *Coal Rules and Regulations* and *Guideline No. 9* (WDEQ/LQD 1998; 1994). These procedures require an identification of the essential hydrologic functions of an area mining operations and the AVF is determined not to have a significant impact to and a determination as to whether or not the area is or has been important to farming. The AVF determination is required during the state mine permitting process. The designation of an area as having an AVF can have a substantial bearing on mining and reclamation plan requirements and could even lead to an unsuitability designation for the specific AVF area.

State and federal mining regulations require the proposed mine operator to determine if the proposed mining operation would have a significant impact on farming or on a farm's agricultural production. If AVFs are identified within areas to be disturbed by farming or on a farm's agricultural production, state and federal mining regulations allow the AVF to be mined. However, the mine operator is required to reestablish the hydrological function of the AVF during reclamation, as well as the hydrological functions of any AVFs located outside of the mine area that may be negatively impacted.

Several AVFs have been identified 3 to 5 miles south of the proposed lease exchange area along Rawhide Creek and Spring Draw. None of these undeveloped rangeland AVFs were determined to be significant to farming or to a farm's agricultural production (Triton 1996). The proposed lease exchange area includes several first order tributaries of Hay Creek within undeveloped rangeland which could include AVFs; however, a site-specific AVF delineation has not been conducted for the area. Before any disturbance occurs within the project area, an AVF delineation and determination would have to be completed and the results reviewed and approved by WDEQ/LQD. It is unlikely that there would be any AVFs significant to farming in the proposed lease exchange area based on the fact that there is no agricultural activity in the area.

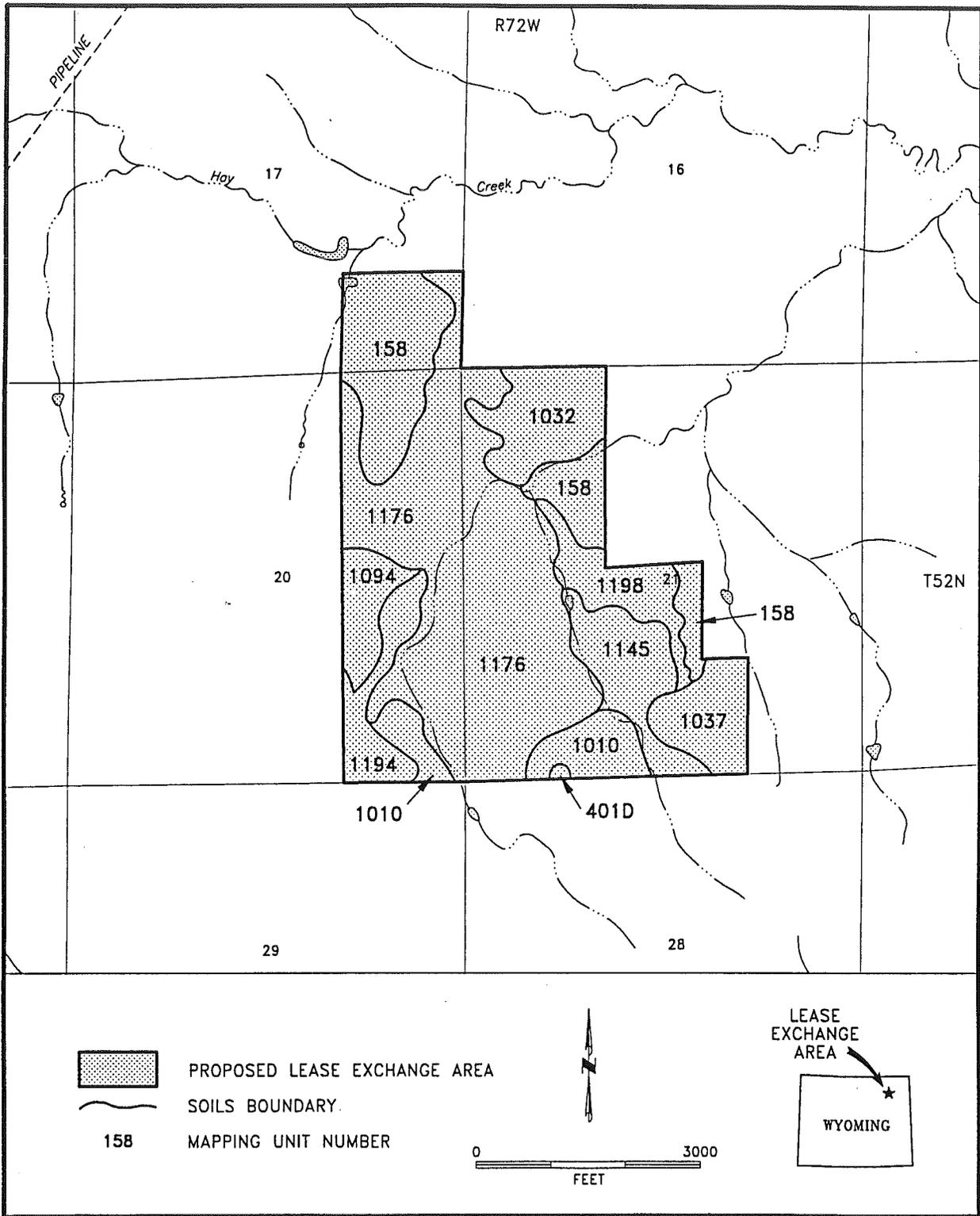
SOILS

Based on an unpublished soil survey of Campbell County done by the Natural Resources Conservation Service (NRCS 1999), ten soil associations occur within the proposed lease exchange area (table 3-4 and map 3-4). The principal limitations for reclamation are steep slopes, shallow depth to bedrock, moderate to strong alkalinity, moderate to severe wind/water erosion potential, and moderate to high shrink-swell potential. One or more of these limitations occur in each soil in the proposed lease exchange area.

