

3.0 AFFECTED ENVIRONMENT

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. Figure 3-1 shows the general analysis area for most environmental resources.

Critical elements of the human environment (BLM 1988) that could potentially be affected by the proposed actions include air quality, cultural resources, Native American religious concerns, threatened or endangered (T&E) species, hazardous or solid wastes, water quality, and wetlands/riparian zones. USFS Region 2 Sensitive Species could also be affected by the proposed projects. 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 the project on topography and physiography, geology and mineral resources, soils, water quantity, alluvial valley floors, wetlands, vegetation, wildlife, land use and recreation, paleontological resources, visual resources, noise, transportation resources, and socioeconomics.

3.1 General Setting

The project area is located in the PRB, a part of the Northern Great Plains, which includes most of northeastern Wyoming. Vegetation is primarily sagebrush and mixed grass prairie. The climate is semi-arid, with an average annual precipitation at Wright (see

Figure 3-1) of just over 11 inches (Martner 1986). June (2.35 inches) and May (2.04 inches) are the wettest months, and February (0.29 inch) is the driest. Snowfall averages 25.1 inches, with most occurring in March (5.0 inches) and December (4.5 inches). Potential evapotranspiration, at approximately 31 inches (National Oceanic and Atmospheric Administration 1969), exceeds annual precipitation. The average daily mean temperature is 44.2°F. The highest recorded temperature was 103°F and the lowest was -34°F. July is the warmest month, with a mean daily temperature of 70°F, and January is the coldest (20.5°F). The frost-free period is 100-125 days.

The average annual wind speed at the Black Thunder Mine, which is located between the two LBA areas (see Figure 3-1) is 11.6 miles per hour (mph), with winter gusts often reaching 30-40 mph. Wind speeds are highest in the winter and spring and are predominantly from the southwest and northwest. During periods of strong wind, large quantities of surficial sediments may be entrained and transported notable distances by saltation or in suspension, impacting air quality across the region. The absence of locally elevated terrain limits the formation and duration of temperature inversions, resulting in an average of 15 air-stagnation events annually in the PRB with an average duration of two days each (BLM 1974). General information describing the area's resources were gathered from draft BLM Buffalo Resource Area planning documents (BLM 1996a, 1996b, 1996c, 1996d, 1996g) and a BLM coal leasing study (BLM 1996e).

3.2 Topography and Physiography

The PRB is an elongated, asymmetrical structural downfold. The landscape consists of broad plains, low hills, and tablelands.

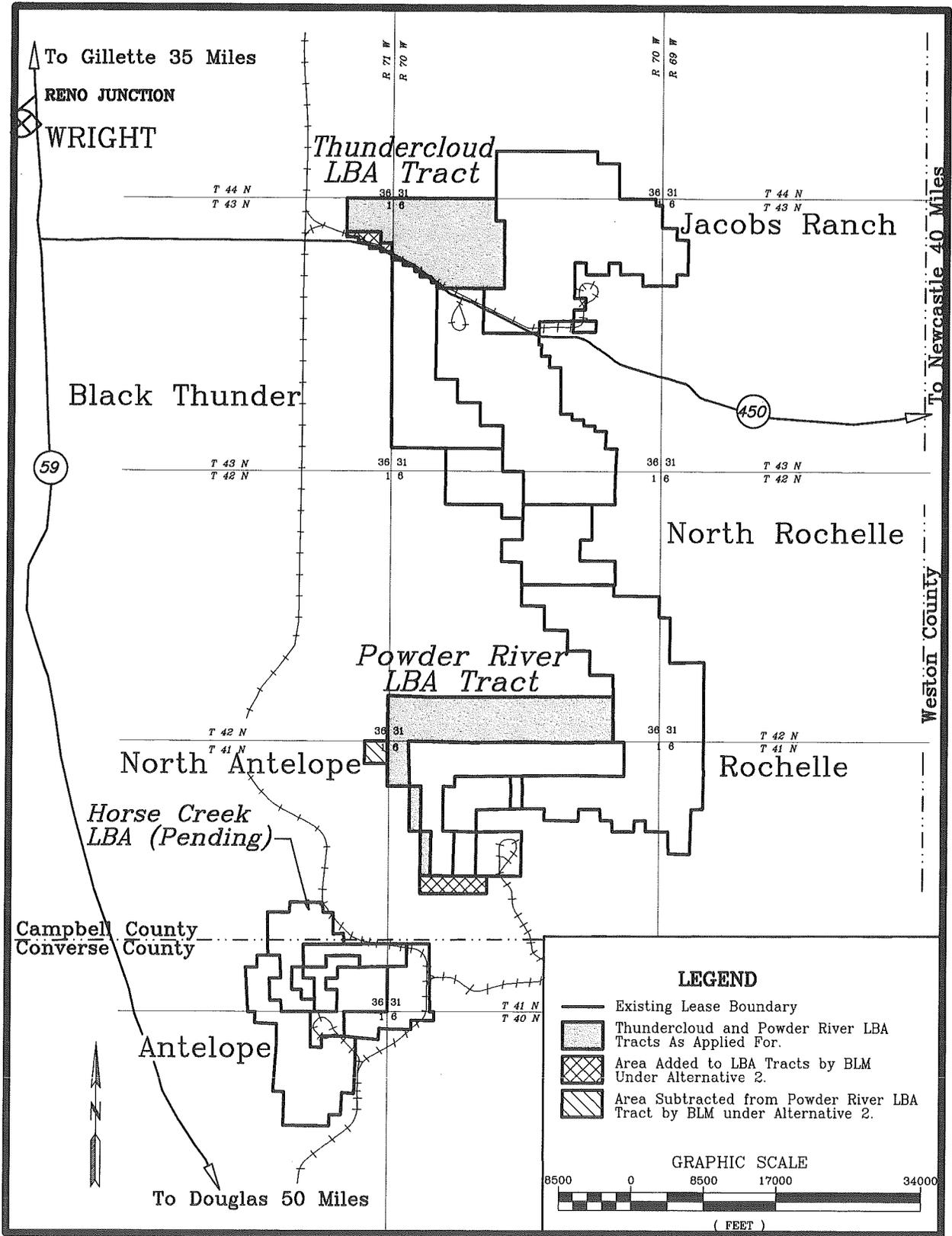


Figure 3-1. General Analysis Area

The steep western limb and the gentle eastern limb of the PRB dip approximately 550 ft/mile and 150 ft/mile, respectively, towards the PRB axis that lies near the western margin. The area is characterized by broad plateaus dissected by incised stream valleys, which create much of the topographic relief. Many of the surfaces exhibit land features strongly influenced by recent wind activity. Strong winds are responsible for differential erosion of the soft surficial sediments by deflation processes. Sediment transport by wind results in removal of large quantities of sediment from some areas. The accumulation of extensive deposits of these fine sediments downwind results where wind velocities are effectively reduced by natural topographic features that influence settling of suspended loads. Generally, the topography changes from open hills with 500-1,000 ft of relief in the northern part of the PRB to plains and tablelands with 300-500 ft of relief in the southern part. Playas--shallow, closed (internally drained) ponds that receive water during wet seasons--are common. Buttes and plateaus capped by clinker or sandstone are also prevalent.

The PRB is bounded by the Casper Arch, Laramie Mountains, and Hartville Uplift to the south, the Miles City Arch in Montana to the north, the Big Horn Mountains on the west, and the Black Hills to the east. The LBA tracts are located in the south-central part of the PRB at an elevation of about 4,700 ft in an area of low rolling topography.

3.3 Geology

The applicants' main mining objective is the Wyodak coal seam. Confusion has resulted from the use of several names for the unit, including Wyodak, Wyodak-Anderson, Anderson-Wyodak, Anderson-Canyon, Roland-Smith, and others. According to Denson and Pierson (1991), the Anderson and

Wyodak form a single, laterally continuous coal unit, which Glass and Jones (1992) refer to as the Wyodak bed in the Gillette area. The Wyodak bed splits to form the Anderson and Canyon beds (Denson and others 1978). Where the Anderson and Canyon beds diverge and the non-coal rock thickness between them exceeds the thickness of either coal, they are referred to separately as the Anderson or Canyon. In the vicinity of the two LBA tracts, partings are present, but they do not exceed the thickness of the two beds they separate.

At the Thundercloud LBA Tract there are up to three mineable coal seams. These seams are referred to by KMCC personnel as the upper, middle and lower Wyodak. At the Powder River LBA Tract there is one mineable seam, referred to as the Wyodak-Anderson by PRCC personnel. The discussions in this EIS refer to the collective coal seams as the Wyodak coal unless noted otherwise.

The rocks above the recoverable coal (overburden) are interbedded sandstones, siltstones, and shales of the Paleocene Fort Union and Eocene Wasatch formations. For simplicity, mine personnel generally consider the top of the thick, mineable coal zone as the contact between the Fort Union Formation and the overlying Wasatch Formation. At the Wyodak Mine near Gillette, the contact between the Wasatch and Fort Union formations occurs at the top of the mineable coal (Glass 1976). The contact between the Fort Union and Wasatch formations in the Thundercloud LBA Tract and Powder River LBA Tract areas as mapped by Denson and others (1978) occurs several feet above the mineable coal zone.

The main coal seam on the LBA tracts is approximately 75 ft thick. At the Thundercloud LBA Tract, where all three beds merge, the combined thickness may

exceed 100 ft. The overburden ranges from about 150 ft thick at the eastern boundaries of the LBA tracts to over 250 ft on the northern and western boundaries. Figures 3-2 and 3-3 show geologic cross sections drawn through the Thundercloud and Powder River LBA Tracts, respectively. These sections are representative of the geology in the vicinity of the two LBA tracts, the primary variables being the amount of sandstone in the overburden, the local presence of overlying coal seams (rider seams, which are not mineable) or splits in the main Wyodak seam with varying thicknesses of non-coal material (parting) between the seams, and the surface topography. In general, due to gentle westward dip of the PRB in this area, overburden thickness increases toward the west. Erosion has lowered the topography, and therefore reduced overburden thickness, in the stream valleys.

Surficial deposits in the analysis area include Quaternary alluvial and eolian deposits, scoria or clinker, and weathered Wasatch and Fort Union formations. Figure 3-4 shows the stratigraphic relationships of the surface and subsurface geology on and within the two LBA tracts. Scoria forms when near-surface coal beds spontaneously burn and bake the overlying rocks. Scoria is characteristically red in color and in some cases is similar to angular porous gravel; it is generally more resistant to erosion than the enclosing sediments and often forms buttes and plateaus east of the LBA tracts in an area regionally known as the Rochelle Hills. Scoria deposits generally are situated along the coal outcrop, which is where the coal is exposed at the surface. The Wyodak coal is below the surface on both LBA tracts; therefore, scoria is not present on either tract. Surface deposits on the LBA tracts consist of minor alluvial deposits along creeks (North Prong Little Thunder Creek and Mills and Shipley Draws in the

Thundercloud LBA Tract and Porcupine Creek in the Powder River LBA Tract) within the Wasatch Formation. The alluvial deposits consist primarily of poorly to well-sorted, irregularly bedded to laminated, and unconsolidated sand, silt, and clay with minor interbeds of fine gravel. Wind-blown sediments form a thin veneer at the surface along the eastern edge of the Thundercloud LBA Tract and over much of the Powder River LBA Tract.

Drilling and sampling programs have been conducted within specific mines to identify overburden which may be unsuitable for reclamation (i.e., poor for use in re-establishing vegetation). All of the mines have identified some materials which may be unsuitable for reclamation purposes and must be appropriately placed in mine backfill to optimize re-vegetation. Backfill monitoring plans are in place at both Jacobs Ranch Mine and North Antelope and Rochelle Mines to evaluate the quality of replaced overburden. Management plans ensure that materials potentially unsuitable due to adverse levels of pH, selenium or other constituents are not placed in areas where they may affect groundwater quality or revegetation success.

Mineral Resources

The PRB contains large reserves of fossil fuels including oil, natural gas or methane (from conventional reservoirs and from coal beds), and coal, all of which are currently being produced. In addition, uranium, bentonite, and scoria are mined in the PRB (BLM 1996g).

Coal. There are 17 active coal mines lying along a north/south line that parallels Highway 59 starting just north of Gillette, Wyoming, and extending south for about 75 miles (see Figure 1-1). The mines have been located where the coal is at its shallowest

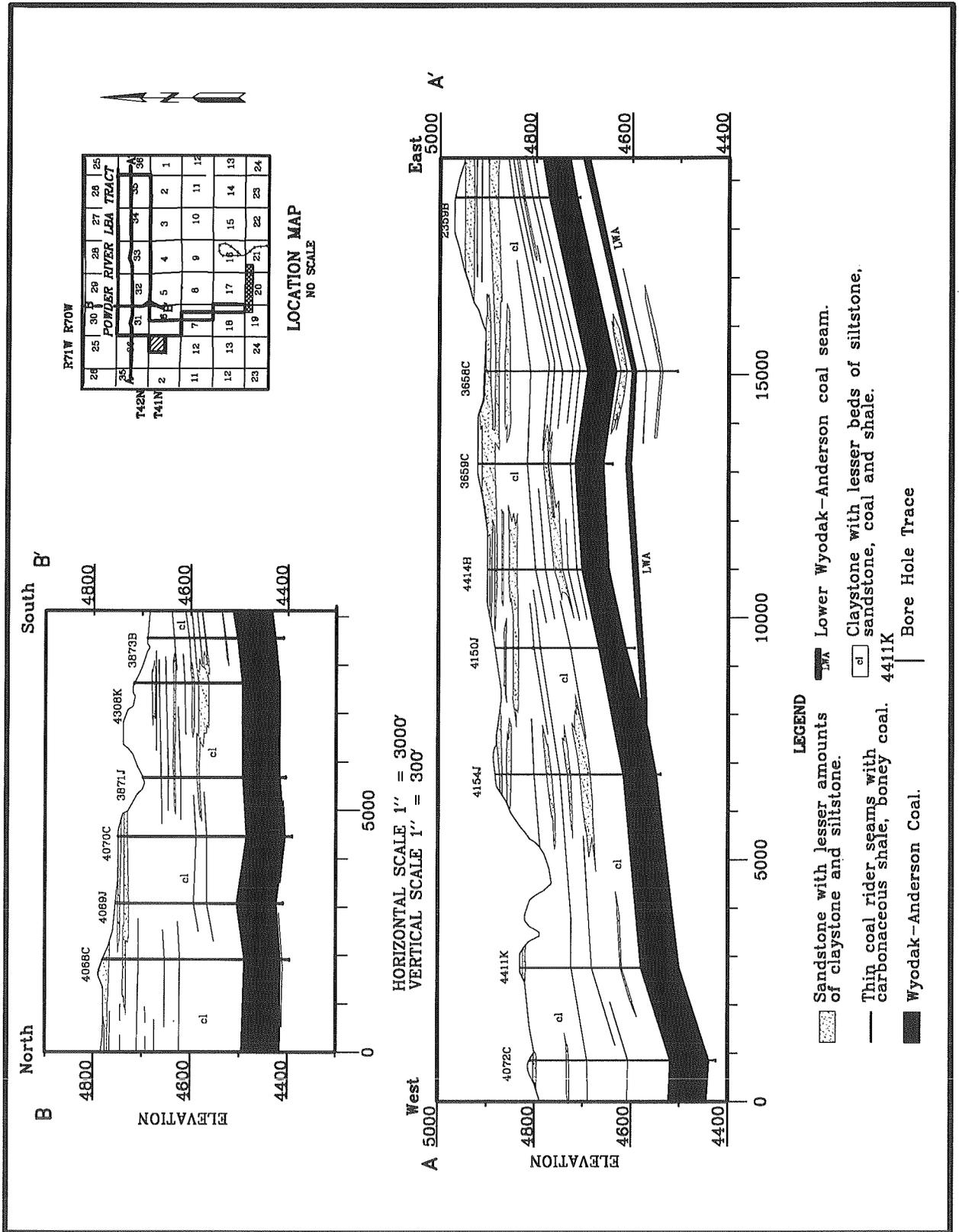
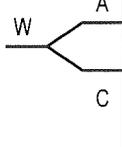


Figure 3-3. North-South and East-West Geologic Cross Sections, Powder River LBA Tract

Geologic Unit		Hydrologic Characteristics
RECENT ALLUVIUM HOLOCENE		Typically fine grained and poorly sorted in intermittent drainages. Occasional very thin, clean interbedded sand lenses. Low yields and excessive dissolved solids generally make these aquifers unsuitable for domestic, agricultural and livestock usage. Low infiltration capacity unless covered by sandy eolian blanket.
CLINKER HOLOCENE TO PLEISTOCENE		Baked and fused bedrock resulting from burning coal seams which ignite on the outcrop from lightning, manmade fires or spontaneous combustion. The reddish clinker (locally called scoria, red dog, etc.) formed by melting, partial fusing from the burning coal. The baked rock varies greatly in the degree of alteration; some is dense and glassy while some is vesicular and porous. It is commonly used as a road construction material and is an aquifer wherever saturated.
WASATCH FORMATION EOCENE		Lenticular fine sands interbedded in predominantly very fine grained siltstone and claystone may yield low to moderate quantities of poor to good quality water. The discontinuous nature and irregular geometry of these sand bodies result in low overall permeabilities and very slow groundwater movement in the overburden on a regional scale. Water quality in the Wasatch formation generally does not meet Wyoming Class I drinking water standards due to the dissolved mineral content. Some wells do, however, produce water with considerably better water quality which does meet the Class I standard.
FORT UNION FORMATION PALEOCENE	TONGUE RIVER MEMBER 	The coal serves as regional groundwater aquifer and exhibits highly variable aquifer properties. Permeability and porosity associated with the coal arises almost entirely from fractures. Coal water typically does not meet Class I or Class II use standards. In most cases, water from coal wells is suitable for livestock use. The coal is used throughout the region as a source of stock water and occasionally for domestic use.
	LEBO MEMBER	The Lebo Member, also referred at as "The Lebo Confining Layer" has a mean thickness of 711 feet in the PRB and a thickness of about 400 feet in the vicinity of Gillette (Lewis and Hotchkiss, 1981). The Lebo typically yields small quantities of poor quality groundwater. Where sand content is locally large, caused by channel or deltaic deposits, the Lebo may yield as much as 10 gpm (Lewis and Hotchkiss, 1981).
	TULLOCK MEMBER	The Tullock Member has a mean thickness of 785 feet in the PRB and a mean sand content of 53 percent which indicates that the unit generally functions well as a regional aquifer. Yields of 15 gallons per minute are common but vary locally and may be as much as 40 gpm. Records from the SEO indicate that maximum yields of approximately 300 gpm have been achieved from this aquifer. Water quality in the Tullock Member often meets Class I standards. The extensive sandstone units in the Tullock Member are commonly developed regionally for domestic and industrial uses. The City of Gillette is currently using eight wells completed in this zone to meet part of its municipal water requirements.
UPPER CRETACEOUS	LANCE FORMATION	Sandstone and interbedded sandy shales and claystone provide yields generally of less than 20 gpm. Higher yields are sometimes achieved where sand thicknesses are greatest. Water quality is typically fair to good.
	FOX HILLS SANDSTONE	Sandstone and sandy shales yield up to 200 gpm, however, yields are commonly significantly less. The water quality of the Fox Hills is generally good with TDS concentrations commonly less than 1000 mg/l.
	PIERRE SHALE	This unit is comprised predominately of marine shales with only occasional local thin sandstone lenses. Maximum yields are minor and overall the unit is not water bearing. Water obtained from this unit is poor with high concentrations of sodium sulfate as the predominant ions in solution.

W = WYODAK COAL; A = ANDERSON COAL; C = CANYON COAL

Figure 3-4. Stratigraphic relationships and hydrologic characteristics of latest Cretaceous and early Tertiary and Recent periods. Powder River Basin, Wyoming.

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depths, i.e., nearest the outcrop. An 18th active mine (Dave Johnston) is located near Glenrock, Wyoming, about 25 miles southwest of the Antelope Mine.

The Wyodak coal seam is subbituminous and is generally a low-sulfur, low-ash coal. Based on 59 analyses taken in the Gillette area, this coal seam has an average heating value of approximately 8,220 British thermal units (Btu's) per pound and contains an average of 6% ash, 0.5% sulfur, 30.7% volatile matter, 33.5% fixed carbon, and 29.8% moisture (Glass and Jones 1992). In general, the Wyodak coal in the southern PRB, including these LBA tracts, has a higher heating value than in the area north of Gillette and commands a slightly higher market price. In 1994, the average delivered quality of the coal at North Antelope Mine was as follows: 8,839 Btu/lb, 4.6% ash, 0.23% sulfur, and 0.51 lbs sulfur dioxide per million Btu (lbs/mmBtu). At Rochelle Mine, the 1994 average delivered quality of the coal was 8,738 Btu/lb, 4.53% ash, 0.21% sulfur, and 0.48 lb/mmBtu sulfur dioxide. For Jacobs Ranch Mine, the respective values are 8,628 Btu/lb, 4.48% ash, 0.45% sulfur, and 1.05 lb/mm Btu sulfur dioxide (Vogler, Larsen and Mehring 1995). Other coal seams in the LBA tracts are either too thin and discontinuous or too deep to be of economic value.

Oil and Gas. Although the PRB is primarily an oil-producing province, large quantities of natural gas are associated with the crude oil. Oil and gas have been produced in the region from reservoir beds that range in age from Pennsylvanian to Oligocene (DeBruin 1996). There are approximately 500 fields that produce oil and/or natural gas from a number of formations of varying geologic ages in the PRB. The estimated mean amount of undiscovered hydrocarbons in the basin are 1.94 billion barrels of recoverable oil and

1.60 trillion ft³ of gas (USGS 1995). Depth to oil-bearing strata is generally between 4,000 ft and 13,500 ft, but some of the older wells are as shallow as 400 ft.

Both LBA tracts overlie geologic structures that contain producible quantities of oil and gas. The Thundercloud LBA Tract overlies a portion of the Hilight Field, which was discovered in 1969. The main zone of production at the Hilight Field is the Early Cretaceous Muddy Sandstone, which lies approximately 9,000 feet below the surface in this area.

The Powder River LBA tract overlies part of the Porcupine Field, discovered in 1972, and the Payne Field, discovered in 1969. The primary zones of production in these fields are the Late Cretaceous Turner and Sussex Sandstones, which lie between 7,000 and 8,000 feet below the surface. See Section 3.11 for further discussion of wells that are currently producing and associated facilities.

Coal Bed Methane. The generation of methane gas from coal beds occurs as a natural process. Methane produced by coal may be trapped in the coal by overburden pressure, by the pressure of water in the coal, or by impermeable layers immediately above the coal. The methane may also migrate upward and be trapped in shallower rocks (like sandstone), or it may disperse to the atmosphere. Deeper coal beds have higher pressures and generally trap more gas. Under favorable geologic conditions, methane can be trapped at shallow depths in and above coal beds, and this seems to be the case in the PRB. The geologic conditions that can enhance methane entrapment at shallow depths include low matrix porosity and permeability in the coals, association of the gas with structurally high features in structurally deformed areas, and the existence of effective seals (Law and others

1991). Without the existence of one or more of these conditions which act to trap the gas in shallow coals or in adjacent sandstones, the gas escapes to the atmosphere. It is likely that much of the methane generated by the coal beds in the PRB has gradually escaped into the atmosphere because of the relatively shallow coal burial depths in the basin. However, a large amount also remains in the coal, probably due primarily to the presence of effective seals in the sediments overlying the coal.

Historically, methane has been reported flowing from shallow water wells and coal exploration wells in parts of the PRB. According to DeBruin and Jones (1989), most of the documented historical occurrences have been in the northern PRB. Olive (1957) references a water well in T54N, R74W, which began producing gas for domestic use in 1916.