**TABLE 3-4
SOIL ASSOCIATIONS, LIMITATIONS, AND ESTIMATED SALVAGE DEPTHS/VOLUMES**

Soil Association and Map Unit Number	Principal Limitations	Acreage Within Proposed Lease Exchange Area	Estimated Salvage Depth ¹ (inches)	Volume to be Salvaged
				Proposed Action (yds ³)
Taluse-Shingle-Rock outcrop complex, 3-30% slopes (401D)	Steep slopes, shallow depth to bedrock, moderately to strongly alkaline, moderate wind/water erosion potential	2	20 to 60	5,378 ----- 16,133
Xema-Vonalf-Mittenbutte sandy loams, 3-30% slopes (1194)	Steep slopes, shallow depth to bedrock, moderate wind/water erosion potential	31	10 to 40	41,678 ----- 166,711
Keeline-Tulloch loamy sands, 6-30% slopes (1094)	Steep slopes, shallow depth to bedrock, moderately to strong alkaline	25	20 to 60	67,222 ----- 201,667
Deekay-Oldwolf loams, 0-6% slopes (1037)	Shallow depth to bedrock, moderately to strongly alkaline, moderate shrink-swell potential, moderate wind/water erosion potential, clayey	30	20 to 60	80,667 ----- 242,000
Arwite-Elwop sandy loams, 0-6% slopes (1010)	Shallow depth to bedrock, moderate shrink-swell potential, moderate wind/water erosion potential, moderately alkaline	38	20 to 60	102,178 ----- 306,533
Deekay loam, 0-6% slopes (1032)	Moderately to strongly alkaline, moderate shrink-swell potential, moderate wind/water erosion potential, clayey	51	60	411,400 -----
Wibaux-Shingle-Taluce complex, 6-40% slopes (1198)	Steep slopes, shallow depth to bedrock, moderately to strongly alkaline, moderate to severe wind/water erosion potential	27	10 to 60	36,300 ----- 217,800
Echeta-Cromack clay loams, 6-15% slopes (1145)	Shallow depth to bedrock	43	20 - 60	11,562 ----- 346,867
Ucross-Iwait-Maladay loams, 3-30% slopes (1176)	Steep slopes, shallow depth to bedrock	268	10 to 60	360,312 ----- 2,161,867
Deekay-Ziggy loams, 0-6% slopes (158)	Clayey	94	60	758,267 -----
Total		599		1,874,958 ----- 4,829,245

¹None of the associations in the proposed lease exchange area correlate with associations within the Buckskin Mine permit area; therefore, estimated salvage depths were based on average soil depth.



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MAP 3-4
SOIL TYPES IN THE PROPOSED LEASE EXCHANGE AREA

VEGETATION

Plant Communities

Baseline vegetation studies were conducted in 1988 on a large area that included the current Buckskin Mine permit area and approximately 279 acres of the proposed lease exchange area. Vegetation on the remainder of the area was determined based on an examination of aerial photographs and consultation with various personnel familiar with the area. Seven vegetation types occur within the proposed lease exchange area, including four grassland types (bunchgrass, lowland prairie, mixed grass prairie, and sandy prairie) and three shrubland types (big sagebrush, silver sagebrush, and rough breaks) (Triton 1996).

Bunchgrass Type. The bunchgrass type occurs primarily on scoria sandstone or shale hills, knolls, and slopes that are moderately steep to steep. In the 1988 survey area, this type occurred on badlands soils which were very shallow and contained abundant coarse fragments. In the proposed lease area, the Wibaux-Shingle-Taluce complex (mapping unit 1198) has these characteristics, and the bunchgrass vegetation type is likely to occur on these soils.

Vegetative cover in the bunchgrass type averaged 20%; total ground cover averaged 65%. Dominant grass species included little bluestem (*Andropogon scoparius*), bluebunch wheatgrass (*Elymus spicatus*), needle-and-thread (*Stipa comata*), threadleaf sedge (*Carex filifolia*), and prairie junegrass (*Koeleria macrantha*). The most common forbs were Hood's phlox (*Phlox hoodii*), Hooker's sandwort (*Arenaria hookeri*), field chickweed (*Cerastium arvense*), pale bastard toadflax (*Comandra umbellata*), and Missouri golden rod (*Solidago missouriensis*). Common shrubs and subshrubs included skunkbush sumac (*Rhus trilobata*), big sagebrush (*Artemisia tridentata*), broom snakeweed (*Gutierrezia sarothrae*), fringed sagewort (*Artemisia frigida*), and prairie rose (*Rosa arkansana*).

Total herbaceous production averaged 366 pounds per acre. Most production was provided by perennial grasses (90% relative production) and perennial forbs (10% relative production).

Shrub density averaged 1,864 plants per acre. Big sagebrush was the most common (42%) of all shrubs, followed by skunkbush sumac (22%), silver sagebrush (*Artemisia cana*) (18%), and prairie rose (13%). Subshrub density averaged 3,803 plants per acre--broom snakeweed (69%) and fringed sagewort (25%) were predominant.

Lowland Prairie Type. The lowland prairie type occurs on gently sloping plains and benches adjoining subirrigated bottoms and in playas. This type tended to occur on saline soils. None of the major soil types within the project area are saline, so this

type is probably limited in extent, possibly occurring adjacent to the unnamed tributary of Hay Creek and in playas.

Vegetative cover in the lowland prairie type averaged 28%; total ground cover averaged 72%. Dominant grass/grasslike species included western wheatgrass (*Elymus smithii*), Kentucky bluegrass (*Poa pratensis*), clustered field sedge (*Carex praegracilis*), prairie junegrass, blue grama (*Bouteloua gracilis*), foxtail barley (*Hordeum jubatum*), and inland saltgrass (*Distichlis stricta*). The common forbs were silvery lupine (*Lupinus argenteus*), white prairie aster (*Aster falcatus*), smooth scouring-rush (*Equisetum laevigatum*), and field chickweed. Common shrubs and subshrubs included rubber rabbitbrush (*Chrysothamnus nauseosus*), cudweed sagewort (*Artemisia ludoviciana*), fringed sagewort, and broom snakeweed.

Total herbaceous production averaged 640 pounds per acre. Most production was provided by perennial grasses (72% relative production), subshrubs (14% relative production), and perennial forbs (10% relative production).

Shrub density averaged 1,452 plants per acre. Rubber rabbitbrush was the predominant shrub (42% of all shrubs), followed by silver sagebrush (35%), and big sagebrush (14%). Subshrub density averaged 3,679 plants per acre (55% broom snakeweed and 45% fringed sagewort).

Mixed Grass Prairie Type. The mixed grass prairie type occupies rolling hills and ridges where soils are moderately deep to deep. This type occurred most frequently on sandy clay loams and fine sandy loams, and is likely to occur on the Arwite-Elwop, Keeline-Tulloch, and Xema-Vonalf-Mittenbutte associations (mapping units 1010, 1094, and 1194) in the project area.

Vegetative cover averaged 23%; total ground cover averaged 66%. Dominant grass/grasslike species in the mixed grass prairie included needle-and-thread, blue grama, prairie junegrass, threadleaf sedge, and western wheatgrass. Dominant forbs included Hood's phlox and low pussytoes (*Antennaria dimorpha*). Common shrubs and subshrubs were silver sagebrush, big sagebrush, prairie rose, broom snakeweed, and fringed sagewort.

Total herbaceous production averaged 428 pounds per acre. Perennial grasses (92% relative production) and perennial forbs (6% relative production) provided the most production.

Shrub density averaged 1,879 plants per acre, 49% of which were silver sage, 40% of which were big sagebrush, and 11% of which were prairie rose. Subshrub density averaged 5,232 plants per acre (72% broom snakeweed and 27% fringed sagewort).

Sandy Prairie Type. The sandy prairie type occurs on rolling hills and plains and is associated with windblown areas. This type commonly occupies areas with deep to moderately deep fine sandy loams and sandy loams. Thus, it is likely to occur in the windblown area on the western edge of the project area on Keeline-Tulloch soils (mapping unit 1094).

Vegetative cover averaged 26%; total ground cover averaged 63%. Dominant grass/grasslike species included needle-and-thread, prairie sandreed (*Calamovilfa longifolia*) sun sedge (*Carex pensylvanica*), prairie junegrass, threadleaf sedge and blue grama. The common forbs were hairy golden aster (*Heterotheca villosa*), western ragweed (*Ambrosia psilostachya*), narrowleaf gromwell (*Lithospermum incisum*), and green sagewort (*Artemisia campestris*). Common subshrubs and shrubs were fringed sagewort, prickly phlox (*Leptodactylon pungens*), and prairie rose.

Herbaceous production averaged 695 pounds per acre and were mainly perennial grasses (90% relative production) and perennial forbs (9% relative production).

Shrub density averaged 1,252 plants per acre--prairie rose (49%) and silver sagebrush) (48%) were predominant. Subshrub density averaged 2,694 plants per acre (60% fringed sagewort and 31% prickly phlox).

Big Sagebrush Type. The big sagebrush type is found on a variety of topographic locations including gentle slopes, rolling hills, and steep, dissected breaks. It commonly occurs on shallow clay loams and deep loams and occasionally occurs on sandy loams. Thus, it could occur throughout the project area although it is unlikely to occur on sandy windblown deposits (mapping unit 1094).

Vegetative cover in the big sagebrush type averaged 35%; total ground cover averaged 74%. Dominant species included big sagebrush (most common), prairie junegrass, needle-and-thread, green needlegrass (*Stipa viridula*), blue grama, bluebunch wheatgrass, western wheatgrass, and threadleaf sedge. Common forbs included Hood's phlox, littleleaf pussytoes (*Antennaria parvifolia*), American vetch (*Vicia americana*) and low pussytoes. Common subshrubs were broom snakeweed and fringed sagewort.

Total herbaceous production averaged 292 pounds per acre, most of which was provided by perennial grasses (92% relative production) and perennial forbs (4% relative production).

Shrub density averaged 5,800 plants per acre (95% big sagebrush and 3% silver sagebrush). Subshrub density averaged 3,039 plants per acre (69% broom snakeweed and 28% fringed sagewort).

Silver Sagebrush Type. The silver sagebrush type occurs on gentle to moderately sloping plains and rolling hills as well as ephemeral drainage bottoms and adjacent terraces. This type is found on a variety of soil textures and probably occurs throughout the proposed lease exchange area, except on the Wibaux-Shingle-Taluca complex (mapping unit 1198) which is steep and rocky.

Vegetative cover averaged 40%; total ground cover averaged 87% in 1988. Dominant species were silver sagebrush, sun sedge, needle-and-thread, Kentucky bluegrass, western wheatgrass, and prairie junegrass. Silverleaf scurfpea (*Psoralea argophylla*), field chickweed, scarlet globemallow (*Sphaeralcea coccinea*), and plains phlox (*Phlox andicola*) were common forbs. The most common subshrub was fringed sagewort.

Herbaceous production averaged 457 pounds per acre. Perennial grasses (91% relative production) and perennial forbs (5% relative production) provided the most production.

Rough Breaks Type. The rough breaks type occupies moderately to steeply sloping dissected areas where there is severe erosion potential. Substrates are very shallow clay loams and very fine sandy loams with frequent outcroppings of shale, siltstone, and sandstone. Within the proposed lease exchange area the Wibaux-Shingle-Taluca (mapping unit 1198) and Ucross-Iwait-Maladay (mapping unit 1176) complexes have these characteristics, and the rough breaks type may be relatively common in the proposed lease exchange area.

Vegetative cover averaged only 11%; total ground cover averaged 32%. Dominant species were bluebunch wheatgrass, broom snakeweed, big sagebrush, little bluestem, plains muhly (*Muhlenbergia cuspidata*), and rubber rabbitbrush. The common forbs were Hood's phlox, Nuttall goldenweed (*Haplopappus nuttallii*), white prairie clover (*Dalea candida*), and wild licorice (*Glycyrrhiza lepidota*).

Herbaceous production averaged 216 pounds per acre--most production was provided by perennial grasses (74% relative production) and perennial forbs (26% relative production).

Shrub density averaged 2,724 plants per acre (44% big sagebrush, 26% rubber rabbitbrush, and 15% prairie rose). Subshrub density averaged 3,657 plants per acre (62% broom snakeweed and 20% fringed sagewort).

Threatened, Endangered, and Candidate Plant Species

No federally listed threatened, endangered, or candidate plant species are known to occur within the project area or within a one-township buffer around it (University of Wyoming [UW] 1999).

Two species, rare to Wyoming, have occurred in the vicinity of the project area: short-point flatsedge (*Cyperus acuminatus*) and the small-flowered flame flower (*Talinum parviflorum*). These species are common elsewhere but reach the edge of their range in Wyoming. Both species are ranked S1 (quite rare in Wyoming) but are globally secure under present conditions, and they do not have any federal status.

WILDLIFE

Wildlife habitats in the area are primarily grasslands, mixed sagebrush, some combination of the two, and some agricultural lands. Antelope are the most common big game animal, and there is a relatively low population of mule deer. White-tailed deer are generally not found in the project area.

Big Game

The area is within the Gillette antelope herd unit (A351, hunt area 17) which covers the area north of I-90 between Wyoming Highway 59 and the Powder River. The herd unit includes 1,362 square miles of occupied habitat, none of which is considered crucial habitat. Within the herd unit, 60% (816.9 square miles) is yearlong range, including all of the proposed lease exchange area. Private lands comprise 83.5% of the herd unit, state lands 8.4%, and BLM-administered public lands 8%. The herd population peaked in 1983 with nearly 12,000 antelope, just above the population objective of 11,000; however, following a series of harsh winters and dry summers the population dropped to about 7,500 (WGFD 1998). During the late 1980s and early 1990s the population increased to nearly 16,000. A severe winter in 1992 and 1993, a very wet spring in 1993, high harvests in 1993 through 1995, and declines in fawn production all contributed to reducing the population to objective levels. The post-1997 population estimate (8,400 antelope) shows a herd well below the objective following a severe winter in 1996 and 1997. It may take two years before the herd reaches the objective level.

Traditional problems associated with managing the Gillette herd include achieving an adequate harvest because most of the occupied range is privately owned. License sales are controlled by landowner tolerance for hunters, often expressed as access fees.

During the 1998 aerial wildlife surveys for the Buckskin Mine permit area and a 2-mile buffer, no antelope were recorded within the area, although four herds (total of 36 animals) were seen within 1 mile of the proposed lease exchange area (Clayton 1999). All were seen in grassland or sagebrush/grassland habitat. Antelope numbers in the 1998 surveys were at their lowest level since 1987, and averaged 5.2 animals per square mile. The north-central portion of the survey area, which includes the proposed lease area had a density of antelope approximately the same as the entire area.