Coal bed methane has been commercially produced since 1989 at Rawhide Butte Field, west of the Amax Eagle Butte Mine. Since that time, the production area has been expanded. In August 1997, coal bed methane was produced from 206 wells in an area that extends from north of Gillette almost to Wright (see Figure 1-1). There were 73 additional wells in that area that have produced coal bed methane in the past but did not produce in August 1997.

There is no coal bed methane production in the vicinity of the Thundercloud and Powder River LBA Tracts at this time. Coal bed methane projects are, however, in testing or commercial stages between Gillette and Wright (BLM 1992a; BLM 1995), and production is now reported as far south as T45N, R71W. The BLM recently evaluated additional development of coal bed methane on federal oil and gas leases south of Gillette in an EIS (BLM 1997). There are currently

no proposals or applications to develop coal bed methane on the Powder River LBA Tract. On the Thundercloud LBA Tract, the current operator of the Hilight Oil and Gas Field has indicated that coal bed methane development may take place by perforating existing deeper gas wells. If coal bed methane resources can be economically developed in and near the LBA tracts, then exploration is likely to continue. In the PRB, methane is typically recovered by the drilling and completion of wells similar to, but generally shallower than, conventional oil and natural gas wells.

Bentonite. Layers of bentonite (decomposed volcanic ash) of varying thickness are present throughout the PRB. Some of the thicker layers are mined where they are near the surface, mostly around the edges of the basin. Bentonite has a large capacity to absorb water, and because of this characteristic it is used in a number of processes and products, including cat litter and drilling mud. No mineable bentonite reserves have been identified on the LBA tracts.

Uranium. Uranium exploration and mining were very active in the 1950's, when numerous claims were filed in the PRB. A decreased demand combined with increased foreign supply decreased uranium mining activities in the early 1980's; however, substantial uranium reserves exist in southwestern Campbell and northwestern Converse Counties. There are currently two in-situ leach operations in the PRB, and the recent price increase in uranium has raised interest in developing additional sites in the PRB and elsewhere in Wyoming (WSGS 1996). No known uranium reserves exist on the LBA tracts.

Scoria. Scoria or clinker has been and continues to be a major source of gravel for

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road construction in the area. Scoria is present along the exposed outcrop of the Wyodak coal seam located along the east sides of the mines, although scoria is not present on the LBA tracts.

3.4 Soils

The soils on the LBA tracts are typical of the soils that occur on the adjoining Jacobs Ranch and North Antelope/Rochelle Mines. Both LBA tracts and adjacent areas have been covered by Order 1-2 soil surveys. All soil surveys were completed in accordance with WDEQ/LQD Guideline No. 1 which outlines required soils information necessary for a coal mining operation. The inventories included field sampling and observations at the requisite number of individual sites, and laboratory analysis of representative collected samples.

The following is a list of the soil series that comprise the various map units delineated on the Thundercloud and/or Powder River LBA Tracts and proposed affected area. The soils considered hydric are so noted (Soil Conservation Service 1991).

Absted Loam
Absted-Openay-Arvada Complex
(hydric in depressions)
Abstinate
Aeric Haplaquepts
Arvada Loam (hydric
in depressions)
Bidman Loam
Bowbac Sandy Loam
Briggsdale Loam
Briggsdale-Cushman Complex
Cambria Clay Loam
Cushman Fine Sandy Loam
Decolney Sandy Loam
Felix Clay (hydric in depressions)

Forkwood Loam
Haverdad Loam (hydric)
Heldt Clay Loam (hydric in
depressions)
Hiland Sandy Loam
Kishona Sandy Loam
Olney Rock Outcrop
Parmleed Clay Loam
Pugsley Fine Sandy Loam
Rauzi Sandy Loam
Renohill Clay Loam
Samday Clay Loam
Samsil
Shingle Clay Loam
Shingle-Rock Outcrop Complex
Shingle-Samday-Rock Outcrop
Taluze Sandy Loam
Taluze-Rock Outcrop Complex
Terro Sandy Loam
Theedle Loam
Turnercrest Sandy Loam Variant
Ulm Clay Loam (hydric)
Vona Very Fine Sandy Loam
Vonalee Sandy Loam
Worf Sandy Loam

The identified map units comprised either a single soil series, series phase, variant, tax adjunct or a combination of the above.

Table 3-1 provides the extent of five depth classes of suitable topsoil within the Powder River LBA Tract and the proposed overstrip area. Table 3-2 provides the extent of five depth classes of suitable topsoil within the Thundercloud LBA Tract and proposed disturbance area. The most suitable topsoil is planned to be salvaged and used for reclamation. An average of 18 to 24 inches of topsoil will be redistributed on all disturbed acres. Areas of unsuitable soils include sites disturbed by oil and gas development and soils with high alkalinity, salinity or clay content.

Table 3-1. Acres of Topsoil Available for Reclamation within the Powder River LBA Tract Lease Area and the Entire Area Which Would Be Disturbed by Mining Activities

	Thickness of Suitable Topsoil (inches)													
	0			1-10			10-20			20-40			40-60	
	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent
Lease Area	28.50	0.7	551.3	13.7	850.5	21.2	1368.6	34.1	1221.8	30.5				
Disturbance Area ¹	51.10	0.6	930.6	9.7	1569.0	18.4	2604.1	31.6	2772.9	39.6				
¹ The disturbance area includes the lease area and adjacent areas which may be affected by mining this lease area as an extension of existing operations.														

Table 3-2. Acres of Topsoil Available for Reclamation within the Thundercloud LBA Tract Lease Area and the Entire Area Which Would Be Disturbed by Mining Activities

	Thickness of Suitable Topsoil (inches)													
	0			1-10			10-20			20-40			40-60	
	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent
Lease Area	481	14	468	14	90	3	2381	69	0	0				
Disturbance Area ¹	519	14	488	13	99	3	2643	70	0	0				
¹ The disturbance area includes the lease area and adjacent areas which may be affected by mining this lease area as an extension of existing operations.														

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The soil depths and types on both LBA tracts are similar to soils currently being salvaged and utilized for reclamation at the adjacent mines and other mines in the PRB, and both tracts are expected to have an adequate quantity and quality of soil for reclamation. Inclusions of hydric soils (soils that are saturated, flooded, or ponded long enough to develop anaerobic [no oxygen] conditions) are found only on the floors of the larger playas in the LBA areas. The site-specific soil surveys have located hydric soils and/or inclusions of hydric soils, and the presence of hydrophytic vegetation and wetland hydrology will be determined during jurisdictional wetland determinations included in the mine permit application package (see Section 3.8).

3.5 Air Quality

Wind speeds for the region average from 9 to 13 miles per hour with local variations due to differences in topography. Winds are predominantly from the northwest or the

southeast and tend to be strongest in the winter and spring and calmer in the summer. Wind velocity tends to increase during the day and decrease during the night (KMCC 1995). Wind roses, air quality and meteorological sampling locations for the North Antelope/ Rochelle and Jacobs Ranch Mines are depicted on Figures 3-5 and 3-6, respectively.

The air quality of the PRB area is generally good with an average annual geometric mean (the nth root of the product of n numbers) for total suspended particulates (TSP) concentrations of 15 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$). Average particulate concentrations in the basin are therefore one-tenth the maximum allowable concentration in Wyoming (see Table 3-3). Visibility for more than 60 miles is common. Major reductions in visibility are generally weather-related, although forest fires to the west and northwest have impaired visibility in the PRB in past years.

Table 3-3. Regulated Air Emissions for Wyoming

Emissions	Averaging Period	Wyoming Standard ($\mu\text{g}/\text{m}^3$)	National Standard ($\mu\text{g}/\text{m}^3$)
Total suspended particulates (TSP)	24-hour ¹	150	---
Particulate matter finer than 10 microns (PM ₁₀)	24-hour ¹	150	150
	annual ²	50	50
Nitrogen oxides (NO _x)	annual ²	100	100
Photochemical oxidants (O ₃)	1-hour ¹	160	235
Sulfur dioxide (SO ₂)	3-hour ¹	1,300	---
	24-hour ¹	260	365
	annual ²	60	80
Carbon monoxide (CO)	1-hour ¹	40,000	40,000
	8-hour ¹	10,000	10,000

¹ Standards not to be exceeded more than once per year.

² Annual arithmetic mean not to be exceeded.

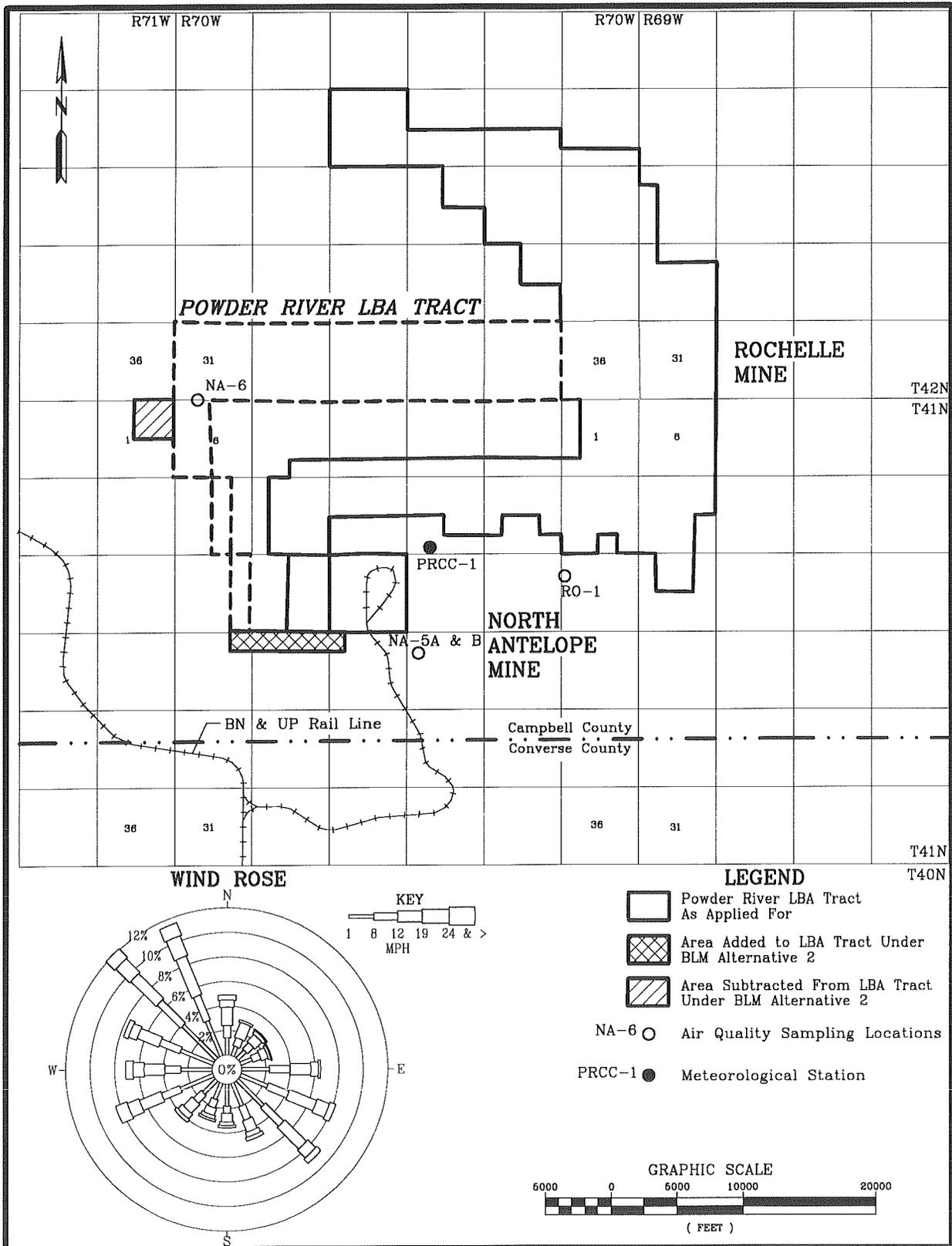


Figure 3-5. Wind Rose, Air Quality and Meteorological Stations at the North Antelope and Rochelle Mines.

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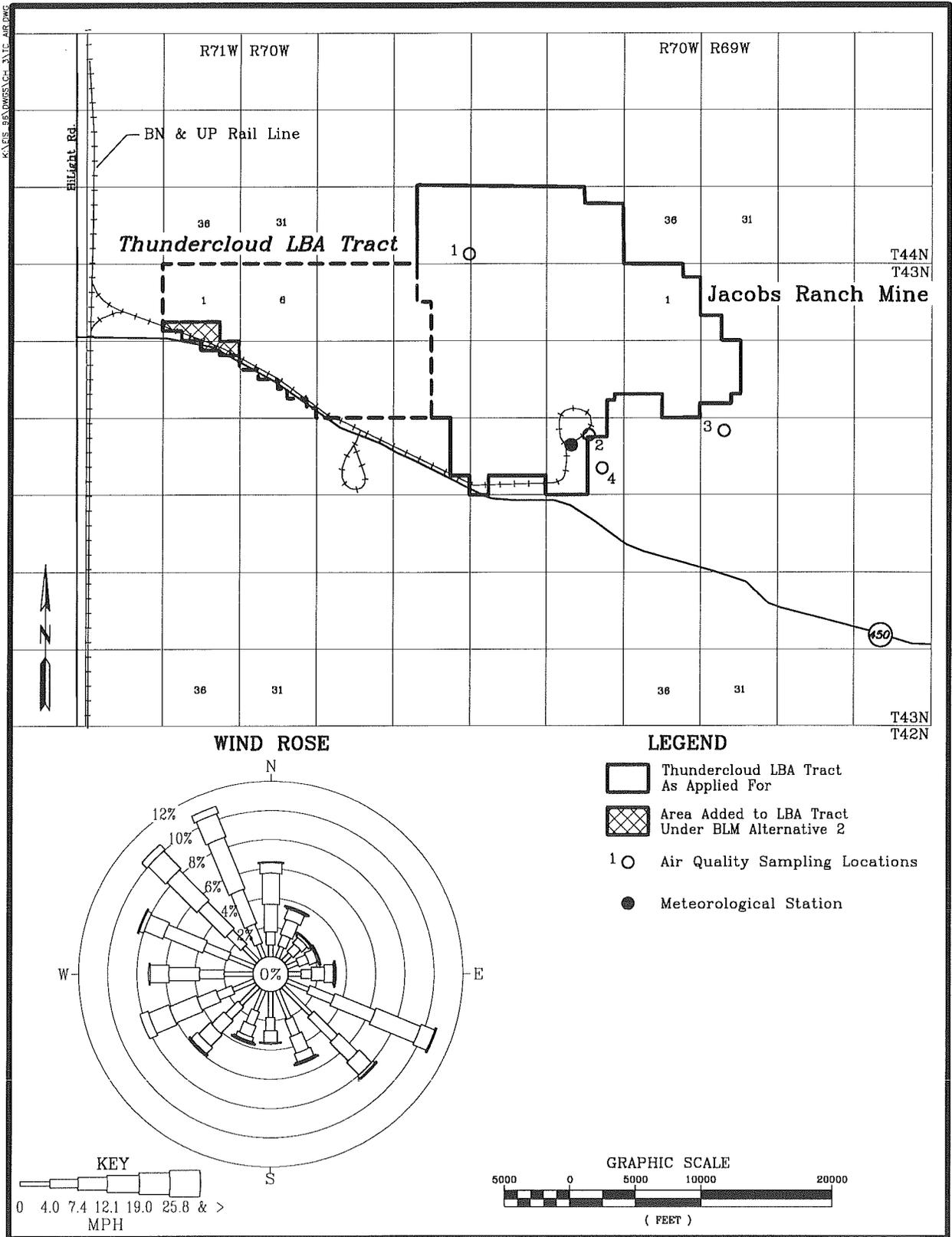


Figure 3-6. Wind Rose, Air Quality and Meteorological Stations at the Jacobs Ranch Mine.

The basic regulatory framework governing air quality in Wyoming is the Wyoming Environmental Quality Act, the accompanying Air Quality Standards and Regulations promulgated by the Wyoming Environmental Quality Council, and the State Implementation Plan approved by the EPA under the Clean Air Act. This regulatory framework includes state air quality standards, which must be at least as stringent as National Ambient Air Quality Standards, and allowable increments for the prevention of significant deterioration (PSD) of air quality. The PSD program is designed to protect air quality from significant deterioration in areas already meeting state standards. In other words, an increase in ambient air pollutant concentrations, above the area baseline, is allowable if the state standard increment for the pollutant is not exceeded for the area. The increment allowable under PSD depends on the area's designation as Class I, II, or III. Class I areas are allowed the smallest increment and Class III the largest. The area the coal mines are located in is Class II, as is all of Wyoming outside the national parks and wilderness areas. The Class I area that is closest to the Thundercloud and Powder River LBA Tracts is Wind Cave National Park in southwestern South Dakota. This national park is approximately 80 miles east

of the Thundercloud and Powder River LBA Tracts. Wyoming's PSD standards for particulates are identical to federal standards, except that Wyoming has not adopted Class III standards (see Table 3-4). Coal mining around the Thundercloud and Powder River LBA Tracts is not currently affected by the PSD regulations because surface coal mines are not one of the 28 EPA-listed major emitting facilities for PSD regulation, and point-source emissions from these mines do not exceed the PSD emissions threshold for applicability of 250 tons per year.

Particulates are the major emissions at surface coal mines. The large areas of disturbed land, blasting, crushing, loading, and hauling of coal associated with mining all produce dust. Wyoming's ambient air standards for particulate matter include standards for both PM_{10} , which includes particles 10 micrometers or less in diameter, and for TSP, which refers to total suspended particulates. The current PM_{10} standards in Wyoming are an annual average of $50 \mu\text{g}/\text{m}^3$ and a 24-hour average of $150 \mu\text{g}/\text{m}^3$. The current Wyoming TSP standard is a 24-hour average of $150 \mu\text{g}/\text{m}^3$. The 24-hour standards are not to be exceeded more than once per year.

Table 3-4. Maximum Allowable Increases for Prevention of Significant Deterioration of Air Quality: Particulates

Emission	Averaging Time	Maximum Allowable Increments of Deterioration ($\mu\text{g}/\text{m}^3$)		
		Class I	Class II	Class III
Total Suspended Particulates (TSP)	Annual Mean	5	19	37
	24-hour ¹	10	37	75

¹ Maximum allowable increment may be exceeded once per year at any receptor site.

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The various motor vehicles used in mining and transporting coal and people produce carbon monoxide, nitrogen oxides, sulfur dioxide and, by secondary processes, ozone. However these pollutants are seldom emitted at levels to cause regulatory concerns at Wyoming's surface coal mines (Table 3-3).

WDEQ/AQD has presented testimony in public hearings documenting that the air quality resource in the region including the Thundercloud and Powder River LBA Tracts did not diminish from 1980 through 1988, although coal production in the region increased substantially during that period. Air quality particulate data from that report is summarized in Table 3-5. To summarize the monitoring data in comparative form, averages of the geometric means from all sites were calculated for each calendar year. The averages ranged from a high of 30.8

$\mu\text{g}/\text{m}^3$ in 1980 to a low of 20.5 $\mu\text{g}/\text{m}^3$ in 1986. During the period covered in Table 3-5, the number of mines producing coal in the Wyoming portion of the PRB increased from 10 to 16 (considering North Antelope and Rochelle as one mine), while annual coal production escalated from 58.8 million tons to 139.1 million tons. The number of mines monitoring air quality increased from 12 to 16. The number of actual monitoring sites varied from a low in 1980 of 29 to a high of 46 in 1986. In 1988 there were 45 operating sampler sites. (Some sites included more than one sampler, so the number of samplers is greater than the number of monitoring sites.) Over 23,000 samples are represented in Table 3-5. The information presented by the WDEQ/AQD shows that air quality in the Wyoming portion of the PRB did not deteriorate while coal production increased nearly 2.5 times in the 1980-1988 period.

Table 3-5. Summary of WDEQ/AQD Report on Air Quality Monitoring in Wyoming's Powder River Basin, 1980-1988

Year	Number of Mines Producing/ Monitoring	# Sites	Coal Produced (MMTPY ¹)	Overburden (MMBCY ¹)	TSP Average of All Geometric Means ($\mu\text{g}/\text{m}^3$)
1980	10/12	29	58.8	93.2	30.8
1981	11/13	34	68.9	108.0	30.4
1982	11/15	43	81.4	120.7	23.1
1983	13/15	41	88.0	157.2	24.3
1984	14/15	44	106.8	166.6	24.3
1985	16/15	45	113.8	196.3	24.3
1986	16/16	46	114.6	169.6	20.5
1987	16/16	45	124.6	180.9	25.6
1988	16/16	45	139.1	209.8	29.3

Notes: 1. Mines include Buckskin, Rawhide, Eagle Butte, Fort Union, Clovis Point, Wyodak, Caballo, Belle Ayr, Caballo Rojo, Cordero, Coal Creek, Jacobs Ranch, Black Thunder, North Antelope/Rochelle, Antelope, and North Rochelle.

2. From WDEQ/AQD 1989 (This study has not been updated).

¹ MMTPY = million tons per year, MMBCY = million bank cubic yards

This is due in part to the conditions attached to air quality permits. These conditions stipulate control measures that must be implemented by the mine operators to meet air quality standards. These measures include increased sprinkling, use of approved chemicals to control dust, limiting the amount of disturbed area, temporary vegetation of disturbed areas, and contemporaneous reclamation. In the mining areas immediately adjacent to the Thundercloud and Powder River LBA Tracts, historical particulate ambient air quality data shows the same result for the Jacobs Ranch, North Antelope, and Rochelle mines as described above for the PRB as a whole. Figure 3-7 presents particulate ambient air data and mine coal and overburden quantities for the years 1991 through 1995 for those mines. As the figure illustrates, substantial increases of coal production and overburden handled by the mines have not been accompanied by any similar increase in ambient concentrations of TSP and PM₁₀.

Before adoption of the current annual PM₁₀ standard, the annual particulate standard was 60 $\mu\text{g}/\text{m}^3$ of TSP (geometric mean). As Figure 3-7 shows, the annual TSP averages are well below this former standard. Assuming that PM₁₀ (which was not monitored during all the years at all the sites shown in the figure) was about 30% of the TSP values (as determined by the WDEQ/AQD based on many years of results from co-located TSP and PM₁₀ samplers), and assuming that the geometric and arithmetic means of TSP data are similar, it can be inferred from Figure 3-7 that the Jacobs Ranch, North Antelope, and Rochelle Mines have historically been well within the current annual PM₁₀ standard of 50 $\mu\text{g}/\text{m}^3$.

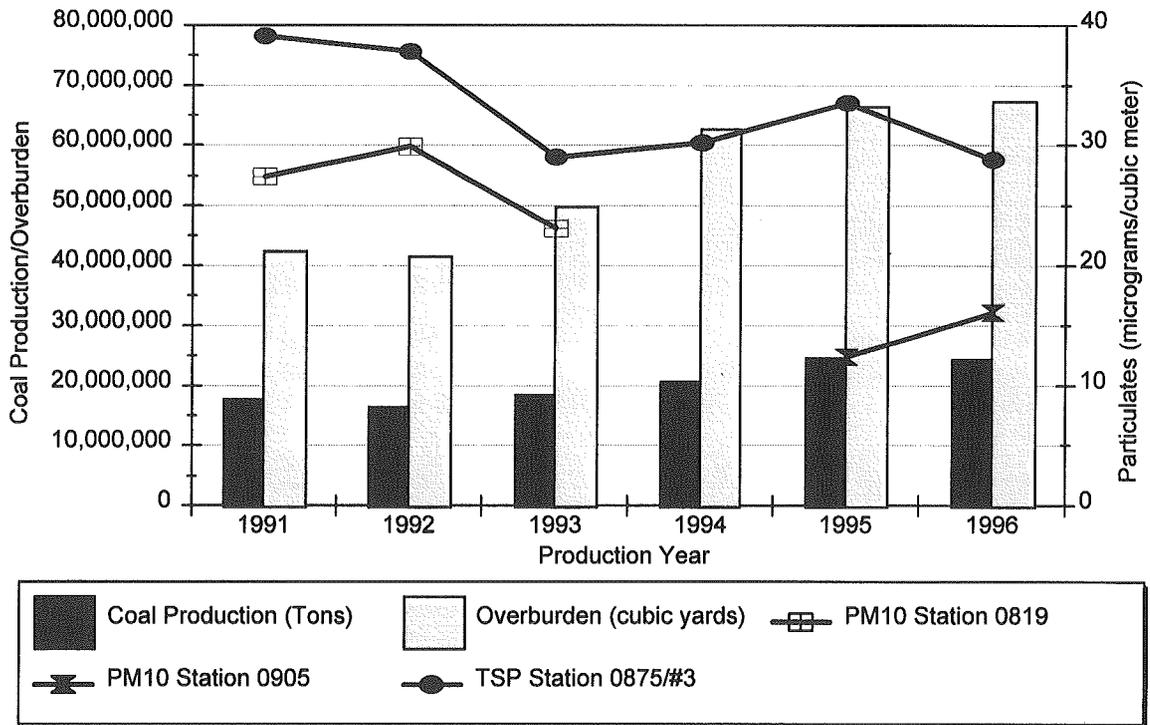
The 1989-1994 TSP data from nearly 1600 samples collected at the Jacobs Ranch, North Antelope, and Rochelle Mines indicate that emissions have not caused any violation of the current standard. From 1989 to 1994, the TSP geometric means for the Jacobs Ranch, North Antelope, and Rochelle Mines, in micrograms per cubic meter, using the same averaging techniques applied to Table 3-3, are as follows: 1989 = 20.91; 1990 = 25.63; 1991 = 25.16; 1992 = 24.23; 1993 = 25.86; and 1994 = 31.79 (WDEQ/AQD Annual Reports for the calendar monitoring years 1989 through 1994.)

3.6 Water Resources

3.6.1. Groundwater

Within both the Thundercloud and Powder River LBA Tracts there are three water-bearing geologic units that could be disturbed by mining. In descending order, these units are: Recent alluvium that occurs in varying amounts adjacent to the stream channels within the LBA tracts, the Wasatch Formation overburden and the Wyodak coal seam. A fourth unit, the sub-coal Fort Union Formation, is used for water supply at Jacobs Ranch and neighboring mines including North Antelope and Rochelle. A fifth unit, the Lance Formation, is also utilized for water supply by PRCC at the North Antelope and Rochelle Mines. The stratigraphic units beneath the two LBA tracts and their hydrologic properties are displayed in Figure 3-4. Because the hydrogeology of the two LBA tracts is similar, a general hydrogeologic discussion can be used to describe both sites. However, there is enough variability in the hydrogeologic units between the sites that site-specific descriptions are included where appropriate.

Kerr McGee Coal Corporation Jacobs Ranch Mine



Powder River Coal Company North Antelope Mine and Rochelle Mine

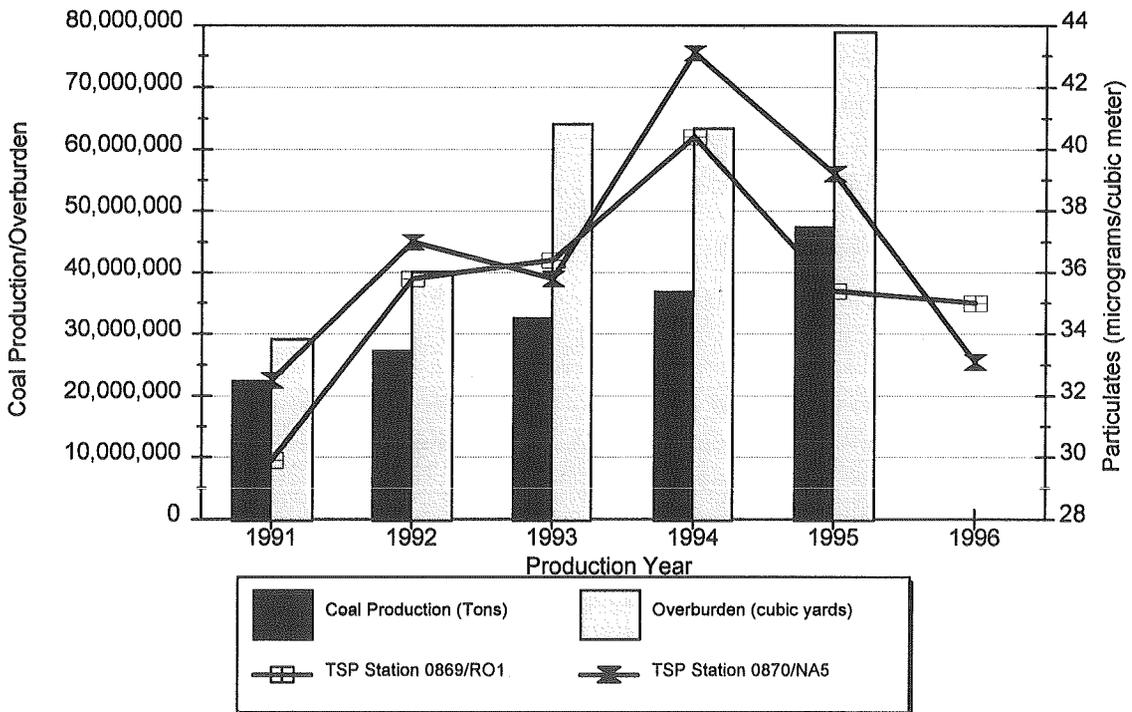


Figure 3-7. Coal Production vs. Ambient Particulates for Jacobs Ranch, North Antelope and Rochelle Mines.

PRCC and KMCC have collected hydrogeologic data at the respective LBA tracts. Monitoring wells have been installed in both tracts. Figure 3-8 shows the monitoring well locations within the Powder River LBA Tract, and Figure 3-9 shows the monitoring well locations within the Thundercloud LBA Tract. The Powder River LBA Tract contains 32 wells; six are completed in the Recent alluvium, 12 in the Wasatch Formation overburden, and 14 in the Wyodak-Anderson coal seam. The Thundercloud LBA Tract contains 11 monitoring wells; five are completed in the Wasatch Formation overburden and six are completed in the Wyodak coal seams. Data from these wells, as well as previously collected data at both the Jacobs Ranch and North Antelope/Rochelle Mines, were used to prepare the following description of baseline groundwater conditions within the LBA tracts.

Recent Alluvium

Within the Thundercloud LBA Tract, the surface drainages are generally dry draws, and the alluvium along these draws is generally thin, fine-grained, and not extensive enough to be considered an aquifer. The alluvial deposits within the Powder River LBA Tract are more extensive than in the Thundercloud LBA Tract, particularly along Porcupine Creek, where the alluvium is up to 1000 ft wide and as much as 12 ft thick. Alluvium also is present along Corder Creek, a tributary of Porcupine Creek, although it is much narrower (about 200 ft wide) and about 10 ft thick. Studies conducted by PRCC on the alluvium of Porcupine and Corder Creeks within the LBA tract indicate that the alluvial hydraulic conductivity (a measure of the rate at which water moves through alluvial materials) is also variable, ranging from 1.1 to 13 ft/day. The alluvial aquifer receives recharge from

the infiltration of precipitation, from lateral movement of groundwater from the adjacent Wasatch Formation, and from infiltration of surface flow within the channels.

Water quality data collected from wells completed in the Porcupine Creek alluvium within the Powder River LBA Tract indicate that total dissolved solids (TDS) concentrations in the alluvial groundwater range from 2,300 to 12,400 milligrams per liter (mg/L) with a mean of 7,250 mg/L (PRCC 1996). Within the Powder River LBA Tract, the high TDS concentrations in the alluvial groundwater generally preclude its use even for livestock watering.

Wasatch Formation

The Wasatch Formation overlies the Wyodak coal beds and is generally similar within the two LBA tracts. Within the PRB the Wasatch Formation consists of interbedded sandstones, siltstones and shale with occasional discontinuous coal stringers and clinker deposits, and this description holds true for both the LBA tracts. The sandstone and coal stringers, where saturated, will yield water to wells, and this groundwater is often used for stock watering. Because the sandstone and coal aquifer units within the Wasatch Formation are not continuous, the Wasatch is not considered to be a regional aquifer.

Recharge to the Wasatch Formation is from the infiltration of precipitation and lateral movement of water from adjacent clinker bodies. Regionally, groundwater is discharged from the Wasatch Formation by evaporation and transpiration, by pumping wells, and by seepage into the alluvium along stream drainages. For the Wasatch Formation as a whole, the discontinuous nature of the water bearing units results in low overall hydraulic conductivity and low

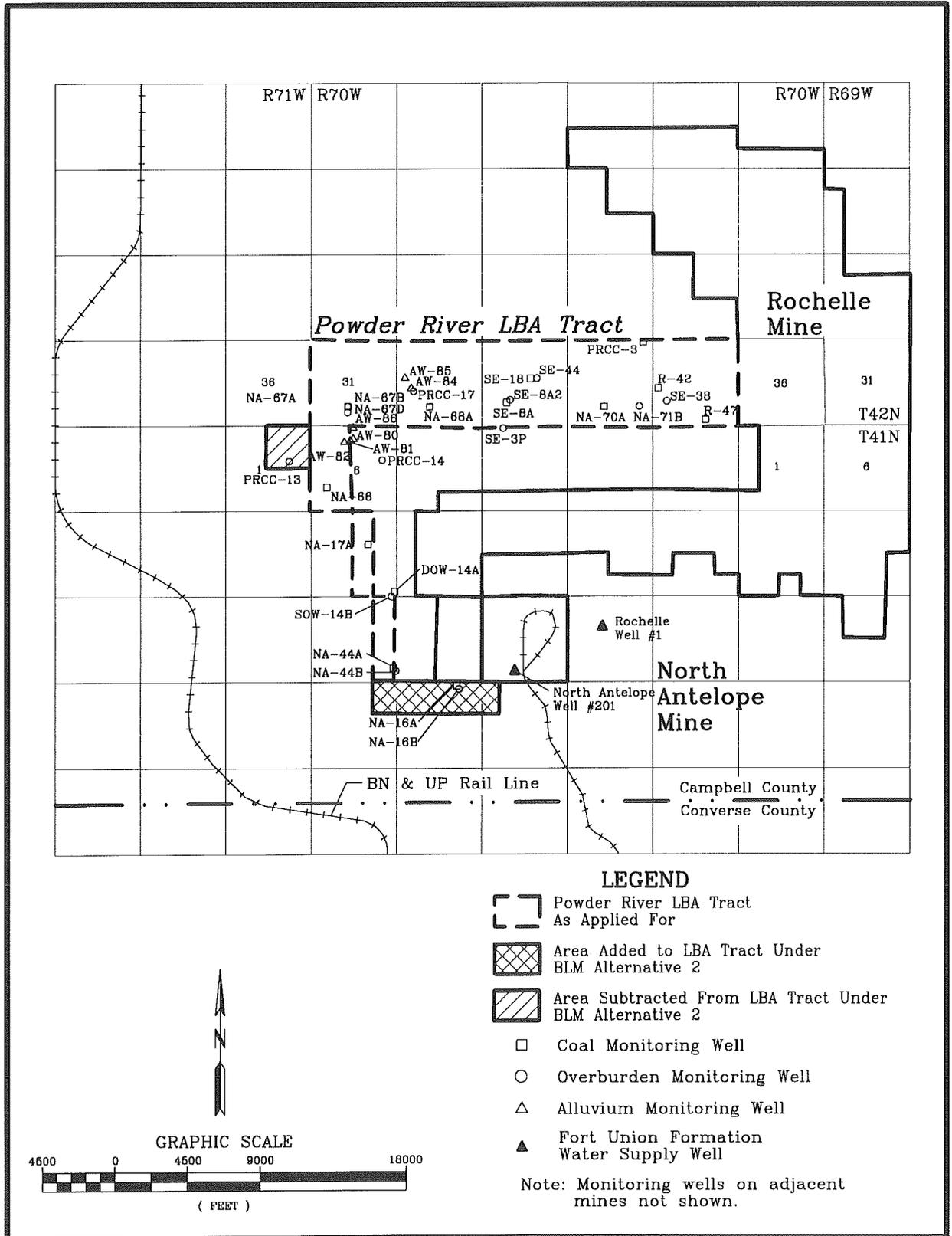


Figure 3-8. Monitoring Well Locations Within the Powder River LBA Tract and Fort Union Formation Water Supply Well Locations at the North Antelope and Rochelle Mines.

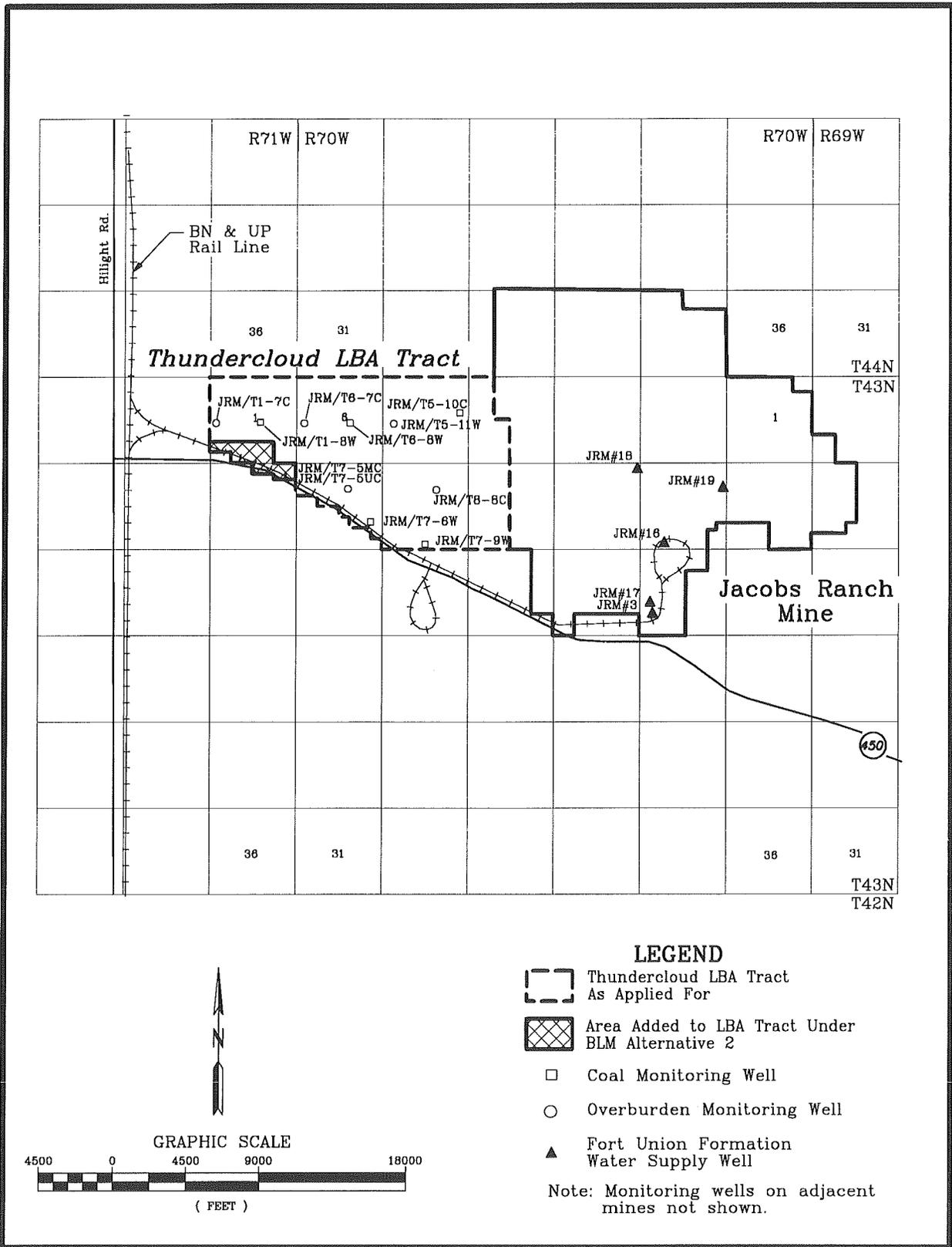


Figure 3-9. Monitoring Well Locations Within the Thundercloud LBA Tract and Fort Union Formation Water Supply Well Locations at the Jacobs Ranch Mine.

groundwater flow rates. Because of the varied nature of the aquifer units within the Wasatch, hydraulic properties are variable as well. Martin, et al. (1988) reported that hydraulic conductivities within the Wasatch ranged from 10^{-4} ft/day to 10^2 ft/day and the geometric mean hydraulic conductivity based on 203 tests was 0.2 ft/day. The geometric mean hydraulic conductivity from 70 aquifer test using wells completed in sandstone in the Wasatch overburden was 0.35 ft/day, while that from 63 aquifer tests completed in siltstone and claystone in the Wasatch overburden was 0.007 ft/day (Rehm et al. 1980). The Wasatch Formation within the Thundercloud and Powder River LBA Tracts is similar in that there is relatively little saturated sand present within the low-permeability silts and clays that make up most of the overburden.

Water quality in the Wasatch Formation is variable, with TDS concentrations ranging from 496 mg/L to 4,436 mg/L and averaging 1,915 mg/L in the Thundercloud LBA Tract and from 363 mg/L to 7,364 mg/L and averaging approximately 3,040 mg/L in the Powder River LBA Tract. Groundwater from the Wasatch Formation is of the sodium-sulfate-bicarbonate type within the Thundercloud LBA Tract and of the sodium-bicarbonate type in the Powder River LBA Tract.

Wyodak Coal

Due to its continuity, the Wyodak coal seam is considered a regional aquifer within the PRB. Within the Thundercloud LBA Tract, the Wyodak coal contains partings which in places divide the Wyodak into three mineable seams. At the Powder River LBA Tract, however, the Wyodak coal seam typically consists of one unit.

Hydraulic conductivity (or permeability to water) within the Wyodak coal seam is highly variable and is reflective of the amount of fracturing the coal has undergone, as unfractured coal is virtually impermeable. The yield of groundwater to wells and mine pits is smallest where the permeability of the coal is derived primarily from localized unloading fractures. These fractures, which are the most common, were created by the expansion of the coal as the weight of overlying sediments was slowly removed by erosion. The highest permeability is imparted to the coal by tectonic fractures. These are through-going fractures of areal importance created during deformation of the south Powder River structural basin. The presence of these fractures can be recognized by their linear expression at the ground surface, controlling the orientation of stream drainages and topographic depressions. Due to their pronounced surface expression, these tectonic fractures are often referred to as "lineaments". Coal permeability along lineaments can be increased by orders of magnitude over that in the coal fractured by unloading only. Preliminary data collected by KMCC suggest that in the far western part of the Thundercloud LBA Tract, groundwater movement may be controlled by a northwest-southeast trending tectonic fracture system. Likewise, aquifer test data collected by PRCC in the vicinity of the Powder River LBA Tract indicate that the coal possesses higher permeability in the northwest-southeast direction.

Numerous aquifer tests have been performed by PRCC on the Wyodak coal seam within and adjacent to the Powder River LBA Tract. Permeability in the coal in the vicinity of the LBA tract is enhanced due to fracturing and has been measured at up to 25 ft/day at well NA-67A (Figure 3-8). Average coal permeability in the vicinity of the LBA tract, however, is approximately 9.5 ft/day.

Although wells have been installed in the coal aquifer within the Thundercloud LBA Tract, aquifer tests have not yet been conducted. Hydraulic properties of the coal can be expected to be similar to that of the coal within the adjacent Jacobs Ranch and Black Thunder Mine permit areas. Coal permeability measured at the Black Thunder Mine ranges from 0.16 ft/day to 84.6 ft/day, and 0.14 ft/day to 1.6 ft/day at the Jacobs Ranch Mine.

The coal aquifer is deeply confined at both LBA tracts, which results in low storage coefficients. Storage coefficients measured in the vicinity of Powder River LBA Tract range from approximately 5×10^{-4} to 1×10^{-3} . Measured storage coefficient values in the vicinity of the Thundercloud LBA Tract range from 2.7×10^{-4} to 8.3×10^{-4} .

Groundwater from the coal aquifer at the Powder River LBA Tract is of the sodium-bicarbonate type with TDS concentrations ranging from 447 mg/L to 2,020 mg/L and averaging approximately 733 mg/L.

Coal groundwater at the Thundercloud LBA Tract is of the sodium-bicarbonate type, with TDS concentrations ranging from 790 mg/L to 1,042 mg/L. The average for all six coal wells sampled on the Thundercloud LBA Tract is 853 mg/L.

Prior to mining, the direction of groundwater flow within the coal aquifer was generally from recharge areas near the outcrop into the basin, following the dip of the coal. Site-specific water-level data collected by KMCC and PRCC in the vicinity of both respective LBA tracts and presented in the Gillette Area Groundwater Monitoring Organization (GAGMO) 15-year report (Hydro Engineering 1996a) indicate that the groundwater flow directions have been influenced by mining activities. Groundwater

flow within the coal aquifer in the vicinity of both LBA tracts is now toward nearby mine pits.

Subcoal Fort Union Formation

The subcoal Fort Union Formation can be divided into three hydrologic units: the Tongue River aquifer, the Lebo Member, and the Tullock aquifer (Law 1976). The hydrologic units below the coal are not directly disturbed by mining, but many of the mines use them for water supply wells. The Tongue River aquifer consists of lenticular fine-grained shale and sandstone. The Lebo Member, also referred to as "the Lebo Confining Layer," is typically more fine-grained than the other two members and generally retards the movement of water (Lewis and Hotchkiss 1981). The Tullock aquifer consists of discontinuous lenses of sandstone separated by interbedded shale and siltstone. Transmissivity is the product of an aquifer's hydraulic conductivity or permeability times its thickness and is commonly used when discussing the hydraulic properties of the Fort Union Formation, where wells are completed by exposing many discrete sand lenses to the well bore. Transmissivities are generally higher in the deeper Tullock aquifer, and many mines in the PRB have water-supply wells completed in this interval (Martin et al. 1988). The average transmissivity for this member as reported in McIntosh, et al. (1984) is 290 ft²/day.

In the vicinity of the Powder River LBA Tract, immediately below the coal, the Tongue River aquifer consists of alternating sandstones, siltstones, and claystones. Measured permeabilities of this sequence are low, averaging approximately 0.6 ft/day (PRCC 1993). Two Fort Union Formation wells are used for mine water supply at the North Antelope and Rochelle Mines. Both

3.0 Affected Environment

wells are approximately 2,000 ft deep. The wells are shown on Figure 3-8.

Near the Thundercloud Tract, KMCC reports that it is difficult to distinguish the Lebo Confining Layer from sand-poor sequences of the overlying Tongue River aquifer and the underlying Tullock aquifer (KMCC 1994). KMCC, therefore, refers only to the Upper and Lower Fort Union Formation. The upper unit consists of the Tongue River aquifer and the lower unit consists of the Tullock aquifer. Transmissivities of the Upper Fort Union Formation at the Jacobs Ranch Mine range from about 110 to 567 ft²/day. Transmissivities of the lower Fort Union Formation at the Jacobs Ranch Mine range from about 190 to 375 ft²/day. KMCC has completed five wells in the subcoal Fort Union Formation to supply water to the Jacobs Ranch Mine. The well depths range from 645 to 1,840 feet. The Jacobs Ranch Mine Fort Union Formation supply wells are depicted on Figure 3-9.

The water quality of the Fort Union Formation is generally good. TDS concentrations measured at Jacobs Ranch Facility Well JRM # 16 average 340 mg/L. Water from this well is of the sodium-bicarbonate type. TDS concentrations for the Fort Union Formation at the North Antelope Mine average approximately 230 mg/L, and 400 mg/L at the Rochelle Mine.