The project area is within the Powder River mule deer herd unit (MD319) which encompasses 4,375.7 square miles of occupied habitat, 91.5% of which is private surface. Of these lands, 75.1% are winter/yearlong range and 24.9% yearlong range. No habitat in the herd unit is classified as crucial. The entire proposed lease exchange area is classified as winter/yearlong deer range, and is located within hunt area 18 of the herd unit. Hunt area 18 encompasses the area from I-90 to the Montana border and from "D" road running from Moorcroft to Rocky Point on the east to US Highway 14/16 and Wyoming Highway 391 on the west. The population in the Powder River mule deer herd peaked during the 1980s at nearly 60,000 animals--well above objective--but fell to 34,000 in 1986 due to a series of harsh winters, dry summers, and hunting seasons designed to reduce the population. The population had been steadily increasing in recent years, but a dry summer in 1992 and severe winters in 1992 and 1993 and 1996 and 1997 caused a decline. The 1997 post-season population was estimated at about 41,000 mule deer, a decrease of almost 20% from the 1996 estimate due primarily to winterkill. The population objective is 52,000 mule deer. As is the case with antelope, finding land with access to hunting is a problem both for sportsmen and managers. Hunting access is also limited by the fact that no hunting is allowed within mine permit boundaries.

Other Mammals

Smaller mammals that most likely inhabit the proposed lease exchange area include the white-tailed jackrabbit, cottontail, thirteen-lined ground squirrel, olive-backed mouse, western harvest mouse, deer mouse, northern grasshopper mouse, meadow vole, prairie vole, and sagebrush vole. Carnivores include coyote, red fox, raccoon, badger, and striped skunk. No prairie dogs are found on the proposed lease exchange area.

Upland Game Birds

Sage grouse are the most common upland game bird species found in the vicinity of the proposed lease exchange area; however, the population is relatively low. There are no known leks within the project area, but one lek is located within approximately .5 mile. Gray partridge (*Perdix perdix*) and sharp-tailed grouse (*Tympanuchus phasianellus*) are occasionally seen in the general vicinity of the proposed lease exchange area.

Raptors

Raptors that have been found to nest in the general vicinity of the proposed lease exchange area include red-tailed hawk (most common), golden eagle, great horned owl, prairie falcon, northern harrier, and kestrel. No ferruginous hawks have ever been seen nesting in the adjacent Buckskin Mine permit area. Recent studies (Clayton 1999) identified three raptor nests in the vicinity of the proposed lease

exchange area that were active in 1998; none were within the proposed lease exchange area. One active great horned owl nest and one active red-tailed hawk nest were found just outside the proposed lease exchange area in section 20, T. 52 N., R. 72 W., and one active red-tailed hawk nest was found in section 27, T. 52 N., R. 72 W., about 1 mile south-southeast of the proposed lease exchange area.

Other Birds

Several common species of waterfowl, shorebirds, and waders have been recorded in the Buckskin Mine permit area to the south of the project area. Most were seen in the vicinity of ponds, reservoirs, and streams, which are not common in the proposed lease exchange area. More than 60 species of songbirds have been seen in the Buckskin Mine permit area, with some of the more common and widespread being the red-winged blackbird, mourning dove, western meadowlark, lark bunting, vesper sparrow, Brewer's sparrow, and horned lark.

The WGFD, FWS, and WDEQ have expressed concern for several avian species or subspecies that may occur in the proposed lease exchange area. These species have been designated as migratory birds of high federal interest (MBHFI). Table 3-5 lists MBHFI in the PRB and their reported occurrence on the Buckskin Mine permit area adjacent to the proposed lease exchange area. Seven of the 17 MBHFI have been observed on the Buckskin Mine permit area from 1989 through 1998-- canvasback, ferruginous hawk, golden eagle, prairie falcon, Richardson's merlin, sandhill crane, and long-billed curlew. Only the golden eagle and the prairie falcon have been seen in more than four of the 10 years of observations, and only those two species are known to nest in the area.

Reptiles and Amphibians

Few reptiles and amphibians have been observed during wildlife surveys on the adjacent Buckskin Mine permit area (Clayton 1999). Five amphibians and nine reptiles have been recorded in or near the Buckskin Mine wildlife study area since 1979, with the most species found in grasslands, sagebrush, and pond habitats.

Fish

There are no perennial streams in the proposed lease exchange area. Some ponds may contain fish populations, but none provide significant sport fisheries.

Threatened, Endangered, Candidate, and Sensitive Animal Species

The FWS and UW were contacted to obtain a list of threatened, endangered, candidate, and sensitive animal species that may be present on the proposed lease exchange area (Long 1999; UW 1999). No threatened, endangered, candidate, or

**TABLE 3-5
MIGRATORY BIRDS OF HIGH FEDERAL INTEREST
AND THEIR OCCURRENCE POTENTIAL**

Species	Seasonal Status/ Breeding Records ¹	Occurrence Potential in Proposed Lease Exchange Area	Record of Sighting near the Proposed Lease Exchange Area ²
White pelican	summer/nonbreeder	rare/migrant	no
Double-crested cormorant	summer/breeder	rare/migrant	no
Canvasback	summer/one record	rare/migrant	yes
Ferruginous hawk	summer/breeder	common	yes
Golden eagle	resident/breeder	common	yes
Bald eagle	winter/nonbreeder	common in winter	no
Osprey	summer/has nested	rare/migrant	no
Prairie falcon	resident/breeder	uncommon	yes
American peregrine falcon	migrant/historical	rare	no
Richardson's merlin	resident breeder	rare	yes
Whooping crane	never recorded	very rare/migrant	no
Sandhill crane	migrant/nonbreeder	uncommon/migrant	yes
Mountain plover	summer/breeder	uncommon	no
Long-billed curlew	summer/possible breeder	rare/migrant	yes
Burrowing owl	summer/breeder	uncommon	no
Lewis' woodpecker	summer/breeder	rare	no
Dickcissel	summer/breeder	rare	no
¹ For northeastern Wyoming, including Campbell and adjacent counties. From USDI, FWS 1980 and Oakleaf et al. 1991. ² From Clayton (1999).			

sensitive animal species have been observed on the proposed lease exchange area, Bald eagle and peregrine falcon have been seen in surrounding areas; however, the proposed lease exchange area would not provide important habitat for either. No black-footed ferret habitat (prairie dog colonies) is located on the project area, and neither mountain plover, burrowing owl, nor swift fox have ever been observed on the

proposed lease exchange area. All the streams in the proposed lease exchange area are ephemeral; therefore, there is no habitat for the sturgeon chub, a candidate species.

CULTURAL RESOURCES

The PRB appears to have been inhabited by aboriginal hunting and gathering people for more than 11,000 years. Throughout the prehistoric past the area was used by highly mobile hunters and gatherers who used a wide variety of resources. The general chronology for aboriginal occupations (dated as years before present [B.P.]) is:

- the Paleoindian period (11,000-7,500 years B.P.);
- the Archaic period (7,500-1,800 years B.P.);
- the Late Prehistoric period (1,800-400 years B.P.);
- the Protohistoric period (400-200 years B.P.); and,
- the Historic period (200-120 years B.P.).