Lance and Fox Hills Formations

Underlying the Fort Union Formation is the Lance Formation of Cretaceous age. At the base of the Lance Formation is the Fox Hills Sandstone. The Fox Hills Sandstone and overlying Lance Formation are utilized by PRCC for water supply at the Rochelle Mine, tapped by a 5,400-ft deep well capable of producing about 400 gpm (576,000 gallons per day). Water from this well is of the

sodium-bicarbonate type, with a TDS concentration of about 1,200 mg/L. The Lance and Fox Hills formations are not used by KMCC at the Jacobs Ranch Mine.

3.6.2 Surface Water

The drainage areas of the Powder River LBA Tract and the Thundercloud LBA Tract consist of gently rolling topography. In general, the streams within these areas are typical for the region, and their flow events are closely reflective of precipitation patterns. Flow events frequently result from snowmelt during the late winter and early spring. Although peak discharges from such events are generally small, the duration and therefore percentage of annual runoff volume can be considerable. During the spring, general storms (both rain and snow) increase soil moisture, hence decreasing infiltration capacity, and subsequent rainstorms can result in both large runoff volumes and high peak discharges. The surface water quality varies with streamflow rate; the higher the flow rate, the lower the TDS concentration but the higher the suspended solids concentration. Surface water features in the Powder River and Thundercloud LBA tracts are displayed in Figures 3-10 and 3-11, respectively. Both LBA tracts are located within the Cheyenne River drainage basin.

The Powder River LBA Tract includes a small portion of the valley of Porcupine Creek as well as the tributary drainages of Mike Draw and Corder Creek. A short reach of Porcupine Creek crosses the Powder River LBA Tract and drains in a southeast direction toward its confluence with Antelope Creek. In the vicinity of the Powder River LBA Tract, Porcupine Creek is a meandering, ephemeral to intermittent stream into which flow small, gullied ephemeral streams. Porcupine Creek has an approximate gradient of 0.3% and a 15-year

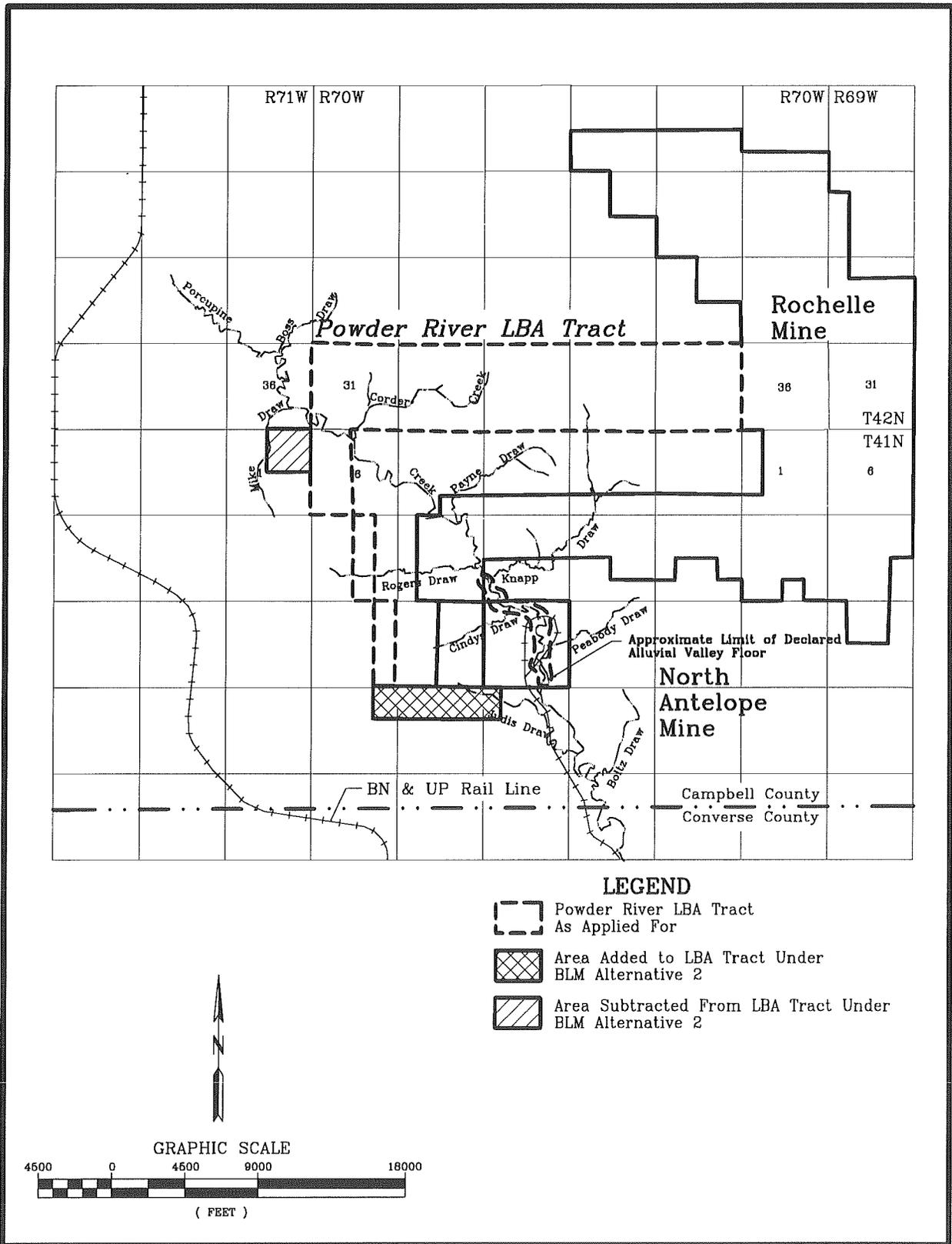


Figure 3-10. Surface Water Features Within and Adjacent to Powder River LBA Tract.

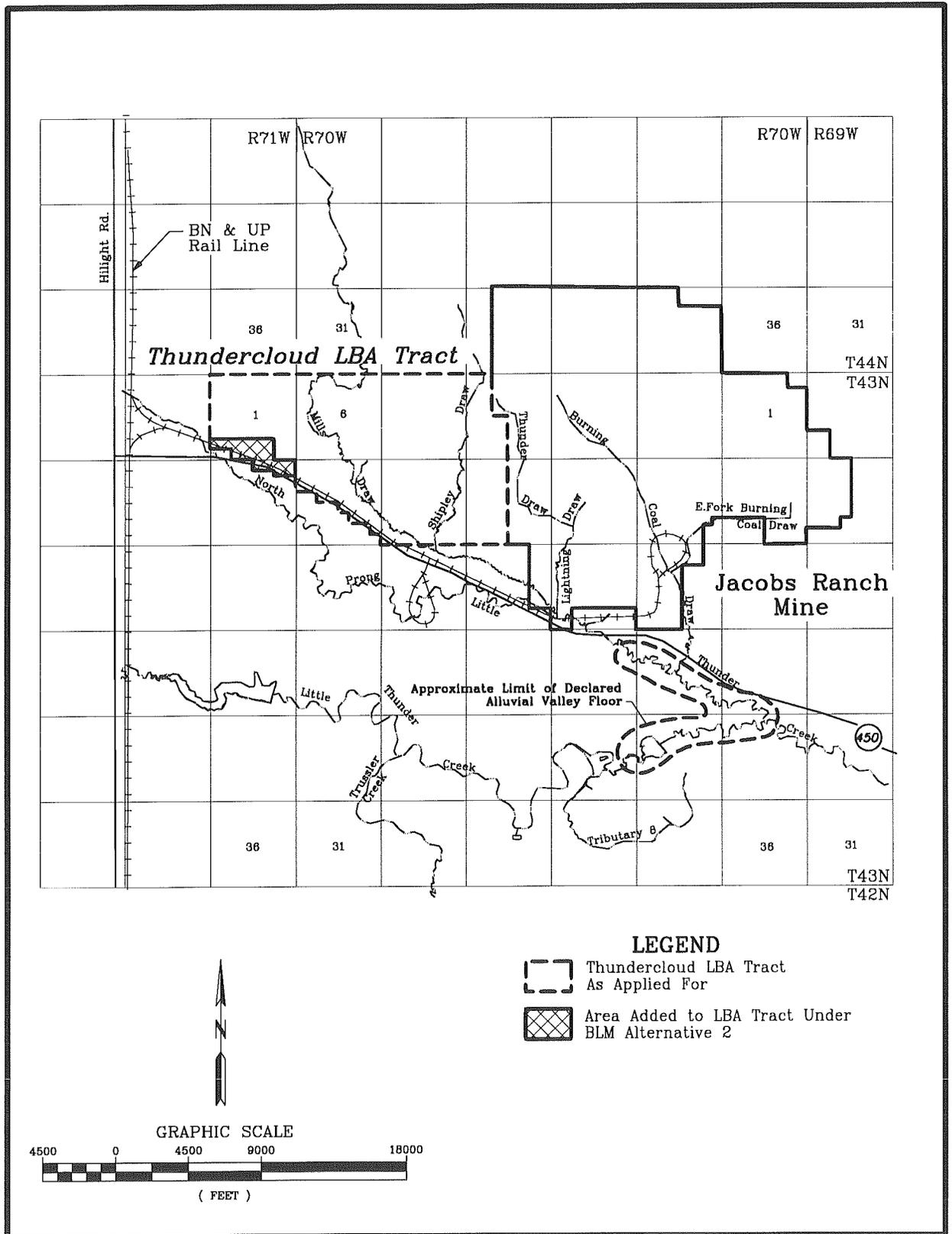


Figure 3-11. Surface Water Features Within and Adjacent to the Thundercloud LBA Tract.

(1981 through 1995) average annual discharge of 10.0 ac-ft/yr (PRCC 1996).

The drainage of Porcupine Creek in and above the Powder River LBA Tract is non-typical of the region in that topography is subdued and drainage density is fairly low. These conditions, combined with numerous upstream reservoirs, result in a much lower annual runoff volume in Porcupine Creek than would otherwise be expected. The water in Porcupine Creek and other local channels comes from three general sources: 1) surface water from the large watershed upstream, 2) groundwater contained in the shallow alluvial aquifer, and 3) lateral inflow of groundwater from surrounding overburden and bedrock.

Porcupine Creek is a typical ephemeral to intermittent stream that flows primarily as a result of snowmelt and general rainstorms in early spring or due to thunderstorms throughout the summer. Thunderstorms in this area are usually short in duration, limited in areal extent, and often characterized by high-intensity rainfall. The isolated events are infrequent and occasionally extreme.

Porcupine Creek within the Powder River LBA Tract shows areas of ponding due to minor discharge of water from the adjacent overburden, but the stream is ephemeral throughout most of the reach. The discharge that is contributed to the drainage from the adjacent overburden is not enough to compensate for evapotranspiration during the summer months, and the stream has extended no-flow periods during each year. Pools in the channel go dry during extended periods of no runoff.

Porcupine Creek has a drainage area of approximately 67 mi² above the Powder River LBA Tract. Corder Creek and Mike Draw have drainage areas of approximately

4.75 mi² and 2.58 mi², respectively. These streams are typical of small ephemeral drainages in the region.

Flows and water quality are monitored by PRCC in Porcupine Creek and several minor tributaries on and near the permit areas, and results are reported annually. The surface water is typically a calcium-sodium-sulfate water and generally contains more than 1,500 mg/L of TDS. This water is usually unsuitable for domestic use, marginal for irrigation, and suitable for stock and wildlife.

The main streams within and near the Thundercloud LBA Tract are North Prong Little Thunder Creek, Shipley Draw, and Mills Draw. These three streams are classified as ephemeral, meaning that they flow only in direct response to snowmelt or precipitation runoff events.

North Prong Little Thunder Creek flows in an easterly direction near the Thundercloud LBA Tract, joining Little Thunder Creek downstream from the Jacobs Ranch and Black Thunder Mines. Little Thunder Creek also flows in an easterly direction and joins Black Thunder Creek, a tributary to the South Fork of the Cheyenne River. North Prong Little Thunder Creek had a total premining drainage area of approximately 72 mi². Due to the presence of numerous closed basins within the drainage area, approximately 23 mi² is non-contributing drainage (KMCC 1993). Therefore, the total contributing drainage area is approximately 49 mi² with a mean annual runoff of approximately 219 ac-ft/yr (KMCC 1993). North Prong Little Thunder Creek exhibits infrequent streamflow events, generally with discharges of less than five ft³ per second. Shipley and Mills Draws are the main streams which contribute streamflow to North Prong Little Thunder Creek in the Thundercloud LBA Tract. The valley of

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North Prong Little Thunder Creek is generally broad and gentle with a steep southwestern rim. The stream has a mean channel gradient of 0.16% through the Black Thunder permit area with a corresponding elevation drop of 45 ft across the permit area.

Mills Draw and Shipley Draw flow in a southerly direction within the Thundercloud LBA Tract. Mills Draw joins Shipley Draw approximately 500 ft upstream of the confluence with North Prong Little Thunder Creek. The premining drainage area of Mills Draw is 5.5 mi² and mean annual runoff is about 50 ac-ft/yr. The contributing drainage area to Shipley Draw is 3.0 mi² with a corresponding mean annual runoff of about 30 ac-ft/yr. Mean annual runoff calculations for Mills and Shipley Draws were performed using relationships developed by Hadley and Schumm (1961). The topography within Mills Draw and Shipley Draw is characterized by very gentle slopes. The channels are incised near the confluence of Mills Draw and Shipley Draw and grade into grassy swales upstream of the confluence.

Flows and water quality are monitored by the Black Thunder and Jacobs Ranch Mines in Little Thunder Creek and North Prong Little Thunder Creek as well as several minor tributaries on and near the permit areas, and results are reported annually. The native surface water is classified as a sulfate-type water that exceeds WDEQ standards for arsenic, manganese, and TDS, depending on the sample location (KMCC 1993; TBCC 1992). Surface water quality is usually unsuitable for domestic use, marginal for irrigation, and suitable for stock and wildlife.

Little Thunder Creek and North Prong Little Thunder Creek have been diverted to the North Prong Diversion Channel. The diversion channel conveys the streamflows through the Black Thunder permit area to the

Jacobs Ranch permit area to facilitate mining operations at both mines. Small portions of Mills and Shipley Draws have been reclaimed in the Black Thunder permit area.

3.6.3 Water Rights

Records of the Wyoming State Engineer's Office (SEO) were searched for groundwater rights within a 3-mile radius of both the Powder River and Thundercloud LBA Tracts, as required for WDEQ permitting.

SEO data indicate there are 347 permitted water wells within three miles of the Powder River LBA Tract. The majority of these wells (274) are owned by coal mining companies. Of the 73 other wells, 38 are permitted for stock watering purposes, five are permitted for domestic use, two for filling reservoirs, one for industrial purposes, and four for miscellaneous use. The 23 remaining wells are used by the USFS for monitoring purposes.

SEO data indicate there are 238 permitted water wells within three miles of the Thundercloud LBA Tract. The majority of these wells (146) are owned by coal mining companies. Of the 92 other wells, 55 are permitted for stock watering purposes, two are permitted for domestic use, one for filling reservoirs, one for industrial use, one for irrigation use, and five for miscellaneous use. The 27 remaining wells were permitted by the Water Resources Research Institute, predecessor to the Wyoming Water Research Center, for monitoring purposes.

The Wyoming SEO's records were searched for surface water rights using the SEO's AREV program. The search was conducted for surface-water rights within one-half mile of the Powder River and Thundercloud LBA Tracts and three miles downstream from

these tracts, as required for WDEQ permitting.

SEO records indicate 86 permitted surface water rights within the search area for the Powder River LBA Tract. The majority of the surface water rights (59) are held by coal mining companies. Of the 27 other surface water rights, five are ditches or pipelines, two are irrigation storage reservoirs and the remaining 20 surface water rights are for stock watering.

SEO records indicate 47 permitted surface water rights within the search area for the Thundercloud LBA Tract. The majority of the surface water rights (36) are held by coal mining companies. Of the 11 other surface water rights, four are ditches or pipelines, six are stock reservoirs and one is an industrial use reservoir.

3.7 Alluvial Valley Floors

WDEQ regulations define alluvial valley floors (AVF's) as unconsolidated stream laid deposits where water availability is sufficient for subirrigation or flood irrigation agricultural activities. Prior to leasing and mining, AVF's must be identified because their presence can restrict mining activities. Impacts to designated AVF's are generally not permitted if the AVF is determined to be significant to agriculture. If the AVF is determined not to be significant to agriculture, or if the permit to affect the AVF was issued prior to the effective date of SMCRA, the AVF can be disturbed during mining but must be restored as part of the reclamation process. The determination of significance to agriculture is made by WDEQ/LQD, and it is based on specific calculations related to the production of crops or forage on the AVF and the size of the existing agricultural operations on the land of which the AVF is a part.

Investigations have been conducted by PRCC, Thunder Basin Coal Company, and KMCC to determine the presence of AVF's on the existing Rochelle and North Antelope, Black Thunder, and Jacobs Ranch mines, and the results of these investigations are discussed below. There is, however, no present or historical record of agricultural use, other than undeveloped rangeland, of the stream-laid deposits within either the Powder River or the Thundercloud LBA tracts. Therefore, if WDEQ determines that AVF's are present on the tracts, it is reasonable to assume that mining will be permitted in those areas because the lack of agricultural development in this area precludes a determination that any of these AVF's will be significant to agriculture.

The North Antelope and Rochelle mine permit areas and adjacent areas, including the Powder River LBA Tract, have been investigated for the presence of AVF's. Reports on AVF's within the current permit areas are included in the North Antelope and Rochelle mine permit documents. There are no declared AVF's in the Rochelle permit area. Along Porcupine Creek, the only area designated as AVF within the North Antelope Mine permit is the extent of stream laid deposits inundated by the agriculturally useful flood, or the 2-yr, 6-hr storm. This classification consists of a very narrow band adjacent to the stream channel.

Porcupine Creek and its tributaries within the LBA tract (Corder Creek and Mike Draw, see Figure 3-10) have been investigated by PRCC for the presence of AVF's in anticipation of preparing an amendment to the mine permit to include the Powder River LBA Tract.

The alluvial deposits along Porcupine Creek consist primarily of a layer of poorly sorted sands and gravels, with some intermixing of

clays and silts, underlain by a layer of moderately well sorted medium sand intermixed with gravel. The groundwater levels in the alluvium show a fairly rapid response to changes in streamflow levels in Porcupine Creek. The valley deposits along Corder Creek and Mike Draw consist primarily of a layer of Quaternary sheet wash and colluvium that is a mixture of poorly sorted clayey sands and sandy clays with occasional rock fragments underlain by a layer of fine grained alluvium consisting of fine sands with clay and silt interbeds.

North Prong and Little Thunder Creek within and adjacent to the Jacobs Ranch and Black Thunder permit areas have also been investigated for the presence of AVF's. A report of these investigations is contained in the Black Thunder Mine permit document (TBCC 1992). Thunder Basin Coal Company investigated the potential for the presence of AVF's along the lower portions of Shipley and Mills Draws and North Prong Little Thunder Creek within and near the Thundercloud LBA Tract and along Little Thunder Creek within and near the Black Thunder Mine permit area. TBCC concluded, and WDEQ concurred, that some characteristics of an AVF may exist but there are no declared AVF's within and surrounding the permit area of Jacobs Ranch Mine. The conclusions included the finding that the lower reaches of Mills and Shipley Draws within the Thundercloud LBA Tract are not AVF's.

WDEQ/LQD has declared 143 acres along the lower reach of Little Thunder Creek and 194 acres along the lower reach of North Prong Little Thunder Creek as AVF's. The declared AVF along Little Thunder Creek extends from the eastern boundary of the Black Thunder Mine downstream to the confluence with North Prong Little Thunder Creek. The reach of the AVF along North

Prong Little Thunder Creek extends from the south edge of Highway 450 downstream to the confluence with Little Thunder Creek, which is several miles southeast of the Thundercloud LBA Tract (Figure 3-11). WDEQ/LQD declared the lower portions of the North Prong and Little Thunder Creek as AVF's due to the potential for subirrigated and flood irrigated agricultural activity on the alluvial deposits. Irrigation structures exist on lower North Prong but have not been used for many years. The declared AVF's will not be affected by the planned mining and reclamation within the Thundercloud LBA Tract since the tract is located several miles upstream from the declared AVF's.

KMCC is currently investigating the heretofore undeclared reaches of Mills and Shipley Draws within and upstream from the LBA tract for AVF characteristics. This investigation is a requirement for a mine permit.

3.8 Wetlands

Wetlands are defined as areas inundated or saturated with 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 (40 CFR 230.3 and 33 DFR 328.3). Wetlands generally include swamps, marshes, bogs and similar areas. Jurisdictional wetlands are those wetlands that are under regulatory authority of the EPA and the U.S. Army Corps of Engineers (COE) pursuant to Section 404 of the Clean Water Act. Such wetlands must exhibit all three diagnostic characteristics including hydrophytic vegetation, hydric soils, and wetland hydrology under normal circumstances.

The presence of jurisdictional wetlands on a mine property does not preclude mining but does entail special permitting procedures to assure that after mining is completed there will be no net loss of wetlands. A wetland delineation must be done 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 number and type of wetlands.

Jurisdictional wetland inventories were completed in 1996 by PRCC on the Powder River LBA Tract and adjacent areas which may be disturbed by mining activities. The wetlands delineation was completed in accordance with the procedures and criteria contained in the COE 1987 Wetlands Delineation Manual. A total of approximately 15 acres of jurisdictional wetlands were delineated within the area to be affected. Identified jurisdictional wetlands include playas (0.7 acre), manmade stockponds (4.3 acres), portions of ephemeral stream channels (9.9 acres), and roadside ditches/borrow pits (<0.1 acre). The jurisdictional wetlands also qualify as waters of the United States. An additional 5.4 acres of waters of the United States which did not qualify as jurisdictional wetlands were also identified. These waters included playas (<0.1 acre), stockponds (0.5 acre), ephemeral stream channels (4.3 acres), and roadside borrow pits (0.6 acre). These sites did not possess wetland characteristics because they pond or contain water for insufficient periods of time. PRCC has submitted a jurisdictional delineation of wetlands and other waters of the U.S. to the COE for the Powder River LBA Tract;

however, COE verification of PRCC's delineation has not been completed.

Jurisdictional wetland inventories were conducted by KMCC on the Thundercloud LBA Tract and adjacent areas which may be disturbed by mining activities in 1994, 1995, and 1996. The wetlands delineation was completed in accordance with the procedures and criteria contained in the COE 1987 Wetland Delineation Manual. KMCC submitted a jurisdictional delineation of wetlands and other waters of the U.S. on the Thundercloud LBA Tract to the COE on July 10, 1997. The COE conducted a site visit on September 8 and 9, 1997. Based upon the information submitted and the site visit, a total of 104.5 acres of waters of the U.S. have been identified, of which 56.7 acres are jurisdictional wetlands. There is an additional 0.97 acre of non-jurisdictional wetlands also contained in the tract. Identified jurisdictional wetlands include playas (35.3 acres), manmade stockponds (8.4 acres), portions of ephemeral stream channels (10.2 acres) and roadside ditches and borrow pits (2.8 acres). The additional 47.8 acres of waters of the U.S. which did not qualify as jurisdictional wetlands include playas (39.8 acres), stockponds (1.8 acres), ephemeral stream channels (5.6 acres) and roadside borrow pits (0.6 acre). These sites did not possess wetland characteristics because they pond or contain water for insufficient periods of time.

3.9 Vegetation

Vegetation studies have been completed within and adjacent to both LBA tracts. The vegetation studies on the Thundercloud LBA Tract were completed in accordance with Appendix A of the WDEQ/LQD's Rules and Regulations. For the Powder River LBA Tract, preliminary vegetation studies were completed in 1996, and final studies in

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accordance with WDEQ/LQD Rules and Regulations are scheduled for completion in 1997. The study areas for these vegetation studies included the LBA tracts and a buffer area around each tract sufficient to mine and reclaim each tract as a part of the existing mine operation.

A total of ten vegetation types or map units were identified by the studies. Vegetation types for the Powder River and Thundercloud LBA Tracts, as well as the total area that would be disturbed while mining tracts as an extension of the existing mining operation, is provided in Tables 3-6 and 3-7, respectively. The vegetation map units are described below.

The **big sagebrush type** was the largest map unit identified on the Thundercloud LBA Tract and occurs on uplands scattered throughout the study area. As the name implies, this area is a shrubland dominated by big sagebrush (*Artemisia tridentata*). Major perennial grass species found in this map unit were western wheatgrass (*Agropyron smithii*), prairie junegrass (*Koeleria macrantha*), Sandberg bluegrass (*Poa secunda*), and needle-and-thread (*Stipa comata*). Annual grasses were also abundant in this vegetation type and were dominated by cheatgrass brome (*Bromus tectorum*).

The **upland grassland** type was the largest map unit identified on the Powder River LBA Tract and was found primarily on uplands scattered throughout the study area. This map unit was generally dominated by perennial grasses, but annual grasses and annual forbs were also common in 1996. The dominant perennial grasses were needle-and-thread, western wheatgrass and prairie junegrass. The dominant annual grass was six-weeks-grass (*Festuca octoflora*), which provided the most coverage of any single species on this map unit. Cheatgrass brome

was another abundant annual grass recorded for this type. Fluffweed (*Filago arvensis*) was the most common annual forb recorded.

The **cultivated** lands documented on the study area were comprised solely of crested wheatgrass (*Agropyron cristatum*) seedlings. In many cases, these seedlings had been completed so long ago that encroachment of native species has since occurred. However, areas tilled and seeded to crested wheatgrass were easily recognized during the growing season and were still dominated by this introduced species. This vegetation type exhibited far less vegetation cover and ground cover than the sagebrush shrubland type. The most common perennial grasses recorded on these areas were western wheatgrass and sandberg bluegrass.

The **breaks grassland** type was found on the central portion of the Powder River LBA Tract. This type occurred primarily on heavy clay soils with numerous slickspots and some salinity or alkalinity. Much of the soil within this vegetation type is unsuitable for salvage as topsoil. This vegetation type exhibited far less vegetation cover and ground cover than the sagebrush shrubland type. The most common perennial grasses recorded on these areas were western wheatgrass and sandberg bluegrass.

The **mixed shrub** type was found on the western portion of the Thundercloud study area. This type occurred primarily on heavy clay soils with numerous slick spots and some salinity or alkalinity. Much of the soil within this vegetation type was deemed unsuitable for salvage as topsoil. Big sagebrush was the dominant shrub on this type but greasewood (*Sarcobatus vermiculatus*) was also common.

The **reclaimed lands** were found mostly in the southeastern corner of the Thundercloud

Table 3-6. Acreage Tabulations for Vegetation Types Identified Within the Powder River LBA Tract and the Total Disturbance Area

Vegetation Type	Powder River LBA Tract		Total Disturbance	
	Acres	Percent of Area	Acres	Percent of Area
Big Sagebrush Grassland	927	23	1,671	33
Upland Grassland	1,338	33	947	29
Cultivated	444	11	144	7
Breaks Grassland	1,056	26	808	24
Disturbed Lands	33	<1	100	2
Reservoirs/ Stockponds	8	<1	3	<1
Bottomland Grassland	151	4	219	5
Playa Grassland	64	2	14	<1
Totals	4,021	100	3,906	100

Table 3-7. Acreage Tabulations for Vegetation Types Identified Within the Thundercloud LBA Tract and the Total Disturbance Area

Vegetation Type	Thundercloud LBA Tract		Total Disturbance	
	Acres	Percent of Area	Acres	Percent of Area
Big Sagebrush	1,373	40	1,522	38
Upland Grassland	968	28	1,173	29
Cultivated	452	13	508	12
Mixed Shrub	394	11	484	12
Reclaimed Lands	78	2	155	7
Disturbed Lands	98	3	113	3
Reservoirs/Stockpond	40	1	48	1
Bottomland Grassland	22	1	24	1
Povertyweed and Saltgrass Playas	11	<1	18	<1
Total	3,436	100	4,045	100

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study area. These sites were reclaimed by the Black Thunder Mine following coal removal in those areas. Vegetation cover and production are generally good. Wheatgrasses dominate the vegetation but some big sagebrush and fourwing saltbush (*Atriplex canescens*) plants are also present.

The **disturbed lands** are located throughout the study area. These sites include oil and gas wells, roads, a pumping station, a plant, pipelines, a railroad and a highway. Most of the disturbed areas are devoid of vegetation or are dominated by weeds.

There are a variety of **reservoirs/stockponds** scattered throughout the study area. Most of these ponds are relatively small and do not contain water throughout the year. Many of the ponds only contain water for a short period of time during the spring or immediately following intense thunderstorms that produce runoff. Many areas are devoid of vegetation following evaporation of the impounded water. Species in this vegetation type are highly diverse. Species typically found in these areas range from wetland species such as longstem spikerush (*Eleocharis palustris*) and bulrush (*Scirpus spp.*) to bottomland grassland species such as Kentucky bluegrass (*Poa pratensis*), foxtail barley (*Hordeum jubatum*), inland saltgrass (*Distichlis stricta*), alkali bluegrass (*Poa juncifolia*) and alkaligrass (*Puccinellia nuttalliana*). All ponds were evaluated as potential wetlands. The results of these evaluations are discussed in Section 3.8.

The **bottomland grassland** type is primarily located along ephemeral drainages and includes the shorelines of stockponds located in the drainages. Predominant species were perennial grasses and included western wheatgrass, Kentucky bluegrass and foxtail barley. The annual grass, Japanese brome

(*Bromus japonicus*), was also abundant in this vegetation type.

One **povertyweed playa** and one **saltgrass playa** were identified in the western portion of the Thundercloud study area. The povertyweed playa was dominated by povertyweed (*Iva axillaris*), a noxious weed, and the annual forb scouler popcorn flower (*Plagiobothrys scouleri*). The saltgrass playa occupied was dominated by inland saltgrass. Vegetation was very sparse on both areas. The **playa grassland** is located within several small playas on the Powder River LBA Tract and adjacent area. The primary grass component of this vegetation type is western wheatgrass. Much of the soil is unsuitable due to high salt content.

Threatened, Endangered, and Candidate Plant Species

The Endangered Species Act (16 U.S.C. 1531-1543) protects plant and animal species that are listed as threatened and endangered (T&E), as well as their critical habitats. Endangered species are defined as those that are in danger of extinction throughout all or a significant portion of their range. Threatened species are those that are likely to become endangered in the foreseeable future throughout all or a significant portion of their range. An additional classification--candidate species (formerly Category 1 candidate species)--includes species for which the USFWS has sufficient data to list as T&E, but for which proposed rules have not yet been issued.

A list of T&E and candidate species potentially occurring in the Powder River and Thundercloud tracts was provided by USFWS (USFWS, written communication, 10/17/96). No T&E or candidate plant species were included on this list as

potentially being present on the Powder River LBA Tract or the Thundercloud LBA Tract. Surveys for T&E plant species within the Powder River LBA Tract and adjacent areas were conducted in 1997. Surveys for T&E plant species were conducted for the Thundercloud LBA Tract and adjacent areas in 1995 and 1996.

Of special concern was the Ute Lady's Tresses orchid (*Spiranthes diluvialis*) which is listed as a threatened plant species. The species was collected along the upper reaches of Antelope Creek in the southwestern part of the PRB during 1994. Surveys completed for the LBA tracts did not locate this species or any other T&E species on either of the LBA tracts or areas adjacent. Discussions with personnel of the Rocky Mountain Herbarium in Laramie, Wyoming indicate habitat for the Ute Lady's Tresses orchid probably did not occur on the study area due to the lack of perennial or intermittent streams with shorelines that are subirrigated throughout the summer.

The 1995 plant surveys of the Thundercloud LBA Tract did result in the collection of one plant species which had never before been collected in Wyoming and was therefore a new state record. The species, *Sesuvium verrucosum*, was verified by personnel from the Rocky Mountain Herbarium. The plant was collected from an alkali playa located north of the Thundercloud LBA Tract. Other plant species or habitats of special concern due to rarity were not identified on the study area.

3.10 Wildlife

Wildlife surveys have been completed within and adjacent to both LBA tracts. Because wildlife habitat and characteristics are site dependent, the wildlife discussions for each LBA tract are presented separately.

Powder River LBA Tract

PRCC has conducted wildlife baseline investigations on the Powder River LBA Tract. The objectives of the project were to collect both qualitative and quantitative data on vertebrate occurrence, abundance, and habitat affinity on the Powder River LBA Tract and surrounding area as a prerequisite to applying for a mining permit.

Baseline studies were completed in 1994 (Powder River Eagle Studies 1996). That year, systematic surveys were conducted for big game, upland game birds, waterfowl and shorebirds, raptors, migratory birds of high federal impact (MBHFI), breeding birds, and lagomorphs. Although specific surveys were not conducted for T&E species, observers watched for those animals and their requisite habitats. Incidental observations were also made of predators, amphibians, and reptiles. The extent of habitats on the Powder River LBA Tract was also mapped. In 1995 and 1996, PRCC conducted monitoring studies at Rochelle and North Antelope Mines. Those studies yielded additional information on wintering big game, nesting raptors, and upland game birds in the vicinity of the Powder River LBA Tract.

Small mammals were not trapped on the Powder River LBA Tract because previous surveys conducted at the adjacent North Antelope (North Antelope Coal Company 1994) and Rochelle Mines (Rochelle Coal Company 1994) demonstrated that no unique or unusual species occurred in the general area.

While wildlife inventory efforts focused on the Powder River LBA Tract, some surveys extended onto adjacent land. The baseline area and a half-mile perimeter were searched for MBHFI. Searches for upland game bird leks extended into a one-mile perimeter

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around the baseline area. The survey area for big game and raptors included the Powder River LBA Tract and its two-mile perimeter.

Fish

Due to the intermittent to ephemeral nature of the drainages present within the Powder River LBA Tract and adjacent areas, habitat to support a fishery is minimal. It is possible that some fish species such as flathead minnow (*Pimephales promelas*) and black bullheads (*Amiurus melas*) may exist in some of the deeper pools on Porcupine Creek, but the tendency of these pools to go dry during drought periods makes the presence of fish unlikely.

Big Game

The WGFDD has classified the entire Powder River LBA Tract as pronghorn (*Antilocapra americana*) yearlong range. A small area in the north-central part of the two-mile perimeter was classified as winter/yearlong range. Pronghorn were commonly observed in the vicinity of the Powder River LBA Tract and were present year-round in moderate numbers.

In 1994, the number of pronghorn observed on the baseline area and in the two-mile perimeter varied considerably during the three aerial surveys. The largest number observed over the entire area was 596 (7 per mi²) during the March survey.

After March, the number of pronghorn in the area decreased considerably. The reduction in pronghorn abundance after winter may reflect some dispersion from the area. However, it is also likely that more pronghorn were overlooked during the June survey. Large winter herds broke up after March and were less obvious. In March,

herds of up to 48 animals were seen; herd size did not exceed 13 animals during the June survey.

By late summer, the number of pronghorn in the area had increased. Fawns, which were small and may have been missed during the June survey, undoubtedly augmented the population. Although pronghorn abundance increased through the summer, the number of pronghorn seen on September 18th was less than half the number recorded in March. During the March and June surveys, pronghorn density was slightly greater on the Powder River LBA Tract than in the two-mile perimeter; densities were very similar during the September survey.

Pronghorn were distributed throughout the Powder River LBA Tract and its two-mile perimeter during all three surveys. However, more pronghorn were observed in the western half of the area, and especially the northwest corner, during each survey. Terrain in those portions of the 79 mi² area is not as rugged as in other sections. Pronghorn seemed to be nearly absent from the extreme north-central section of the survey area during each flight. The habitat in that portion of the area appeared suitable, so the low counts in north-central segment were considered coincidental.

Habitat utilization noted during the aerial surveys was typical of pronghorn in northeast Wyoming. Pronghorn were observed in big sagebrush grassland, upland grassland, breaks grassland, reclaimed grassland, and bottomland grassland during each of the surveys. During the March survey, most of the pronghorn seen (77%) were in big sagebrush grassland. This result is not surprising because big sagebrush grassland is the most abundant type in Powder River LBA Tract disturbance area, and sagebrush grassland is preferred by wintering

pronghorn (Sundstrom et al. 1973). Pronghorn were much less concentrated in big sagebrush grassland during the early and late summer surveys. More pronghorn were seen in upland grassland areas than any other habitat during the June survey.

The number of pronghorn observed during the 1994 driving survey (106) was similar to the number observed during the June aerial survey (139). Approximately 50% of the pronghorn observed during the driving survey were in big sagebrush grassland. The rest were divided evenly between upland and meadow grasslands.

Sex and age data indicated that the percentage of adult and yearling bucks in the area was approximately 36% of all animals classified during the survey. The ratio of fawns per 100 does observed during the ground survey was 103:100. That was greater than the ratio of 85 fawns per 100 does recorded by WGF D (Wilson 1994) for the entire northeast region of Wyoming in 1994.

Densities recorded during winter aerial surveys conducted from 1994 through 1996 indicated that the pronghorn population in the Powder River LBA Tract and two-mile perimeter decreased considerably by March 1996. It is likely that losses to hemorrhagic disease in autumn 1995 reduced the density of pronghorn wintering in the area in the winter of 1995-1996. WGF D personnel estimated that the disease outbreak reduced pronghorn populations throughout the region by 15-25%; in some areas, losses were estimated to be nearly 60% (Gillette News-Record 1996a).

WGF D has classified approximately 60% of the Powder River LBA Tract as mule deer (*Odocoileus hemionus*) "out" range. The habitat in such areas is considered to be

inadequate to support mule deer. The area of mule deer yearlong range has been delineated along Porcupine and Corder Creeks.

Because habitat is limited, few mule deer would be expected to occur in the area. The number of deer recorded in the 79 mi² aerial survey area in 1994 ranged from 34 in March to four in June. Deer recorded during aerial surveys were often seen in the breaks grasslands located in the eastern and south-southeastern portions of the survey area. The number of deer observed in the Powder River LBA Tract and two-mile perimeter during winter aerial surveys completed from 1994-1996 ranged from 15 to 34. Variations in the number of mule deer observed during the flights may not be important. The aerial surveys, as conducted, are designed primarily to census pronghorn and may not yield accurate counts of deer.

Driving surveys completed in 1994 indicated that deer were scarce in the baseline area. The greatest number of deer seen was 33 on June 23rd. Big sagebrush grassland was the only habitat in which deer were observed during all surveys. Meadow grassland habitat was the only other habitat in which deer were recorded more than once.

Although the Powder River LBA Tract is within the WGF D Elk (*Cervus elaphus*) Hunt Area 113, which contains the Rochelle Hills Elk Herd, the LBA tract itself is classified as elk "out" range. Elk sightings within the LBA tract are rare to non-existent.

Upland Game Birds

The sage grouse (*Centrocercus urophasianus*) is the only upland game bird that occurs in the vicinity of the Powder River LBA Tract. One known sage grouse lek, "Wilson", is located within 0.5 mile of the eastern boundary of the Powder River LBA Tract, in

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NW1/4 NE1/4 Section 36, T42N, R70W (see Figure 3-12). Wilson lek was discovered by WGFD personnel in spring 1975; WGFD also monitored the lek in 1979 and 1980. Because Wilson lek is on the Rochelle Mine permit area, it has been monitored each spring since mine construction began in 1985.

During the springs of 1979 and 1980, 30 to 35 males were regularly seen at the lek. The next year the lek was checked, 1985, substantially fewer males were attending Wilson. The decrease in attendance was probably caused by two weather factors that reduced sage grouse populations throughout the PRB in 1984. The winter of 1983-1984 was very severe and resulted in the loss of breeding birds from the population; a blizzard in April 1984 largely eliminated reproduction that spring.

Sage grouse populations remained low through 1988. By the 1989 breeding season, however, grouse attendance at Wilson and other leks in the region was starting to increase (PRES 1997). From 1989 through 1991, attendance at Wilson lek was similar to that observed in 1979 and 1980. After 1991, attendance at Wilson steadily declined. By 1996, male attendance at the lek dropped to its lowest level ever.

Natural factors have probably caused the most recent decline in attendance at Wilson lek. Drought conditions severely limited brood rearing habitat during the late 1980's and early 1990's. Without good brood rearing areas, chick survival is reduced and the population declines. No land use changes occurred within 1.5 miles of the lek from 1979 through 1996.

No new leks were found on the Powder River LBA Tract or within its one-mile

perimeter during searches completed in spring 1994.

Meadow grasslands (bottomlands) on the Powder River LBA Tract appear to be suitable sage grouse summering and brood-rearing habitat. However, observations indicated that few grouse used the area in summer 1994. No broods were seen along the three transects surveyed in July. A single adult female was seen on the southwest-most transect on July 21st. A female and brood of three young were incidentally observed near a pond at an old oil well site in SW1/4 SW1/4 Section 28, T42N, R70W, on July 14th.

Because sage grouse droppings generally persist with little deterioration for up to a year, scat noted during the initial June 4th survey were indicative of use during the previous year; results from the August 11th survey reflected summer use. Only two old droppings were found during the early summer survey; one scat was found in meadow grassland and one was found in big sagebrush grassland. No scats were found when the transects were surveyed in August 1994. Although the big sagebrush grasslands on and near the Powder River LBA Tract seem sufficiently dense to serve as wintering or nesting habitat, apparently few grouse have used the area in recent years.

Waterfowl and Shorebirds

Little standing water was present in ponds or in Porcupine Creek on the Powder River LBA Tract during the June 23rd and July 14th surveys. Of the 14 ponds, three were completely dry during both surveys and eight held little water through summer 1994; only three ponds were more than half full during a survey. Water in Porcupine Creek was limited to several scattered pools separated

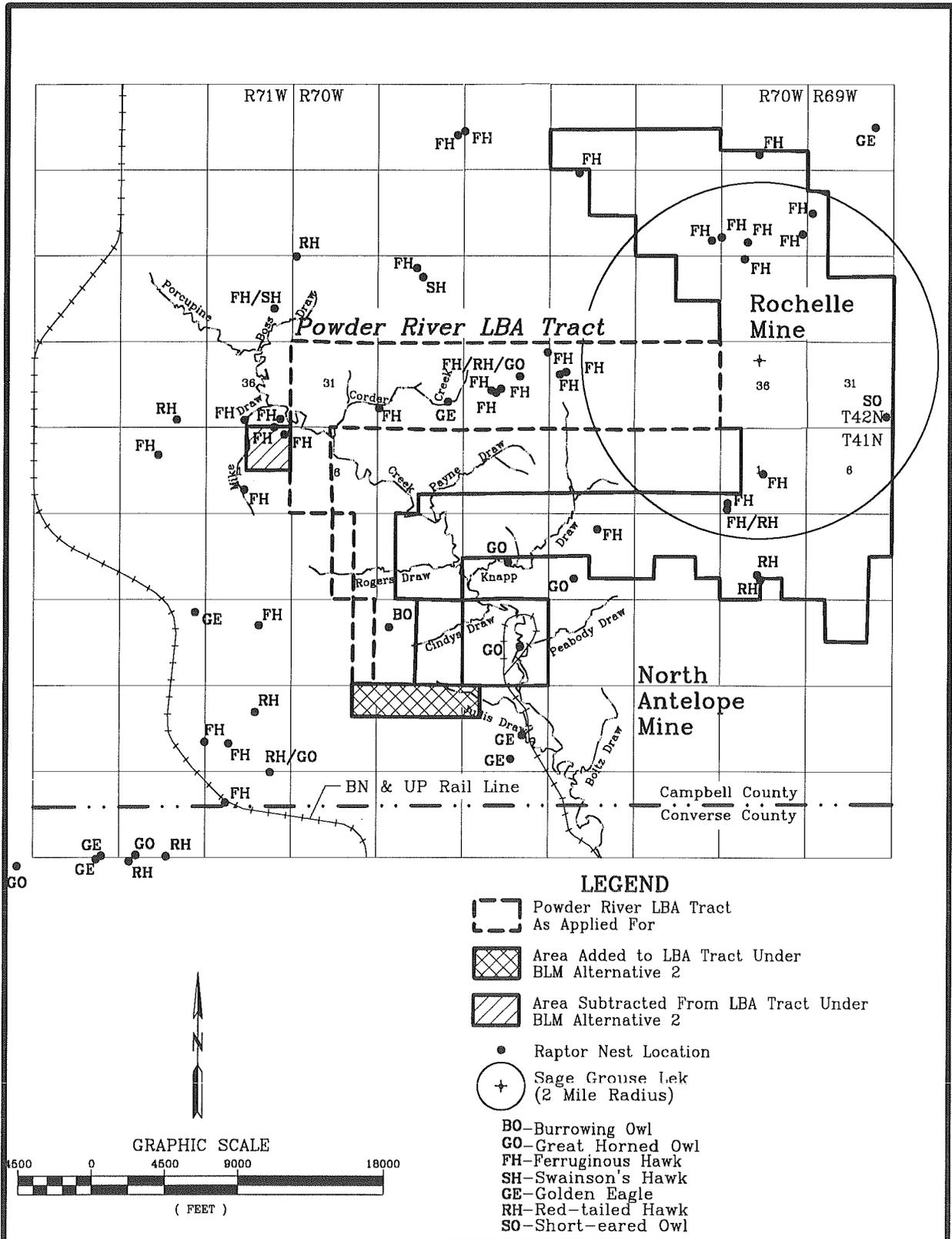


Figure 3-12. Raptor Nest Sites and Sage Grouse Leks Within and Adjacent to the Powder River LBA Tract.

by dry sections. No flowing water was observed in the creek in summer.

Five species of dabbling ducks and one shorebird were seen in the Powder River LBA Tract. Most of the birds seen during the surveys were along Porcupine Creek and a stock pond located in NW1/4 NW1/4 Section 34, T42N, R70W. Water levels in the creek and ponds diminished after June, and substantially fewer birds were observed in July than in June.

The American wigeon (*Anas americana*) was the most common duck recorded in June; mallards (*Anas platyrhynchos*) were the most common species during the July 14th survey. The killdeer (*Charadrius vociferus*) was the only shorebird seen during surveys. Just one brood of five mallards was seen during the July 14th survey; no young killdeer were identified, but it is likely that killdeer bred on the Powder River LBA Tract.

The scarcity of waterfowl and shorebirds on the Powder River LBA Tract is not surprising. Waterfowl habitat in northeast Wyoming in general, and the Powder River LBA Tract in particular, is very limited and largely ephemeral. Typically, most of the migrants that visit the region in the spring move elsewhere to breed.

Raptors

Over the years, 98 nests have been located in the entire 79 mi² area. After their discovery, some of those nests were destroyed by natural forces; others were removed as mitigation measures. Consequently, as of August 31, 1996 there were 57 known intact raptor nests in the area (Figure 3-12); 16 nests were on the Powder River LBA Tract and 41 were in the 2-mile perimeter. The 57 intact nests included:

- 31 ferruginous hawk nests,
- 7 golden eagle nests,
- 6 red-tailed hawk nests,
- 5 great horned owl nests,
- 1 Swainson's hawk nest,
- 1 burrowing owl nest hole,
- 1 short-eared owl nest,
- 2 nests that have been used by red-tailed hawks and by great horned owls,
- 1 nest that has been used by ferruginous hawks and Swainson's hawks,
- 1 nest that has been used by ferruginous hawks and red-tailed hawks, and
- 1 nest that has been used by ferruginous hawks, red-tailed hawks, and great horned owls.