The Paleoindian period includes a series of cultural complexes identified by distinctive large projectiles (spear points) often associated with the remains of large now-extinct mammals (mammoth, bison, camel, etc.). The Archaic period is characterized by a range of small side-notched, stemmed, or corner-notched projectile points and by more generalized subsistence pursuits including plant gathering. The lifeway continued to the Late Prehistoric period, which is marked by a technological change from dart projectiles to the bow and arrow and by the appearance of ceramics. During the Archaic and Late Prehistoric periods the PRB was occupied by small bands of hunters and gatherers. Their movements were determined largely by seasonal and environmental changes that influenced the occurrence of subsistence resources (USDI, BLM 1979).

Protohistoric and early Historic sites found in the PRB include rare historic trade goods, sites and routes associated with early trappers, military expeditions, and with early ranching attempts. A few small early coal mining sites also occur in the PRB.

The majority of the project area has been subject to previous surveys of several kinds. However, for a number of reasons, the 1982 cultural inventory conducted by the UW (Reher et al. 1983) was not submitted to the SHPO for review, and the sites located have not been evaluated for National Register eligibility. A small portion of section 20 has not been inventoried at all. Adjacent portions of sections 19 and 20 were surveyed by High Plains Consultants (Miller et al. 1982) and have been considered to fall within the Buckskin Mine lease.

The file search reports that five sites have been recorded within the proposed lease exchange area (table 3-6). None of these sites have been evaluated for National

Register eligibility, although 48CA874, a site with unusual cairn features, has been recommended as eligible for inclusion in the NRHP. Site 48CA867 has been recommended for avoidance. Since the sites were not evaluated at the time they were recorded, evaluation standards require an up-to-date condition description and environmental context. The sites must be relocated and evaluated in light of current knowledge of settlement patterns and environmental change. Site recommendation for eligibility must then be submitted to the Wyoming SHPO. Eligible sites will then be identified for protection or mitigation in the future mine plan.

**TABLE 3-6
CULTURAL RESOURCE SITES RECORDED ON OR
IMMEDIATELY ADJACENT TO THE PROPOSED ACTION**

Site Number	Site Type	Inventory History	Recommendations
48CA1615	open camp	Reher et al. (1983)	not eligible
48CA867	cairn, rockshelter	Reher et al. (1983)	unevaluated
48CA873	cairn	Reher et al. (1983)	not eligible
48CA874	cairns	Reher et al. (1983)	eligible
48CA1837	lithic scatter	Miller et al. (1982)	not eligible

Site 48CA874, a site with stone features, has been evaluated as eligible for inclusion in the NRHP. Formal consultation with the Wyoming SHPO has not been conducted for any of the sites.

The Crow, Shoshoni, Arapaho, Cheyenne, and Sioux were among the primary Native American groups that used the PRB (USDI, BLM 1979). Native American tribes have been consulted at a general level for the 1995-1996 draft Buffalo Field Office's RMP (USDI, BLM 1983a). For this EA, letters were sent to the Northern Arapaho, Eastern Shoshone, Northern Cheyenne, Ogalala Lakota Nation, and Crow tribal councils or tribal representatives requesting comments on the proposed project's potential impacts to important cultural or traditional sites. No responses have been received to date, and no Native American concerns have been identified.

PALEONTOLOGICAL RESOURCES

The Wasatch Formation in the PRB is known to contain important vertebrate fossils including fishes, turtles, champsosaurs, crocodiles, alligators, and mammal material (Delson 1971; Carpenter 1980, 1981a, 1981b; Breithaupt 1985). Vertebrate fossils are also known to exist in the Wasatch (McKenna 1960) and Fort Union (Winterfeld 1979) formations in other parts of Wyoming and Colorado. The Spring Draw Tract, located

in the northern portion of the current Buckskin permit area, was surveyed in 1982 and no fossils were discovered (Miller et al. 1982). However, Peterson et al. (1982) discovered significant vertebrate fossils in the Rawhide Mine permit area just south of the Buckskin Mine, so there is potential for important fossils to occur within the proposed lease exchange area.

VISUAL RESOURCES

Visual sensitivity levels are determined by people's concern for what they observe and how frequently they observe them. Landscapes within the area include rolling sagebrush and short-grass prairie that is common throughout the PRB. Existing surface coal mines form a somewhat continuous band on the east side of US 14/16 north of Gillette (map 1-2 in chapter 1). Other man-made intrusions include ranching activities (fences, homes and ranch buildings, and livestock), oil and gas development (pump jacks and pipeline facilities), electric transmissions lines, and residential housing. The scenic quality in the vicinity of the proposed lease exchange area is relatively low because of this development and the existing surface coal mining operations.

The visual resource management (VRM) classifications and guidelines system is the basic tool BLM uses to inventory and manage visual resources on public lands. VRM classes provide for an increasing level of change within the characteristic landscape combined with an evaluation of visual quality, sensitivity of the area, and viewing distances. The VRM classes are defined as follows:

Class I: Natural ecological changes and very limited management activity is allowed. Any contrast (activity) within this class must not attract attention.

Class II: Changes in any of the basic elements (form, line, color, texture) caused by an activity should not be evident in the landscape.

Class III: Contrasts to the basic elements caused by an activity are evident but should remain subordinate to the existing landscape.

Class IV: Activity attracts attention and is a dominate feature of the landscape in terms of scale.

Class V: This classification is applied to areas where the natural character of the landscape has been disturbed to a point where rehabilitation is needed to bring it up to the level of one of the other four classifications.

When development is proposed, the degree of contrast between the proposed activity and the existing landscape is measured. In this process, various factors such as form, line, color, texture variety, contrast, and lighting are evaluated. The area was

classified VRM Class IV in the Buffalo RMP (USDI, BLM 1985 [map 3]). The natural character of the landscape on and adjacent to the proposed lease exchange area has already been interrupted by human-related disturbances.

NOISE

Existing noise sources in the project area include adjacent surface coal mining activities, traffic on Wyoming 59, US 14-16, Campbell County roads 17-23 and 17-73, railroad traffic, ranching activities, and wind. No site-specific noise level data are available for the area. Because the Buckskin Mine is adjacent to the proposed lease exchange area, noise is probably in the range reported for "suburban residential at city outskirts" (Wyle Laboratories 1971). That is, a median noise level of 40 to 60 A-weighted decibels (dBA) for day, evening, and nighttime, with the noise level increasing closer to active mining. Mining activities are characterized by noise levels of 85 to 95 dBA at 50 feet from the actual mining operations and related activities (USDI, BLM 1992). Table 3-7 presents noise levels associated with commonly heard sounds.