Four species of raptors nested in the area each year from 1992 through 1996: golden eagles (*Aquila chrysaetos*), ferruginous hawks (*Buteo regalis*), red-tailed hawks (*Buteo jamaicensis*), and great horned owls (*Bubo virginianus*). Swainson's hawks (*Buteo swainsoni*) nested during four of those years. Burrowing owls (*Athene cunicularia*) have historically nested within the area, but none were observed from 1992-1996. Short-eared owls (*Asio flammeus*) were found nesting in the area for the first time in 1996. Northern harriers (*Circus cyaneus*), prairie falcons (*Falco mexicanus*), and turkey vultures (*Cathartes aura*) have been observed in the area during most breeding seasons, but no nests containing eggs or young of those species were found. Northern harriers could nest in the area, but the lack of cliff habitat on the Powder River LBA Tract would probably preclude nesting by prairie falcons and turkey vultures.

Ferruginous hawk nests were by far the most abundant nests in the area. Thirty-one intact ferruginous hawk ground nests existed at the

end of 1996; 13 on the Powder River LBA Tract and 18 in the two-mile perimeter. Three other nests have been used by ferruginous hawks and other species over the years. The abundance of ferruginous hawk nests in the area is undoubtedly due to this species' habit of building multiple nests within individual territories. Based on the spacing of nests and monitoring data, it appeared that the 31 intact ferruginous hawk nests were in fourteen different territories. Each year since 1992, at least three pairs of ferruginous hawks attempted to nest in the area. Reproduction was highest in 1992, when nine young fledged. Since then, annual production has been considerably reduced.

There were seven golden eagle nests, presumably in five territories, in the survey area in August 1996. One of those nests (GE1e) was on the Powder River LBA Tract and six were within the two-mile perimeter. Nest GE1e is a nesting platform that was erected in 1993 by PRCC to mitigate potential impacts to eagles nesting at the North Antelope Mine. Three or four pairs have nested in the survey area each year from 1992 through 1996. After a peak of three young fledged in 1992, annual production was only one young per year from 1993 through 1995. Two young fledged in 1996. At the end of 1996 there were six red-tailed hawk nests in the area; there were four other intact nests that had been used alternately by red-tailed hawks and other raptors. Two of the nests that have been used by red-tailed hawks are on the Powder River LBA Tract. From 1992 through 1996, red-tailed hawks nested in seven different territories in the entire survey area. The highest number of nesting pairs observed was five in both 1992 and 1996; one to three pairs nested each year from 1993-1995. Productivity was highest in 1992 when eight young fledged. Productivity fell to none or one young during

each of the next three years. In 1996, productivity increased to five fledglings.

At the end of the 1996 breeding season, there were eight intact nests in the survey area that had been used at least once by owls. Only one of the nests used by owls was on the Powder River LBA Tract; the remaining sites were in the two-mile perimeter. As with other species, great horned owl nesting success was highest in 1992. The number of nesting pairs was greatly reduced in 1993, and remained low in subsequent years.

Each year since 1992, there have been one or two intact Swainson's hawk nests in the two-mile perimeter. A third nest on the Powder River LBA Tract was used by Swainson's in the past but has been used by ferruginous hawks since 1993. During most years, only one pair of Swainson's hawks was found nesting in the area; two pair nested in 1994.

Monitoring data indicate that there was a considerable decline in raptor breeding productivity after 1992. All species experienced decreased productivity, but the decline was especially evident for ferruginous hawks, red-tailed hawks, and great horned owls. Reduced production in recent years was undoubtedly the result of a decline in prey (lagomorph) abundance. Surveys at mines throughout the PRB have demonstrated that lagomorph populations declined dramatically after winter 1992-1993 and remained relatively.

Migratory Birds of High Federal Interest

Table 3-8 lists the 17 MBHFI of concern in the PRB and their expected occurrence in the Powder River LBA Tract. Historically, 12 of the 17 MBHFI have been recorded in the area. Seven of the observed MBHFI are raptors.

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Table 3-8. MBHFI Status Northeast Wyoming and Expected Occurrence on or near the Powder River LBA Tract

Species	Seasonal Status/ Breeding Records in NE Wyoming ¹	Sighting Records in Vicinity of Powder River LBA Tract	Expected Occurrence in Vicinity of Powder River LBA Tract
White Pelican	Summer/nonbreeder	Yes	Rare
Double-crested Cormorant	Summer/breeder	Yes	Rare
Canvasback	Summer/one record	No	Rare
Osprey	Summer/nonbreeder	Yes	Rare
Bald Eagle	Winter/nonbreeder	Yes	Common in Winter
Ferruginous Hawk	Summer/breeder	Yes	Common
Golden Eagle	Resident/breeder	Yes	Common
Richardson's Merlin	Resident/breeder	Yes	Rare
Peregrine Falcon	Migrant/historical breeding record only	No	Rare
Prairie Falcon	Resident/breeder	Yes	Uncommon
Sandhill Crane	Migrant/nonbreeder	Yes	Uncommon
Whooping Crane	Never recorded	No	Very Rare
Mountain Plover	Summer/breeder	Yes	Uncommon
Long-billed Curlew	Summer/breeder	Yes	Rare
Burrowing Owl	Summer/breeder	Yes	Uncommon
Lewis' Woodpecker	Summer/breeder	No	Rare
Dickcissel	Summer/breeder	No	Rare

¹ Compiled from Oakleaf et al. (1992), includes Campbell County and adjacent counties.

Only three MBHFI--the ferruginous hawk, golden eagle, and burrowing owl--have ever been found breeding on the Powder River LBA Tract or its half-mile perimeter. Ferruginous hawk and golden eagle nesting on the Powder River LBA Tract were discussed above. Burrowing owls were found nesting in a black-tailed prairie dog (*Cynomys ludovicianus*) colony in the half-mile perimeter in 1985, but not in subsequent years. Non-breeding MBHFI raptors that

have been recorded on or near the Powder River LBA Tract include bald eagles (*Haliaeetus leucocephalus*), prairie falcons, Richardson's merlins (*Falco columbarius richardsonii*), and osprey (*Pandion haliaetus*). Bald eagles occur only as winter visitors in northeast Wyoming. Although they were seen flying over the Powder River LBA Tract each winter, there were no roost sites or unique prey sources that attracted bald eagles to the area.

There is no nesting habitat for prairie falcons or merlins on the Powder River LBA Tract. Both of those species, however, have nested in the vicinity of the adjacent Rochelle Mine.

Non-raptor MBHFI that have been recorded in the vicinity of the Powder River LBA Tract include American white pelicans (*Pelecanus erythrorhynchos*), double-crested cormorants (*Phalacrocorax auritus*), sandhill cranes (*Grus canadensis*), long-billed curlews (*Numenius americanus*), and mountain plovers (*Charadrius montanus*). White pelicans and double-crested cormorants sporadically frequent Porcupine Reservoir, which is approximately 2.5 miles southeast of the Powder River LBA Tract. Although it has a large capacity and holds water in spring, Porcupine Reservoir usually is dry or mostly empty by July. Consequently, it is extremely doubtful that pelicans or cormorants would ever breed at the reservoir.

Sandhill cranes commonly migrate over Campbell County in spring and fall; however, this region does not lie within the major migration routes shown by Evans and others (1983). Migrating cranes frequent wet meadows, grainfields, and alfalfa fields. Such areas do not occur on the Powder River LBA Tract. The only long-billed curlews reported in the area were probably migrants passing through the region. Curlews were seen during monitoring studies at the nearby Rochelle Mine in 1994 and 1996.

Mountain plovers have regularly nested at the nearby Antelope Mine, but few have been sighted in the Powder River LBA Tract survey area. Only one observation of a lone plover was seen near a playa in the southeast part of the half-mile perimeter in 1988. Each year from 1994 through 1996, adult plovers were seen in a black-tailed prairie dog colony in the half-mile perimeter in SE1/4 NW1/4 Section 17, T41N, R70W. All of those

sightings were made in spring. Numerous searches of the colony and surrounding area have failed to locate any plover nests and no young have ever been seen.

Breeding Birds

Twenty-eight species were seen during breeding bird surveys completed in 1994. Species richness was greatest in bottomland grassland, where 21 species were observed, more than twice as many as were observed in any other habitat. Ten species were observed in upland grassland and nine in big sagebrush grassland. Cultivated land (seeded grassland) and tree windbreak had the fewest species; eight species were found in each of those habitats.

Twenty-three of the 28 species recorded were classified as regular (observed three or more times over the four survey mornings) in at least one habitat. The remaining five species were considered to be occasional (observed fewer than three mornings). The western meadowlark (*Sturnella neglecta*) was the only species observed in all five habitats and it was a regular species in each. Lark buntings (*Calamospiza melanocorys*), horned larks (*Eremophila alpestris*), vesper sparrows (*Pooecetes gramineus*), grasshopper sparrows (*Ammodramus savannarum*), and mourning doves (*Zenaida macroura*) were observed in four of the five habitats surveyed. Lark buntings, horned larks, vesper sparrows, and grasshopper sparrows were not observed in the tree windbreak; mourning doves were absent from upland grasslands. In addition to being wide-spread, lark buntings and horned larks were abundant and regular in all four habitats where they occurred. Vesper sparrows and grasshopper sparrows were regularly found in two habitats and were occasional in two others. Mourning doves were regular in the tree windbreak, but were occasional in the other three habitats where

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they occurred. Fourteen species recorded in 1994 were seen in only one habitat.

Avian abundance (mean number of birds observed per day per transect/plot) was very similar among all habitats except tree windbreak. Abundance was greatest in meadow grassland (35.8 birds/day), followed by big sagebrush grassland (34.4 birds/day), upland grassland (33.0 birds/day), and seeded grassland (31.1 birds/day). The value for meadow grassland transects was inflated because a flock of 71 starlings (*Sturnus vulgaris*) was observed in the transect during one survey period (abundance was 26.5 birds/day when the starlings were omitted from the calculations). Slightly more than 8.0 birds/day were seen in the tree windbreak. That result, however, was undoubtedly influenced by the small size of the tree plot.

Lagomorphs

Lagomorph surveys completed on September 9-10, 1994 confirmed that hare and rabbit populations in the Powder River LBA Tract were very depressed. No rabbits were seen during the two nights of spotlighting (23.2 miles total). Surveys completed at coal mines in the PRB in 1993 demonstrated that lagomorph abundance was very low throughout the region that year (PRES 1996). Results from surveys conducted at area mines in 1995 and 1996 indicated that the population was slowly beginning to recover (PRES 1996). Reduced numbers since 1993 probably reflect a natural low in the lagomorph population cycle.

Predators and Furbearers

No formal surveys for predators or furbearers were conducted, but personnel watched for them during all field studies. The Powder River LBA Tract and

surrounding area are primarily used for sheep grazing. Because sheep are particularly vulnerable to predation, local ranchers continually attempt to control predators in the area. Consequently, few predators were observed during 1994; only one coyote was seen during field studies that year. Red foxes (*Vulpes vulpes*) were occasionally observed throughout the year on the Powder River LBA Tract and in the perimeter. On September 10th, four foxes were seen on the Powder River LBA Tract by personnel spotlighting for lagomorphs. Also seen on September 10th was a family group of four young raccoons (*Procyon lotor*) along Porcupine Creek in the northwest corner of the Powder River LBA Tract. A muskrat (*Ondatra zibethicus*) was recorded on a pond on the Powder River LBA Tract on April 14th. Other species seen in 1994 included striped skunks (*Mephitis mephitis*) and feral cats (*Felis domesticus*).

Other

Other species seen during each of the aerial surveys included mule deer and golden eagles. One bald eagle was seen during the March survey; two red-tailed hawks were recorded in June; and one coyote (*Canis latrans*) was noted in September. A total of three dead pronghorn were observed during the March and June surveys.

Thundercloud LBA Tract

Detailed wildlife surveys for the purpose of obtaining a WDEQ/LQD mining permit for the Thundercloud LBA Tract were completed during 1995 and 1996. The entire Thundercloud LBA Tract was also surveyed during baseline studies for the adjacent Jacobs Ranch Mine (JRM) permit and/or Black Thunder Mine (BTM) permit. Additionally, the Thundercloud LBA Tract is covered under portions of the wildlife

monitoring programs for both mines. The result is over 15 years of wildlife surveys that have covered all, or portions of, this area.

Fish

Although several ponds and ephemeral drainages exist within the Thundercloud LBA Tract and adjacent areas, habitat to support a fishery is not present. The ponds and drainages generally do not hold water throughout the year or only do so as the result of an extremely wet year. Only one pond, a manmade stockpond located in NW1/4 Section 4, T43N, R70W, has been observed to consistently hold water over the past 10 years. However, water levels in this pond are so low in the fall that fish would not be able to survive or over-winter.

Big Game

Three big game species have been observed on the Thundercloud LBA Tract. These species include pronghorn, mule deer and elk. The white-tailed deer (*Odocoileus virginianus*) is found in limited numbers in portions of the PRB but has not been recorded on or adjacent to the Thundercloud LBA Tract. WGFD big game herd unit maps show this area is out of the normal white-tailed deer range.

The pronghorn is the most abundant big game animal in the region. The Thundercloud LBA Tract is within the WGFD Hilight Pronghorn Herd Unit with approximately 2,695 acres of the proposed disturbance within winter-yearlong range and the remaining 1,350 acres within yearlong range. None of the disturbance or areas within two miles have been classified as crucial or critical pronghorn habitat. Data obtained for the Hilight Herd Unit indicate the WGFD estimated population numbers

averaged approximately 17 animals per mi² of occupied habitat from 1980 through 1995. The yearly big game monitoring surveys completed for the adjacent JRM and BTM mines also covered the Thundercloud LBA Tract. The JRM surveys averaged 11 pronghorn per mi² and the BTM surveys averaged eight per mi² for the same period of 1980 through 1995. This would indicate that pronghorn numbers are much lower in this portion of the herd unit.

The Thundercloud LBA Tract and disturbance area are located within the western portion of the WGFD Thunder Basin Mule Deer Herd Unit. The WGFD maps show the proposed disturbance area includes 2,225 acres of yearlong mule deer range and 1,820 acres of lands which are generally out of normal use areas. Crucial or critical mule deer ranges do not occur on or within several miles of the proposed disturbance area. WGFD data from 1980 through 1995 for the entire herd unit show an average of four mule deer per mi² of occupied habitat while data collected by JRM and BTM averaged less than one animal per mi² for the same time period. The low densities exhibited by the mines' monitoring data reflect the fact that a good portion of the LBA tract is classified by WGFD as not being within normal mule deer use areas.

The Thundercloud LBA Tract is not generally considered by WGFD to be an elk use area, but several elk have been recorded on the eastern portion of the Thundercloud LBA Tract over the past several years. Elk have been observed spending considerable time wintering on reclaimed areas and adjacent grasslands on the southeastern portion of the Thundercloud LBA Tract in recent years. Three mature bull elk were also observed during wildlife surveys on the Thundercloud LBA Tract in July of 1996. At that time, they frequented bottomland

grasslands and upland grasslands on the eastern portion of the site.

None of the disturbance or areas within two miles have been classified as crucial or critical elk habitat. The nearest crucial elk habitat is 2.5 miles to the east on JRM reclaimed area. The WGFD (Oedekoven 1994) has designated an approximately five mi² area on reclaimed and adjacent lands as crucial winter habitat for the Rochelle Hills elk herd.

Upland Game Birds

Several upland game bird species have been observed on the Thundercloud LBA Tract or adjacent areas, including sage grouse and migratory mourning doves (*Zenaidura macroura*). Based on field observations, the mourning dove was the most common of the two species. This species only inhabits the area from late spring to early fall for breeding and reproduction.

The sage grouse is a yearlong resident but did not appear to frequent the Thundercloud LBA Tract. Sage grouse lek surveys completed in April and early May of 1995 and April of 1996 failed to locate any active sage grouse strutting grounds on or within two miles of the Thundercloud LBA Tract. Previous monitoring for the adjacent JRM identified several strutting grounds located approximately 2.5 miles northeast of the Thundercloud LBA Tract. Only one of those grouse strutting grounds, located at the edge of a playa in SW4 Section 22, T44N, R70W, was active in 1995 and 1996. Figure 3-13 shows the location of this active lek and a two-mile radius which research identified as the area in which most of the hens will nest. This particular strutting ground was active from 1993 through 1996 with the maximum number of males recorded at 24 in 1993. A maximum of 14 males was observed at this

lek in 1995 and also in 1996. Wildlife surveys and monitoring for BTM identified one lek more than three miles south of the Thundercloud LBA Tract but that lek was abandoned in 1994 (TBCC 1996). Over 15 years of wildlife monitoring for the adjacent JRM revealed that sage grouse in that area did not have a long term affinity for a certain strutting ground but used six different sites during that period. The change of sites did not appear to be mine related as some movements were actually closer to mining. The different sites used over the 15 year period include playas (three), reclaimed oil/gas well drill holes (two), and bottomland grassland (one).

Sage grouse brood surveys were conducted on the Thundercloud LBA Tract along ephemeral stream drainages in July of 1995 and 1996. These surveys covered approximately four miles each year. Adult sage grouse or broods were not observed during either survey. However, one brood of six young were observed during other surveys completed in the summer of 1995. Two biologists spent a total of 18 man-days in July 1996 conducting various surveys on the Thundercloud LBA Tract but failed to record any sage grouse. These surveys indicate sage grouse use of the area for reproduction and raising young is very low. Sage grouse also were rarely observed on this study area during surveys completed in previous seasons.

Raptors

Numerous raptor species have been observed on or adjacent to the Thundercloud LBA Tract. These species include the golden eagle, bald eagle, northern harrier, Swainson's hawk, red-tailed hawk, ferruginous hawk, rough-legged hawk (*Buteo lagopus*), prairie falcon, American kestrel (*Falco sparverius*), turkey vulture,

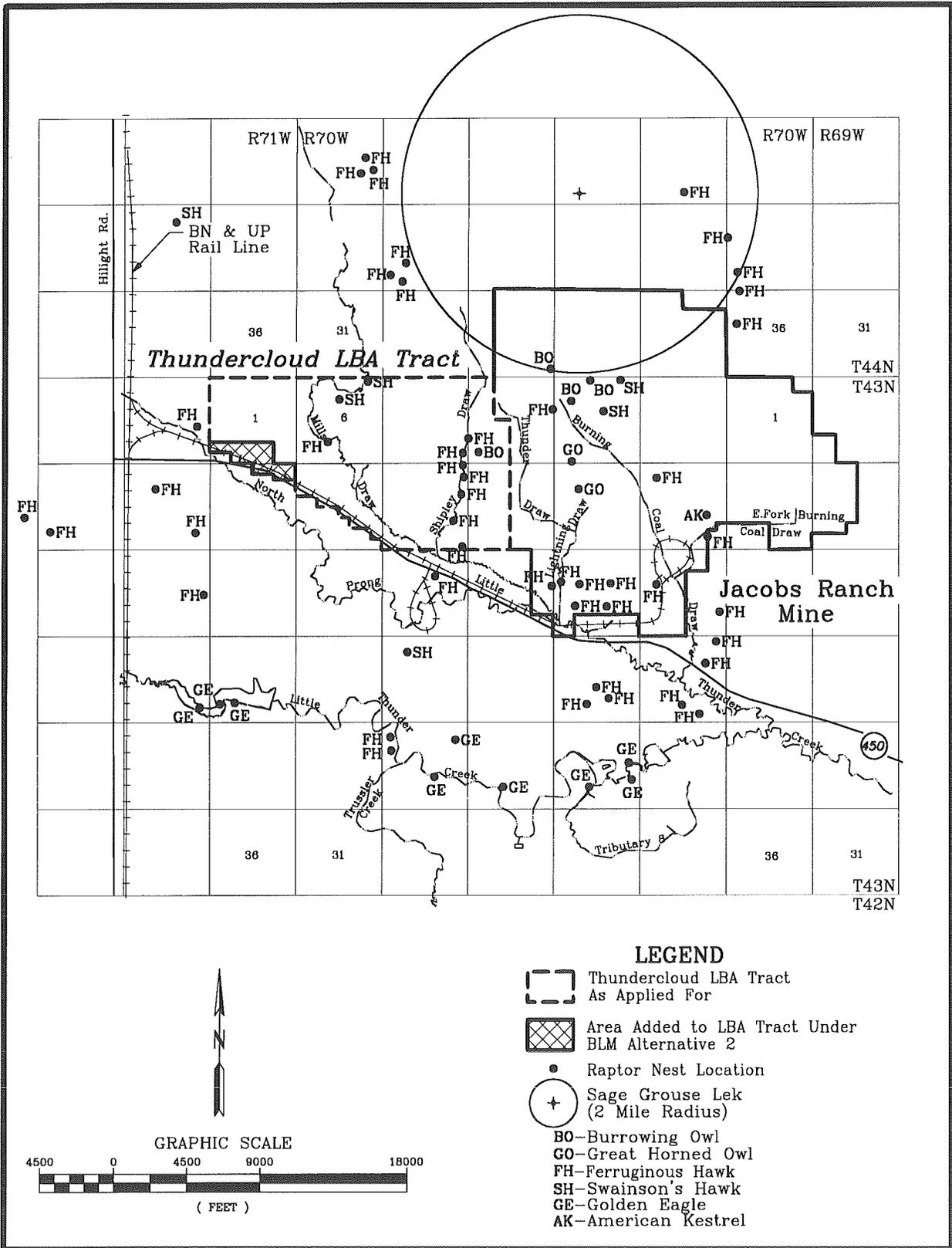


Figure 3-13. Raptor Nest Sites and Sage Grouse Leks Within and Adjacent to the Thundercloud LBA Tract.

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great horned owl, short-eared owl and burrowing owl. Although numerous raptor species have been observed in the area, very few nested on or near the site due to the lack of suitable nesting habitat (cliffs and tall trees). Figure 3-13 shows the locations of raptor nest sites that have been identified since monitoring began for the JRM which includes the Thundercloud LBA Tract and a 2.5-mile radius. The figure shows a total of 69 nest sites. As of 1996, 43 of those nest sites were still intact but only represented about 18 pairs of birds because many had alternate nest sites. Of the 26 nest sites that were no longer present, 15 were destroyed by natural events, eight were removed by mining activities and three were mitigation platforms that were moved. Eighteen of the intact nest sites were created by the mining companies to mitigate other sites impacted by mining. These sites consist of either platforms or nests placed on rock piles or on the ground for ferruginous hawks. A total of six raptor species have been identified nesting on or within 2.5 miles of the Thundercloud LBA Tract. These species include the burrowing owl, great horned owl, ferruginous hawk, Swainson's hawk, golden eagle and American kestrel. The ferruginous hawk was the most common species nesting in the area. In 1995, only six nest sites were active and included five ferruginous hawk nests and one Swainson's hawk nest.

Only three raptor species have been recorded nesting on the Thundercloud LBA Tract. The ferruginous hawk had the most nest sites, but all except one of those nest sites belonged to the same pair of birds. One of the ferruginous hawk nest sites was a platform erected by JRM to mitigate disturbed nests and enhance nesting success of an existing pair of birds. This pair had nested on the ground and generally failed to produce young due to predation. One pair of Swainson's hawks with two nest sites, one on

a power pole and the other in a small willow tree, have been successful nesting on the Thundercloud LBA Tract. A burrowing owl was recorded nesting on the Thundercloud LBA Tract in 1988 and 1989. That nest site was located in an old badger den. The burrowing owl has not been recorded nesting in adjacent areas since 1989.

The Thundercloud LBA Tract and lands within one mile do not contain trees large enough to support eagle nests. Cliffs also do not occur within the area, so falcon nesting habitat is not present.

Migratory Birds of High Federal Interest

Table 3-9 provides a list of the MBHFI species that may occur on the Thundercloud LBA Tract or disturbance areas. Nine MBHFI species have been documented in the area. The ferruginous hawk nests on the area, generally using ground nests. The burrowing owl was also recorded nesting on the area, but for only two years and has not been observed there since 1989. The golden eagle does not have nesting habitat on or within one mile of the Thundercloud LBA Tract but frequents the site in search of prey. The bald eagle is a common winter resident but would not nest in the area due to lack of suitable habitat. The other MBHFI species observed on the area were recorded as migrants or foraging in the area, and nesting habitat for those species does not occur on the site.

Other Species

Wildlife surveys completed specifically for the Thundercloud LBA Tract, and surveys completed for the adjacent mines, have documented numerous other wildlife species that inhabit the area. All of these species were generally common inhabitants of the area and none were of specific concern to state or federal agencies. The other species

Table 3-9. MBHFI Status in Northeast Wyoming and Expected Occurrence on or near the Thundercloud LBA Tract

Species	Seasonal Status/Breeding Records in NE Wyoming ²	Documented on or near Thundercloud LBA Tract	Expected in Thundercloud LBA Tract
White Pelican	Summer/nonbreeder	No	Rare
Double-crested Cormorant	Summer/breeder	No	Rare
Canvasback	Summer/one record	Yes	Rare
Ferruginous Hawk	Summer/breeder	Yes	Common
Bald Eagle ¹	Winter/nonbreeder	Yes	Common in winter
Golden Eagle	Resident/breeder	Yes	Common
Osprey	Summer/nonbreeder	No	Rare
Prairie Falcon	Resident/breeder	Yes	Uncommon
Peregrine Falcon	Migrant/historical breeding record only	Yes	Rare
Richardson's Merlin	Resident/breeder	Yes	Rare
Whooping Crane	Never recorded	No	Very rare
Sandhill Crane	Migrant/nonbreeder	No	Uncommon
Mountain Plover	Summer/breeder	No	Uncommon
Long-billed Curlew	Summer/breeder	Yes	Rare
Burrowing Owl	Summer/breeder	Yes	Uncommon
Lewis' Woodpecker	Summer/breeder	No	Rare
Dickcissel	Summer/breeder	No	Rare

¹ Although the bald eagle is generally considered a non-breeder in the PRB, a nesting attempt that failed was recorded by Black Thunder Mine.

² Compiled from Oakleaf et al. (1992). Includes Campbell County and adjacent counties.

observed included seven carnivores, 15 rodents, three lagomorphs, 35 waterbirds, 28 other bird species, and eight herptiles.

USFS Region 2 Sensitive Species

The USFS has identified certain sensitive species that they must consider in making land use decisions for lands they administer. Prior to mining, the LBA tracts will have to be evaluated for habitat for these species, and the USFS will have to make a determination

as to how mining could impact these species. A list of USFS Region 2 Sensitive Species that the LBA tracts will have to be evaluated for prior to mining is included as Appendix F.

Threatened, Endangered and Candidate Animal Species

The Endangered Species Act (16 U.S.C. 1531-1543) protects plant and animal species that are listed as threatened and endangered

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(T&E), as well as their critical habitats. Endangered species are defined as those that are in danger of extinction throughout all or a significant portion of their range. Threatened species are those that are likely to become endangered in the foreseeable future throughout all or a significant portion of their range. An additional classification--candidate species (formerly Category 1 candidate species)--includes species for which the USFWS has sufficient data to list as T&E, but for which proposed rules have not yet been issued.

A list of T&E and candidate species potentially occurring in the Powder River and Thundercloud tracts was received from USFWS (USFWS, written communication, 10/17/96). T&E animal species potentially occurring on the LBA tracts are the black-footed ferret (endangered), bald eagle (threatened), and peregrine falcon (endangered). Two candidate species, mountain plover and swift fox, may potentially be present on the LBA tracts.

Powder River LBA Tract

The bald eagle has been observed in the area and was discussed previously. The bald eagle is a common winter resident and migrant and has been observed occasionally roosting in trees located in NW1/4 NW 1/4 Sec. 30, T42N, R70. The peregrine falcon has not been sighted in the vicinity of the Powder River LBA Tract, and would not be expected due to the absence of tall cliffs required for nesting habitat. Black-footed ferrets are found almost exclusively living in prairie dog towns. The prairie dog town nearest the Powder River LBA Tract is located in SW1/4 NW1/4 Sec. 17, T41N, R70W in the North Antelope Mine permit area. Because of the absence of habitat, and the fact that prior ferret searches in the nearby areas failed to provide any record of

their existence, ferrets would not be expected to occur in the Powder River LBA Tract. Mountain plovers have been sighted in the area of the Powder River LBA tract, but those sightings are uncommon, as indicated in the section on MBHFI. There have also been no observances of plover nests or young on the LBA tract.

Although red foxes have been observed on the Powder River LBA tract, there have been no sightings of swift foxes during the field studies on the Powder River LBA tract.

Thundercloud LBA Tract

The bald eagle and peregrine falcon have been observed on the area as discussed in previous sections. The bald eagle is a common winter resident and migrant and has been observed foraging on the area every winter. This species also has winter roost sites in the Rochelle Hills approximately six miles east of the Thundercloud LBA Tract. Bald eagle roosting and nesting habitat does not exist within two miles of the Thundercloud LBA Tract. The peregrine falcon was only observed on the area during migration. This falcon requires tall cliffs for nesting habitat, so it would not be expected to nest in this portion of the PRB due to the absence of that habitat feature. Black-footed ferrets are found almost exclusively living in prairie dog towns. Surveys indicate prairie dog towns are not located within the Thundercloud LBA Tract, and the nearest town observed was more than two miles away. Based on these facts, and the fact that prior ferret searches in the area failed to provide any record of their existence nearby, ferrets would not be expected to occur in the area.

As indicated in Table 3-9, mountain plovers have not been documented on or near the

Thundercloud tract. No sightings of swift foxes have been recorded on the area.

3.11 Ownership And Use of Land

The surface on the Powder River LBA Tract and the Alternative 2 configuration is owned by the United States of America, the State of Wyoming, PRCC, the Bridle Bit Ranch Company, and Jerry and Barbara Dilts (see Figure 3-14). The federally owned land is part of the Thunder Basin National Grassland, administered by the USFS. Livestock grazing (both cattle and sheep) is the principal land use of the area. The headquarters for one ranch, with two houses, barns, and corrals, is in the northwest corner of the area; three mobile homes are situated in the south-central part of the area.

Areas of disturbance within the Powder River LBA Tract include roads, oil and gas wells, and associated facilities. Disturbed land was characterized by bare ground or annual weeds, where native vegetation had been removed and nothing has been revegetated. A paved county road, "Antelope Road", runs north-south to the west of the LBA tract; a gravel county road, "Mackey Road", runs east-west through the northern edge of the tract. There were numerous bladed oil field roads to active or former well sites in the area (PRES 1996).

Six wells have been drilled and completed as producing oil and gas wells on the Powder River LBA Tract, and five wells are currently producing (Figure 3-14). These wells, which were originally drilled in the early 1980's, produce from the Late Cretaceous Turner and Sussex Sandstones, and the Early Cretaceous Dakota Formation. The majority of the oil and gas leases in the Powder River LBA Tract are federal leases. Facilities associated with these wells include production casing, which extends from the

surface to the zone of production, production equipment, and pipelines which gather the oil and gas produced by the individual wells and carries it to a larger pipeline or collection facility.

The surface on the Thundercloud LBA Tract and the Alternative 2 configuration is owned by the United States of America, KMCC, Atlantic Richfield, and the Gladys K. Norwood estate (see Figure 3-15). The federally owned land is part of the Thunder Basin National Grassland, administered by the USFS. The principal land use of the area within the tract is domestic grazing. Secondary land use is oil and gas production with incidental wildlife use (KMCC 1995).

Areas of disturbance within the Thundercloud LBA Tract include roads, oil and gas wells and disturbances associated with oil and gas production. Wyoming State Highway 450 and the BN/C&NW railroad spur serving both the Jacobs Ranch and Black Thunder mines both cross the southern portion of the LBA tract.

Sixteen wells have been drilled and completed as producing oil and gas wells on the Thundercloud LBA Tract, and eleven of these wells are currently producing (Figure 3-15). All of these wells, which were originally drilled in 1970 and 1971, produce from the Early Cretaceous Muddy Sandstone.

The majority of the oil and gas leases in the Thundercloud LBA Tract are federal leases (about 85%). Facilities associated with these wells include production casing (which extends from the surface to the zone of production), production equipment (which may be located on the surface and/or underground), and underground pipelines which gather the oil and gas produced by the individual wells and carry it to a larger transportation pipeline or collection facility.

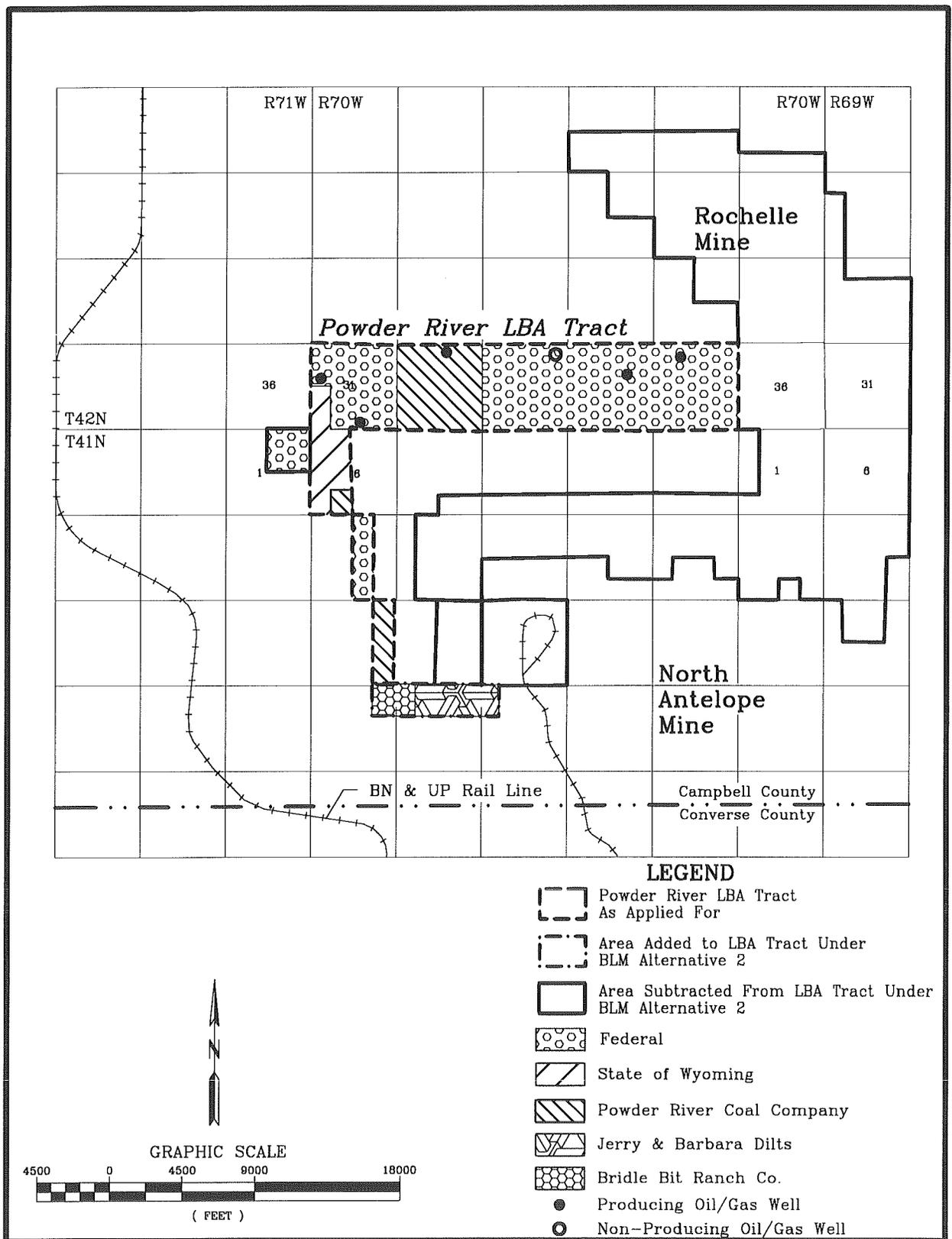


Figure 3-14. Surface Ownership Within the Powder River LBA Tract.

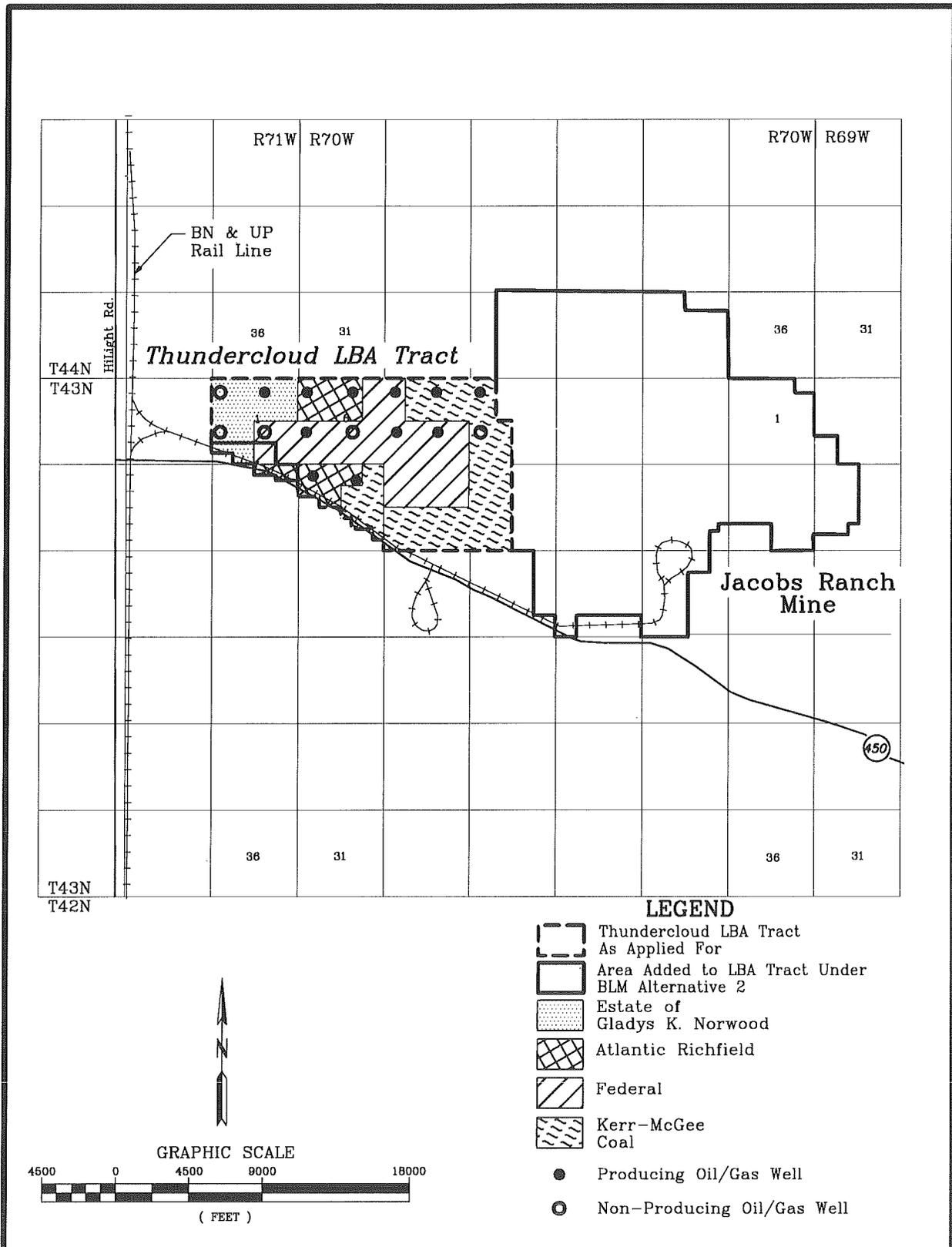


Figure 3-15. Surface Ownership Within the Thundercloud LBA Tract.

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Coal mining is a dominant land use in the area surrounding both LBA tracts. The existing Jacobs Ranch and North Antelope/Rochelle Mines are within a group of six operating surface coal mines located in southern Campbell and northern Converse Counties (see Figure 3-1). Coal production at these six mines increased by 87% between 1990 and 1996 (from about 70 million tons in 1990 to over 131 million tons in 1996). Since 1992, five maintenance coal leases have been or are about to be issued within this group, and applications have been submitted and are being processed for three more maintenance tracts in this same group, including the two LBA's being evaluated in this EIS (see Tables 1-1 and 1-2). BLM also received an application for a coal lease for a potential new mine start (New Keeline tract, see Table 1-2) located north of the Jacobs Ranch Mine (see Figure 1-1). This application was reviewed by the PRRCT at their April 23, 1997 public meeting. The PRRCT recommended that the BLM defer action on this application at this time. The application was subsequently rejected without prejudice by the BLM Wyoming State Director in a June 13, 1997 decision.

The Powder River LBA Tract also contains the right-of-way for the Powder River Energy Corporation (formerly Tri-County) high-voltage powerlines. Voltages in these lines range from 14.4/24.9 kilovolts (Kv) to 230 Kv.

Campbell County has no county-wide land use plan, and the LBA tracts have no designated zoning classification. The *City of Gillette/Campbell County Comprehensive Planning Program* (City of Gillette 1978) provides general land use goals and policies for state and federal coal leases in the county. The long-term land use objectives established

for the Thunder Basin National Grassland include livestock grazing and wildlife habitat.

Big game hunting is the principal recreational use in the analysis area. Land ownership within the PRB is largely private (approximately 80%), with some private landowners permitting sportsmen to cross and/or hunt on their land. Others charge an access fee, and some do not allow any access. There has been a trend over the past two decades towards a substantial reduction in lands open and reasonably available for hunting. Access fees continue to rise and many resident hunters feel these access fees are unreasonable. This trend has created management problems for the WGFD in their attempt to distribute and control harvest at optimal levels, as well as to sportsmen who desire access to these animals (WGFD 1996). Due to safety concerns, public lands contained within an active mining area are often closed to the public, further limiting recreational use. In the PRB, the publicly owned Thunder Basin National Grassland, BLM lands, and state school sections (normally Sections 16 and 36) are generally open to hunting if legal access is available.

Approximately 36% of the surface of the Thundercloud LBA Tract and 70% of the Powder River LBA Tract are federally owned and publicly accessible. The remaining lands are private, and recreational use is allowed only with landowner permission. Due to the federal land present, and its accessibility, sport hunting in varying degrees is conducted on both LBA tracts. Pronghorn, mule deer, and white-tailed deer occur on and adjacent to both LBA tracts. Sage grouse, mourning dove, waterfowl, cottontail rabbit, and coyote may also be harvested in the vicinity, and some trapping of red fox may occur.

Specific details regarding big game herd management objectives in the project area are contained in the *Casper and Sheridan Region Annual Big Game Herd Unit Reports* (WGFD 1995). The Thundercloud LBA tract is within pronghorn antelope Hunt Area 24, which contains the Hilight Herd Unit. According to the WGFD, the primary problems associated with the management of this herd include achieving an adequate harvest and hunter distribution caused primarily by an abundance of privately owned land and poor access to the limited public land.

The 1995 postseason population estimate for the herd is 12,322 antelope, slightly over the objective of 11,000. In 1995, the WGFD issued 2,000 licenses for the Hilight Herd, an increase of 100 licenses from 1994 and 200 licenses from 1993. In the years 1991-1995, hunters on average harvested about 1,150 animals, with better than 85% success, and spent about 1.9 days per animal harvested. Approximately 2,500 recreation days were spent on antelope hunting in 1995, compared to the WGFD objective of 3,500. The primary cause of the population being over objective, and the recreation days being under objective, is lack of public access in the hunt area. Approximately two-thirds of the Thundercloud LBA tract is classified as yearlong habitat for antelope (habitat used by a portion of the animals yearlong and into which a significant influx of animals occurs during the winter), with none of the LBA tract or areas two miles adjacent classified as crucial or critical habitat. Pronghorn are widely scattered throughout the herd unit.

The Powder River LBA tract is within pronghorn Hunt Area 27, part of the Lance Creek Herd Unit which also includes Hunt Areas 6, 8, 9, and 29. The severe winter of 1992-93 resulted in an estimated 39% mortality in this herd, and WGFD thus

reduced the number of licenses in 1993 from 3,000 to 2,000. They have issued 2,750 licenses annually in the past two years and anticipate the pronghorn population will continue to grow to the post-hunt population objective of 27,000 (assuming normal reproduction and good weather conditions). The actual number of antelope in the herd unit has been approximately 22,500 over the past few years. Hunters annually harvest about 2,400 animals with better than 90% success and spend about 2.1 hunting days per animal harvested. The Powder River LBA tract is classified as yearlong habitat for antelope. The Lance Creek Herd Unit does not contain any designated crucial habitat. Antelope are widely scattered throughout the herd unit.

Both the Thundercloud and Powder River LBA tracts are in mule deer Hunt Area 21, part of the Thunder Basin Herd Unit, which also includes Hunt Areas 7, 8, 9, 10 and 11. This herd was above the 13,000 post-season deer population objective prior to the winter of 1992-93, which reduced the population to near objective. The current population is estimated at about 14,000. The WGFD has managed this herd for an annual harvest of approximately 1,800 deer, with hunter success running at about 71% and 3.9 days spent per deer harvested. The hunting season is designed to allow the population to grow; however, much of the preferred habitat in this herd unit occurs in drainage bottoms on private land, where grazing-related conflicts occur with landowners. The population objective may be increased in the future if landowner and public sentiment allow. About 45% of the Thundercloud LBA Tract is not within any designated mule deer habitat. Most of the Powder River LBA Tract is classified as mule deer "out" range, except for a small area of yearlong range along Porcupine and Corder Creeks. Although white-tailed deer and elk have been

seen occasionally in the vicinity of both LBA tracts, they are not common. The Rochelle Hills Elk Herd is located about six miles to the east of the LBA tracts. Elk Hunt Area 123 extends into the Thundercloud LBA Tract; and Elk Hunt Area 113 extends into the Powder River LBA Tract. However, very limited use of these lands by elk occurs. Elk favor the ponderosa pine/juniper woodlands, savanna, and steeper terrain habitat in the Rochelle Hills, east of the LBA tracts. This small herd (about 200 elk) is hunted every two to three years. Owing to their habituation to humans, these elk provide a significant amount of nonconsumptive recreational use. Landowners appear tolerant of the elk, and the WGFD will likely increase the population objective in the future. These elk are dispersing from the designated herd unit boundary, possibly due to density-dependent population factors related to limited habitat.

White-tailed deer are managed as part of the Thunder Basin Herd Unit, an area which extends from the Montana border through Gillette, Moorcroft, Newcastle, and south to Lusk and Douglas. White-tailed deer are not managed separately in this herd unit, but generally are included in the management of the corresponding mule deer herd units. White-tailed deer use is concentrated in riparian areas, which are predominantly privately owned. Doe/fawn licenses are therefore allocated to reduce grazing conflicts on private land in specific areas.

Public fishing opportunities are extremely limited in the PRB. Only one fishery exists in the general analysis area: Little Thunder Creek supports channel catfish and a variety of nongame fish. No fisheries exist on either of the LBA tracts.

3.12 Cultural Resources

Cultural resources, which are protected under the National Historic Preservation Act of 1966, are the nonrenewable remains of past human activity. 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 exploited a wide variety of resources.