**TABLE 3-7
COMPARISON OF MEASURED NOISE LEVELS
WITH COMMONLY HEARD SOUNDS**

Source	dBA	Subjective Description
Normal breathing	10	barely audible
Rustling leaves	20	
Soft whisper (at 16 feet)	30	very quiet
Library	40	
Light traffic (100 feet)	50	quiet
Vacuum cleaner (10 feet)	60	moderately loud
Busy traffic (100 feet)	70	noisy
Freight cars (50 feet)	80	
Heavy truck (50 feet)	90	very loud
Ambulance siren (100 feet)	100	
SOURCE: US Department of Housing and Urban Development 1985.		

AIR QUALITY

Air quality standards in Wyoming are administered by the state of Wyoming and the Environmental Protection Agency (EPA) through the Wyoming Air Quality Standards and Regulations (WDEQ/AQD 1995), which are enforced by the WDEQ/AQD. Air quality on lands outside of an approved mine permit boundary (within the public domain) are regulated by the WDEQ/AQD. Lands within an approved mine permit boundary and not accessible to the public are not subject to WDEQ/AQD standards. They are governed by the Mine Safety and Health Administration respirable dust regulations. In order for Wyoming to have state primacy of the federal Clean Air Act, the WDEQ/AQD has adopted the primary (health) and secondary (property) air quality standards presented in table 3-8. Maximum allowable increments of deterioration are presented in table 3-9.

The prevention of significant deterioration (PSD) program administered by the WDEQ/AQD is designed to preserve air quality that meets existing standards by limiting the increase in pollutants over current levels. Table 3-9 lists the allowable increment of PM_{10} sized particulates that is allowed under WDEQ/AQD PSD regulations (WDEQ/AQD 1995). Class I areas, which are allowed the smallest increment, include national parks and wilderness areas. All of Wyoming outside of national parks and wilderness areas is included in the Class II designation, reflecting the state's low overall air pollution level. The closest Class I area to the proposed lease exchange area is Wind Cave National Park in southwestern South Dakota, about 120 miles to the southeast.

In the vicinity of the proposed lease exchange tract, the main sources of air pollution are surface coal mines, vehicle traffic, various sources associated with oil and gas production, railroad traffic, and farming and ranching activities. The closest operating power plants are approximately 15 miles south of the tract in Gillette.

The major type of emissions from surface coal mining activities is fugitive dust. Blasting and moving overburden, crushing, loading, and hauling coal, and the large areas of disturbed land all produce dust. Wyoming's ambient air standards for particles include both PM_{10} and TSP standards. PM_{10} is respirable particulate matter (less than 10 microns) which can penetrate into the lungs and cause health problems. TSP is total suspended particles. The current Wyoming and national standards are shown in table 3-8.

Vehicle traffic, both inside and outside the areas of surface coal mining, is responsible for tailpipe emissions and for the emission of fugitive dust from paved and unpaved surfaces. Vehicle emissions consist primarily of nitrogen oxides (NO_x) and carbon monoxide (CO) and may include sulfur dioxide (SO_2) and, by secondary processes, ozone. The national and state standards for emissions of these substances are also shown in table 3-8.

**TABLE 3-8
NATIONAL AND WYOMING AIR QUALITY STANDARDS**

Air Pollutant	Averaging Period¹	Wyoming Standard ($\mu\text{g}/\text{m}^3$)²	NAAQS³ ($\mu\text{g}/\text{m}^3$)²
Total suspended particulates (TSP) ⁴	24-hour	150	----
Respirable particulate matter (PM ₁₀) ⁴	24-hour	150	150
	annual geometric mean	50	50
Nitrogen oxide (NO _x)	annual arithmetic mean	100	100
	1-hour	160	235
Photochemical oxidant (ozone) (O ₃)	1-hour	160	235
Sulfur dioxide (SO ₂)	3-hour	1,300	----
	24-hour	260	365
	annual arithmetic mean	60	80
Carbon monoxide (CO)	1-hour	40,000	40,000
	8-hour	10,000	10,000

¹May not be exceeded more than once per year.

²Adapted from WDEQ/AQD (1995).

³National Ambient Air Quality Standard, adapted from 40 CFR 50.5-50.12.

⁴Particulates are very small-diameter solids or liquids. Crushing or grinding rock or loading dry materials in bulk can create fine dusts. Vehicle traffic on dirt and gravel roads also generates large quantities of dust. Combustion processes can also emit small particles of noncombustible ash or incompletely burned soot. TSP includes all particulates suspended in the atmosphere. Respirable particulate matter is the very fine fraction (less than 10 microns in diameter) which can penetrate deep into the lungs and cause health problems.

TABLE 3-9
MAXIMUM ALLOWABLE INCREMENTS OF DETERIORATION
 ($\mu\text{g}/\text{m}^3$)

Pollutant	Class I	Class II
Particulate Matter: PM ₁₀ , annual arithmetic mean	4	17
PM ₁₀ , 24-hour maximum	8	30
Sulfur Dioxide: Annual arithmetic mean	2	20
24-hour maximum ¹	5	91
3-hour maximum ¹	25	512
Nitrogen Dioxide: Annual arithmetic mean	2.5	25
¹ May not be exceeded more than once per year at any receptor site. SOURCE: WDEQ/AQD 1995.		

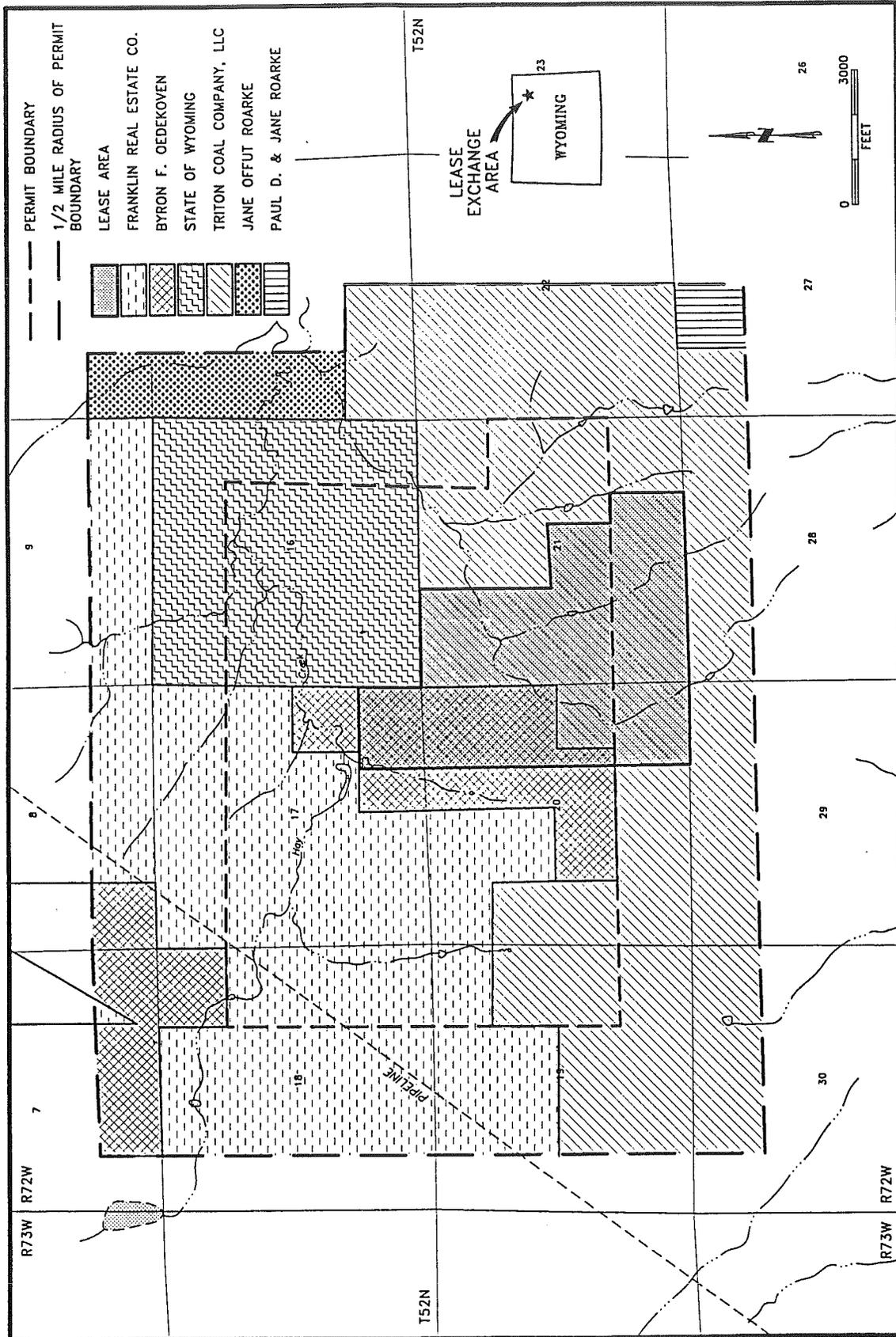
The compressor stations and large generators associated with oil and gas production and transport, and fossil fuel-fired power plants produce emissions of NO_x, SO₂, CO, TSP, PM₁₀, volatile organic compounds, and smaller amounts of other pollutants.

The main pollutant of concern associated with the locomotive for the trains used to haul coal and other commodities is No_x. The main pollutants produced by farming and ranching activities are dust and No_x.

In order to obtain a state air quality construction and operating permit, each mine may be required to demonstrate, through dispersion modeling, that its activities will not increase PM₁₀ levels above the annual standard established by the Wyoming Air Quality Standards and Regulations (WDEQ/AQD 1995). The modeling demonstration must include the estimated air pollutant emissions from other existing pollution-generating activities, including adjacent mines, so that control of overall air quality is part of the permitting process.

LAND USE

Past uses of the proposed lease exchange area and adjacent properties include ranching and farming, coal and scoria mining, oil and gas exploration, wildlife habitat, hunting, residential, and transportation and utility corridors (Triton 1996). These land uses are occurring now except scoria mining and residential. The surface of the project area is privately owned, whereas coal is all federally owned (map 3-5). According to the oil and gas plat, the federal government owns the oil and gas rights on about 153 acres of the tract--the oil and gas rights on the rest of the tract are privately owned.



MAP 3-5
 SURFACE OWNERSHIP IN THE PROPOSED LEASE EXCHANGE AREA

Agriculture/Rangeland

The proposed lease exchange area is not within any BLM-administered grazing allotment (USDI, BLM 1983a). Livestock carrying capacity in this area averages 3 to 5 acres per animal unit month (AUM). Approximately 579 acres are grazed, so the tract provides an estimated 116 to 193 AUMs.

The remaining 30 acres in the tract are dryland farmed, primarily for hay for livestock. Hay production averages 1 ton per acre.

Extractive Mineral Operations/Oil and Gas Exploration

No mining is currently occurring in the proposed lease exchange area. One federal oil and gas lease (WYW138419) occurs in NWSE of section 20. Three oil and gas exploration holes have been drilled, plugged, and abandoned on the proposed lease exchange tract. Although scoria mining has occurred in the area, it is not a current land use.

Recreation

Recreational use of the area is primarily hunting and off-highway vehicle travel. Other uses (hiking, camping, and wildlife watching) are limited. The proposed lease exchange area is in antelope hunt area 17 and mule deer hunt area 18. In 1997, 1,100 antelope licenses were offered and 978 hunters harvested 977 animals--853 bucks, 98 does, and 26 fawns--for a 99.9% success rate. This represents a 7-year low in harvest. Hunters spent an average of 2.7 days to harvest an antelope. In 1997, an estimated 3,902 deer licenses were offered and 3,819 hunters harvested 2,935 animals--2,862 bucks and 73 does and fawns--for a 76.9% success rate. Hunters spent an average of 5.5 days to harvest a deer.

Land Status and Prior Rights

The project area can be accessed by two-track dirt roads. No permanent residences, easements, or ROWs occur within the area. The nearest ROW is the Western Oil Transportation Company pipeline in the extreme northwestern corner of section 17, T. 52 N., R. 72 W., approximately 0.75 mile northwest of the proposed lease exchange area.

Triton Coal Company currently holds the federal lease for coal immediately south of the Hay Creek tract where annual coal production averages 20 million tons (Faulconer 1999).

SOCIOECONOMICS

The geographic area considered for socioeconomic analysis is Campbell County and primarily the town of Gillette. This area was selected because it is impacted most by the proposed project. It provides most of the housing and services to existing mine personnel and would likely do so for mine personnel employed at the proposed project. There would be some limited direct impacts to surrounding counties, especially Crook, where a few workers reside mainly in Moorcroft. Because of the magnitude of surface coal mining in Campbell County, and the revenues the industry generates to state, county, and local coffers, the mining industry in Campbell County has a significant positive impact on the finances of Wyoming.

Employment

In 1997, 81% of the average annual covered employment (those employees covered by the Unemployment Insurance Law) in Campbell County were in the private sector and 19% in the public sector (Wyoming Department of Employment [WDE] 1998). The total payroll for the private sector from covered employment was approximately \$422.5 million, or 85% of the \$497.4 million payroll in Campbell County during 1997. Total wages increased by 7% in 1997 as compared to 1996. Of the 13,315 private sector jobs, 4,133 (31%) were in mining (including oil and gas), 2,798 (21%) were in retail trade, 2,391 (18%) were in service, and 1,583 (12%) were in construction. Of the 3,037 government employees, 92% worked for local governments, 5% for state government, and 3% for the federal government.

The average annual wage for Campbell County covered employees in 1997 was \$30,420 (WDE 1998)--the second highest of any county in Wyoming. The mining industry had the highest average annual wage (\$52,702), followed by federal employees (\$36,079) and wholesale trade (\$35,988). The lowest average annual wages were for retail trade (\$13,447) and agriculture (\$13,976).

Major employers in Campbell County include coal mines and related mine services, the Campbell County School District, Burlington Northern Santa Fe Railway, Campbell County Memorial Hospital in Gillette, and Campbell County government (Wyoming Department of Administration and Information [WDAI] 1996). Unemployment rates in Campbell County during 1998 and January 1999 varied from a high of 6.7% in January 1999 to a low of 3.9% in August 1998. Unemployment rates were 5.9% and 3.8%, respectively, in Wyoming and 4.8% and 4.5%, respectively, in the US (Evans 1999).

Population

Campbell County's 1999 estimated population is 32,400, up from 31,456 in 1995; the estimated 1999 population of Gillette is 19,436, up from 18,889 in 1995; and the 1999

estimated population of Wright is 1,357, up from 1,305 in 1995 (Liu 1999). A majority of the employees who work at the existing coal mines in the Gillette area also live in Gillette.

Housing

According to the 1990 census, there were 9,968 occupied and 1,570 unoccupied housing units in Campbell County. Comparable numbers for Gillette were 6,241 and 837, respectively, and for Wright were 381 and 146, respectively (Liu 1999). The existing market for rental units is tight, but there is a good supply of homes for sale. New homes range in price from \$100,000 and up, whereas existing homes sell for \$85,000 to \$90,000 and up (Palmer 1999). Space in mobile home parks is limited, but some subdivisions allow modular homes. Numerous hotel and motel facilities are available, especially in Gillette.

Schools

Campbell County has one school district made up of 23 schools with 366 classroom units. Fall 1996 enrollment was 7,906, and 528 students graduated from high school in 1997. Gillette was recently second in the nation for state and local government monies spent for higher education and second in the nation for high school graduation rate. Northern Wyoming Community College and a vocational school for welding and diesel instruction are also located in Gillette.

Local Government Taxation and Revenue

Property taxes are determined by multiplying the assessed value of properties by the tax rate (mill levy). Residential and commercial properties are assessed at 9.5% of market value, industrial properties at 11.5%, and mineral and mine products at 100% (Wyoming Taxpayers Association [WTA] 1998). Taxes are collected for the county, as well as cities, towns, school districts, and special districts, and each jurisdiction receives revenue according to the mill levy for that jurisdiction. The 1998 mill levy for Campbell County was 59.970 mills and 67.182 mills in Gillette and Wright. Based on an assessed valuation of approximately \$1,495 million (the highest of any county in Wyoming), the county collected taxes totaling approximately \$90.3 million (WTA 1998). The assessed valuation of Campbell County was 58% and was comprised of the assessed valuation of surface coal.

State sales tax (4%) collections for fiscal year 1998 in Campbell County were approximately \$39.9 million. Local government receives 28% of the state sales and use taxes. In fiscal year 1998, more than \$18 million were distributed to Campbell County and incorporated areas within the county. Campbell County received \$6.5 million, Gillette received \$10.8 million, and Wright received \$0.761 million Wyoming Department of Revenue [WDR] 1999).

Community Characteristics, Facilities, and Infrastructure

Gillette, the county seat of Campbell County, is more than 100 years old and was founded when the Burlington and Missouri route to Sheridan was being planned. Originally called "Donkey Town" because of its proximity to Donkey Creek, it was instead named after Edward Gillette, the surveyor who suggested the route. The railroad reached Gillette in 1891, and the town was incorporated the following year. It became a shipping point for local ranchers and homesteaders and grew slowly over the years. Since the 1960s, Campbell County and Gillette have experienced growth first powered by oil and then by coal. Gillette's oil boom began in 1967. When the oil boom of the 1970s was followed by the bust of the 1980s in much of the state, Campbell County and Gillette caught the coal wave from the enormous reserves of low-sulfur coal in the area. Wright, located in southern Campbell County, is Wyoming's newest town (established in 1976). It has grown to over 1,300 with modern schools and a small shopping mall. Funded partly by Atlantic Richfield Company, Wright was built to house workers for nearby coal mines.

Gillette has all of the usual facilities for a town its size, including both AM and FM radio stations, a 50+ member full-time police department, a full-time fire department, zoning regulations, a small airport, bus service, and a public transportation system. It is governed by a mayor/council type of city government, is serviced by US West (telephone), City of Gillette (electric and water), and Northern Gas of Wyoming (natural gas), and has a conventional activated sludge domestic sewage system. There are three libraries, nearly 100 day care centers, 39 churches, numerous shopping centers, a 150-room hospital, ambulance service, more than 40 parks, two museums, and a multi-events center.

Transportation

Public roads closest to the proposed lease exchange area are US Highway 14-16, Wyoming State Highway 59, and Campbell County roads 17-23 and 17-73. US 14-16 is about 3 miles west of the project area and Wyoming 59 lies approximately 2 miles east. Both highways are paved two-lane roads that run generally north-south. The county roads are improved two-lane roads that also run north-south. Campbell County Road 17-23 is about 2.5 miles west of the proposed lease exchange area; Campbell County Road 17-73 branches east of Campbell County Road 17-23 about 1.5 miles from the northeast corner of the project area. There are also several unnamed two-track roads that either cross the area or are adjacent to it.

The nearest railroad facilities are the Burlington Northern/Santa Fe Railroad spurs accessing the Buckskin Mine 1.5 miles south of the proposed lease exchange area, and the Rawhide Mine approximately 5 miles southeast of the proposed lease exchange area. The Buckskin Mine railroad loop is the northern terminus of a series of spur lines that serve the surface coal mines north of Gillette.

Environmental Justice

Environmental justice issues are concerned with actions that unequally impact a given segment of society as a result of physical location, perception, design, and noise, among others. On February 11, 1994, Executive Order 12898, "Federal Action to Address Environmental Justice in Minority Populations and Low-Income Populations" was published in the *Federal Register* (59 *Fed. Reg.* 7629). It requires federal agencies to identify and address disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations (defined as those living below the poverty level). The executive order makes clear that its provisions apply fully to American Indian populations and Indian tribes--specifically to effects on tribal lands, treaty rights, trust responsibilities, and the health and environment of Indian communities.

Minority population refers to individuals classified by Office of Management and Budget as Black/African American, Hispanic, Asian and Pacific Islander, American Indian, Eskimo, Aleut, or other nonwhite person. To be affected under environmental justice, the minority population of the affected area must either exceed 50%, or the minority population percentage of the affected area must be meaningfully greater than the minority population percentage of the general population (or other appropriate unit of geographic analysis), or if more than one minority group exists and by aggregating all minority groups together meets the above-stated thresholds.

Low-income populations are determined by using two tests: Department of Health and Human Services poverty guidelines or Department of Housing and Urban Development statutory definition for very low-income for the purposes of housing benefits programs.

Socioeconomic analysis for the area includes the incorporated and unincorporated communities located within Campbell County. There are no communities within the proposed lease exchange area. There are no groups of minorities or aggregated group of minorities found within the county that meet the minority threshold (exceed 50%). Any direct, indirect, and cumulative health and environmental impacts of management actions on the minority population in Campbell County would be minor. Therefore, minority populations would not be affected by any alternative identified in a disproportionately high manner. Environmental justice is not discussed further in this EA.