The general chronology for aboriginal occupation (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 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 projectile points (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 smaller side-notched, stemmed, or corner-notched projectile points and by more generalized subsistence pursuits including the gathering of plant resources. This 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 whose movements were

determined to a large degree by seasonal and environmental changes which influenced the occurrence of subsistence resources (BLM 1979).

Protohistoric and early Historic sites are found in the PRB, including rare historic trade goods, sites and routes associated with early trappers and military expeditions, and early ranching attempts which date to the 1880's. A few small coal mining sites also exist.

Historic sites within the analysis area have been recorded as debris scatters representing shepherd camps and related activities. No historic trails are known or have been recorded on the LBA tracts; however, the Bozeman Trail crosses the southwestern portion of the PRB.

A Class III cultural resources survey is a professionally conducted, intensive inventory of a target area, designed to locate all cultural properties which have surface and exposed profile indications. Cultural properties are recorded and sufficient information collected on them to allow evaluation for possible inclusion on the National Register of Historic Places (NRHP). That determination is made by the managing federal agency in consultation with the State Historic Preservation Office (SHPO).

Once a Class III survey is completed, site-specific testing or limited excavation is utilized, if necessary, to gather additional data which will: 1) determine the final evaluation status of a site and/or 2) form the basis of additional work that will be conducted during implementation of a treatment plan if the site is eligible for the NRHP. A treatment plan is then developed for those sites that are eligible for the NRHP and are within the area of potential effect. Treatment plans are implemented prior to

mining and can include such mitigative measures as avoidance (if possible), large scale excavation, complete recording, Historic American Building Survey/Historic American Engineering Record documentation, archival research, and other acceptable scientific practices.

Numerous Class III cultural resource inventories have been conducted by PRCC for lease expansion areas adjacent to the North Antelope and Rochelle Coal Mines. These inventories were conducted in 1990, 1991, 1993, 1994, 1995, and 1996.

Forty-five sites and 18 isolated finds have been identified by all cultural inventories conducted in the Powder River LBA tract and buffer zone. 23 sites are prehistoric, 19 are historic, and 3 contain both prehistoric and historic materials. The sites include 13 lithic scatters; 6 stone circles and stone circle complexes; 7 campsites; 3 historic foundations or depressions; 5 homesteads; 6 shepherd's camps; 4 cairns; and 4 historic debris scatters.

Of the 45 sites, one site, 48CA2675, is considered eligible to the NRHP, while 48CA1127 and 2617 remain unevaluated. Site 2675 is a historic homestead, while 1127 is a historic depression, possibly the remains of a structure or homestead, and 2617 is a historic rock cairn. These sites will require identification or description of protection measures in the mine plan, until such time as they have been evaluated or mitigated. NRIIP eligible sites or those of undetermined eligibility should be avoided during ground disturbing activities, or an approved testing or evaluation program should be implemented to determine eligibility and record data. Recent mitigation efforts have taken place at sites 48CA132, 1059, 1063 and 1065, sites considered eligible in related

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Table 3-10. Sites Recorded in the Class III Cultural Resource Inventory of the Powder River LBA Tract and Buffer Zone

Prehistoric sites	Historic sites	Multicomponent Sites
Lithic: 48CA129; 182; 207; 667; 771; 1061; 1126; 2610; 2632; 2633; 2669; 2679; 2683	Foundation, depression: 532; 1127; 2674 Sheepcamp: 667; 2668; 668; 1622; 2677; 2682	667; 2612; 2633
Stone Circle: 131; 132; 2672; 2678; 2680; 2681	Homestead: 694; 2670; 2675; 2795; 2796 Cairn: 949; 2617; 2676; 2684	
Campsite: 183; 1059; 1063; 1065; 2611; 2612; 2630	Historic debris: 2612; 2616; 2633; 2673	

mine plans, and no further work will be required under this plan for these sites.

The following sites have been determined not eligible to the NRHP 48CA129; 131; 182; 183; 207; 532; 667; 668; 694; 771; 949; 1061; 1126; 1622; 2610; 2611; 2612; 2616; 2630; 2632; 2633; 2669; 2670; 2672; 2673; 2674; 2678; 2679; 2680; 2681; 2682; 2683; 2684; 2795; 2796. SHPO consultation has not yet been completed for 3 sites: 48CA2668; 2676; and 2677; all three sites are recommended not eligible.

There is minimal potential for important surface cultural material to have gone unnoticed during the survey. Potential does exist for undetected, buried cultural material in some areas, however. This evaluation is based on the presence of recent (Holocene) deposition within the project area, particularly in the floodplain of Porcupine Creek. Portions of the floodplain would have been ideal camp locations for aboriginal inhabitants of the region. Any remains of these camps would have been buried quite rapidly by alluvium, making these sites undetectable by a standard pedestrian survey.

The widespread and extensive ground disturbance caused by coal mining activities could impact these potentially buried cultural resources. Cultural resource clearance has been recommended by the investigators for the project area adjacent to the North Antelope and Rochelle Coal Mines subject to the following stipulations to eliminate direct impacts to cultural resources:

- All disturbance should be restricted to inventoried areas.
- Ground disturbing activities within or adjacent to sites 48CA2675, 1127 and 2617 should be avoided until a testing, evaluation or data recovery program can be implemented.
- If evidence of additional prehistoric or historic sites (unanticipated discoveries) is located during ground disturbing activities, all activities within a 100-ft radius of the site(s) should cease immediately, and appropriate personnel within PRCC should be notified to assure proper

handling of the discovery by qualified archaeological personnel.

- All construction and maintenance personnel should be instructed of the confidentiality of site location information and that the collection of cultural material is prohibited (Mariah Associates, Inc. 1990 and 1991; CGM Services, Inc. 1993).

None of the above sites is currently listed on the NRHP, but sites considered eligible or unevaluated must be protected until consultation with the SHPO has occurred and the sites are identified for mitigation or release.

The Thundercloud LBA Tract and buffer zone was subjected to a Class III cultural resource inventory during 1995-1996. The survey was conducted by investigators from the Cultural Heritage Resource Office, University of Montana. The survey area covered 4,700 acres. This inventory has been sent to SHPO for review.

Forty-two sites (Table 3-11) and 45 isolated artifacts were located by the inventory. Only one site within the inventory area, 48CA1907, is considered eligible for nomination to the NRHP. Site 48CA400, a

historic grave and homestead site, is not considered eligible, but the grave, which lies immediately outside the project area, is recommended for avoidance. The remaining 40 sites and the isolated artifacts are considered not eligible for nomination to the NRHP (Cultural Heritage Resource Office and SHPO Nov. 25, 1997). Cultural sites located within the project area included 31 lithic scatters, 1 occupation, 1 homestead with associated grave, 2 historical structural remains, and 15 historic debris scatters. Nine of the sites were multi-component, containing both prehistoric and historic materials.

3.13 Native American Consultation

Native American heritage sites can be classified as prehistoric or historic. Some may be presently in use as offering sites, fasting or vision quest sites and selected rock art sites. Other sites of cultural interest and importance may include rock art sites, tepee rings, and various rock features, fortifications, or battle sites, burials, as well as locations which are sacred or part of the oral history and heritage that have no man-made features. No evidence of Native American heritage sites was observed during this investigation.

Table 3.11 Sites Recorded in the Class III Cultural Resource Inventory of the Thundercloud LBA Tract and Buffer Zone

Prehistoric Sites	Historic Sites	Multicomponent Sites
Lithic: 48CA2593; 2629; 2689; 2690; 2922; 2923; 2924; 2927; 2928; 2929; 2989; 2993; 2994; 2995; 2996; 2997; 2998; 2999; 3000; 3001; 3002; 3003; 3004; 3005; 3006; 3007	Homestead w/grave: 48CA400 Historic structure: 1315; 2988; Debris: 1907; 2459; 2921; 2926; 2990; 2992	48CA1907; 2690; 2919; 2920; 2925; 2986; 2987; 2991; 3008
Occupation: 1907		

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There are presently no documented Native American sacred sites in the general analysis area. However, the position of the grasslands between the Big Horn Mountains to the west, the Black Hills to the east, and Devils Tower to the north, mountains considered sacred by various Native American cultures, creates the possibility of existing locations which may have special religious or heritage significance to Native American groups.

Native American tribes have been consulted at a general level for the 1995-1996 draft Buffalo Resource Area RMP. The Crow, Northern Cheyenne, Eastern Shoshone, Northern Arapaho, and Oglala Sioux tribal governments and representatives received scoping notices requesting information on any concerns they have relating to these lease applications. These tribal governments and representatives were sent certified letters providing them with information about the location of the LBA tracts and known sites on these tracts and requesting their help in identifying potentially significant religious or cultural sites on these two LBA tracts prior to a leasing decision on either of the tracts.

3.14 Paleontological Resources

The formations exposed on the surface of the PRB are the sedimentary Eocene Wasatch and Paleocene Fort Union formations, which are both known to contain fossil remains. Some paleontological surveys have been conducted in the PRB. Vertebrate fossils that have been described from the Wasatch Formation in the PRB include fish, turtle, champosaur, crocodile, alligator, and mammal specimens. The Fort Union also contains fossils of plants, reptiles, fish, amphibians, and mammals. No significant paleontological localities have been recorded on federal lands in or near the LBA tracts, which are within the BLM Buffalo Resource

Area and the Thunder Basin National Grassland. A paleontological survey has been conducted within and adjacent to the Powder River LBA Tract. Due to the absence of exposed bedrock on the Thundercloud LBA Tract, a paleontological survey was not considered necessary.

Lands adjacent to the Rochelle and North Antelope Mines and including the Powder River LBA Tract were surveyed to determine the potential for recovery of significant fossils prior to disturbance. These lands include approximately 3,000 acres in T42N, R70W, Sections 31, 32, 33, 34, and 35; and T41N, R70W, Sections 2, 3, 4, 5, 6, 7, 17, 18, and 20.

The Powder River LBA Tract was surveyed for paleontologic resources in compliance with the WDEQ/LQD and BLM requirements. The Powder River LBA Tract was surveyed during March 19-23 and April 1-4, 1990. Prior to the field survey, a literature search was conducted at the Geology and Vertebrate Paleontology libraries at the University of Wyoming to identify known fossil bearing sites in the area.

The Powder River LBA Tract was inspected by traversing the area on foot and examining sedimentary outcrops for fossils of all kinds. Certain areas prone to fossil accumulations were examined most carefully. These areas include 1) well-developed flats within and adjacent to outcrops, 2) ant hills (the Western Harvester Ant is known to incorporate small fossil bones and teeth into its hill), 3) sandstone blowouts or wind-deflated spots where lags of fossil bones and teeth might be expected, and 4) the bases of sandstone channels where coarse-grained material, including fossils, may accumulate.

Fossil plant material (wood and leaf impressions) of poor quality was found

scattered throughout the Fort Union Formation in the project area. These were most common in lignitic mudstones, ironstone concretions, and sandstones immediately overlying lignitic layers. In many places the ironstone appears to have precipitated around ancient tree trunks and root masses and are riddled with stem and leaf impressions.

At one site in NW1/4NW1/4 Section 2, T41N, R70W, leaf impressions were well preserved in a friable sandstone. Although fossil logs were common in the project area, they were not notably well preserved. Fossil plant remains are well known from the Fort Union Formation of the PRB and those found within the project area are not considered significant.

Fossil invertebrates, including the shells of the snail *Viviparus meeki* and the bivalve *Pleisielliptio priscus*, were found at the base of the Wasatch Formation in SE1/4 NW1/4 Section 7, T41N, R70W. These two fossil invertebrates are well known from the Wasatch Formation and equivalent aged rocks throughout Wyoming (Taylor 1975; Hanley 1976) and are not considered significant. A fragmentary tooth chip, probably part of a mammal incisor, was found in an ant hill in the same area as the invertebrate fossils. This tooth chip was too fragmentary to be identified and is not considered significant. No other mammalian fossil remains were found in the vicinity (Mariah Associates Inc. 1990).

3.15 Visual Resources

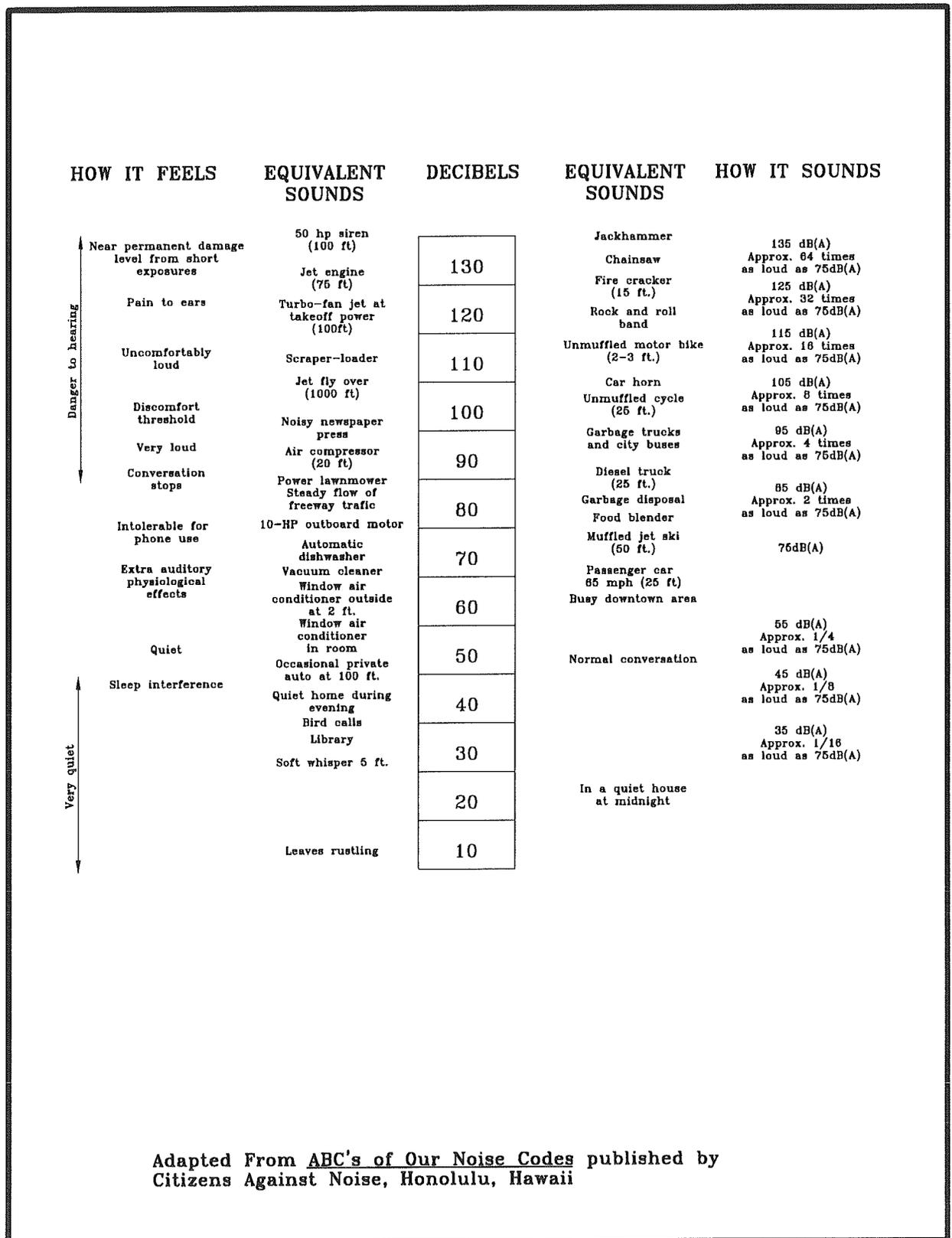
Visual sensitivity levels are determined by people's concern for what they see and the frequency of travel through an area. Landscapes within the general analysis area include rolling sagebrush and short-grass prairie, which are common throughout the

PRB. Existing surface mines form a nearly continuous band on the east side of Highway 59 from Gillette south about 75 mi. Other man-made intrusions include ranching activities (fences, homesteads, livestock), oil and gas development (pumpjacks, pipeline ROW's), and electric power transmission lines. The scenic quality in the immediate lease areas is fairly low because of the industrial nature of the adjacent existing mining operations.

The USFS has established visual quality objectives for the Thunder Basin National Grasslands (4,080 acres of which occur in the LBA tracts). The management objectives for these lands allow activities to visually dominate the landscape; however, alterations must be blended into the surrounding area so the original character (form, line, color, and texture) is retained. All mining activities on USFS lands must apply the standards and guidelines of the National Forest Visual Management System (USFS 1985).

3.16 Noise

Existing noise sources in the area include adjacent coal mining activities, traffic on State Highways 59 and 450, rail traffic, and wind. Studies of background noise levels at adjacent mines indicate that ambient sound levels generally are low, owing to the isolated nature of the area. Current noise levels in the Thundercloud and Powder River LBA Tracts are estimated to be 40-60 A-weighted decibels (dBA), with the noise level increasing with increasing proximity to active mining at the Jacobs Ranch Mine, Black Thunder Mine, North Antelope Mine and Rochelle Mine. Mining activities are characterized by noise levels of 85-95 dBA at 50 ft from actual mining operations and activities (BLM 1992b). Figure 3-16 presents noise levels associated with some commonly heard sounds.



Adapted From ABC's of Our Noise Codes published by Citizens Against Noise, Honolulu, Hawaii

Figure 3-16. Relationship Between A-scale Decibel Readings and Sounds of Daily Life.

3.17 Transportation Facilities

Transportation resources in the vicinity of the Thundercloud LBA Tract include State Highways 59 and 450; the Gillette-Douglas rail spur used jointly by the Burlington Northern-Santa Fe and Union Pacific Railroads; pipelines; and local roads and accesses.

Since the Thundercloud LBA Tract as applied for would be an extension of the existing Jacobs Ranch Mine operations, the transportation facilities and infrastructure would be the same as those identified in the WDEQ/LQD Mine Permit for Term T3 approved on August 30, 1994, the BLM Resource Recovery and Protection Plan (R2P2) approved in February 1995, and the BLM logical mining unit approved in April 1995 (KMCC 1995).

Transportation resources in the vicinity of the Powder River LBA include both paved and gravel county roads, numerous pipelines and high voltage electrical lines, and local roads and accesses.

Since the Powder River LBA Tract as applied for would be an extension of the existing North Antelope and Rochelle Mine operations, the transportation facilities and infrastructure would be the same as those identified in the WDEQ/LQD Mine Permit for Term T4 approved on July 9, 1993 for the North Antelope Mine and on August 31, 1994 for the Rochelle Mine, the BLM R2P2 approved on February 1, 1996 for the North Antelope Mine and on September 19, 1994 and modified on January 13, 1997 for the Rochelle Mine, and the BLM logical mining unit approved on November 25, 1986 for the North Antelope Mine. (The Rochelle Mine does not have an logical mining unit).

Access to the Thundercloud LBA Tract is on Highway 450 via State Highway 59 or the Hilight Road. Access to the Powder River LBA Tract is on Mackey Road via State Highway 59 or the Hilight Road from the north or Antelope Road via State Highway 59 from the south.

Two-tracks also occur in the LBA tracts. The paved Hilight Road runs north/south about one mile to the west of the Thundercloud LBA tract, paralleling the Gillette-Douglas rail spur used jointly by the Burlington Northern-Santa Fe and Union Pacific Railroads. This rail line serves all the existing coal mines in the southern PRB.

The transportation system and facilities that would service the Powder River and Thundercloud LBA Tracts, if mined in conjunction with the adjacent mines as applied for, are in place. These facilities consist of a series of roads, a rail network, and internal transportation routes to facilitate mining operations. Transportation facilities within and adjacent to the Powder River and Thundercloud LBA Tracts are depicted on Figures 3-17 and 3-18, respectively.

3.18 Socioeconomics

The social and economic study area for the proposed project involves primarily Campbell County and the cities of Gillette and Wright; however, it also includes the city of Douglas in Converse County. For example, employees of the North Antelope and Rochelle Mines reside in Gillette (33%), Wright (8%), Douglas (46%), and Glenrock (13%) (BLM 1992c). The communities of Gillette and Douglas would most likely attract any new residents due to their current population levels and the availability of services and shopping amenities.

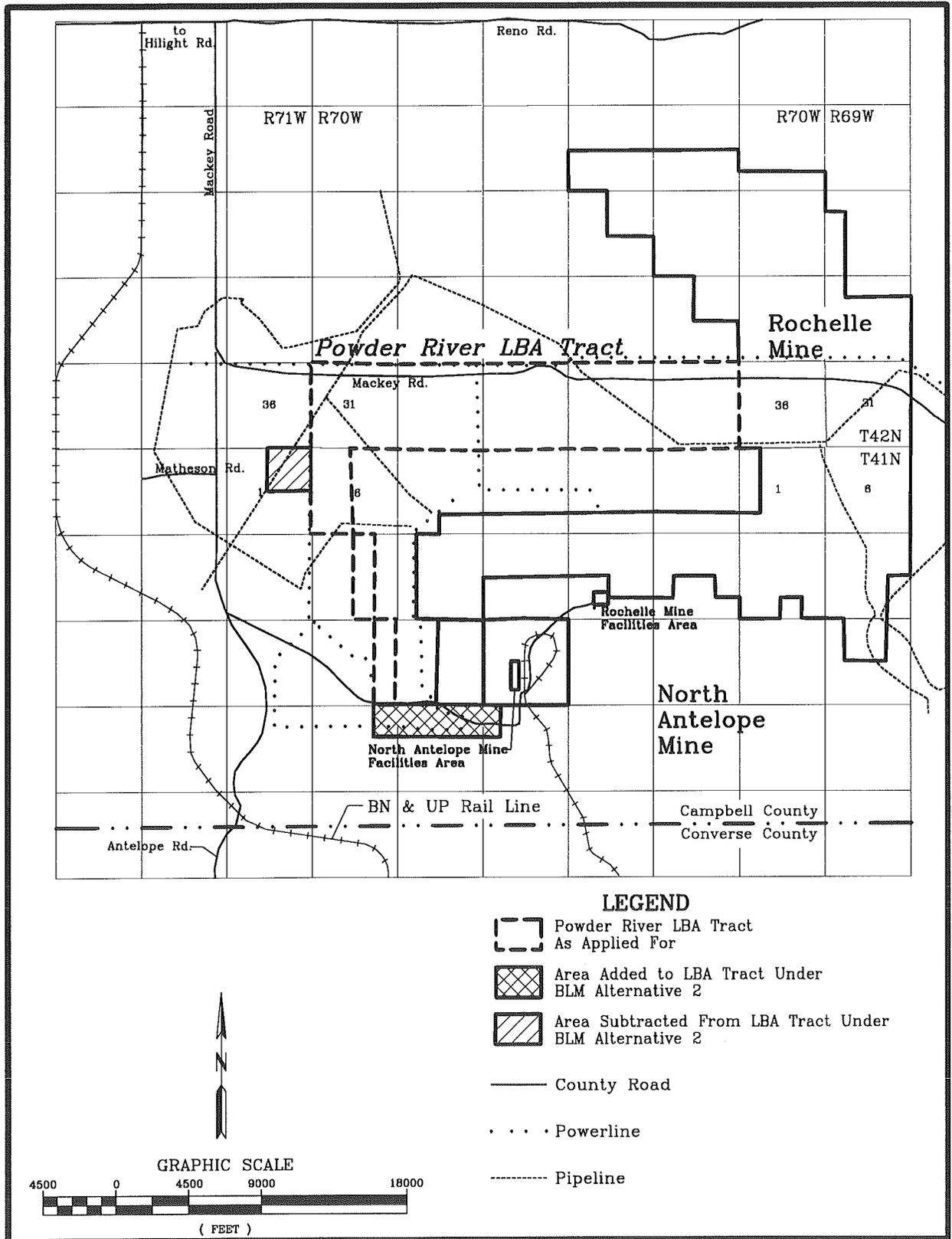


Figure 3-17. Transportation Facilities Within and Adjacent to the Powder River LBA Tract.

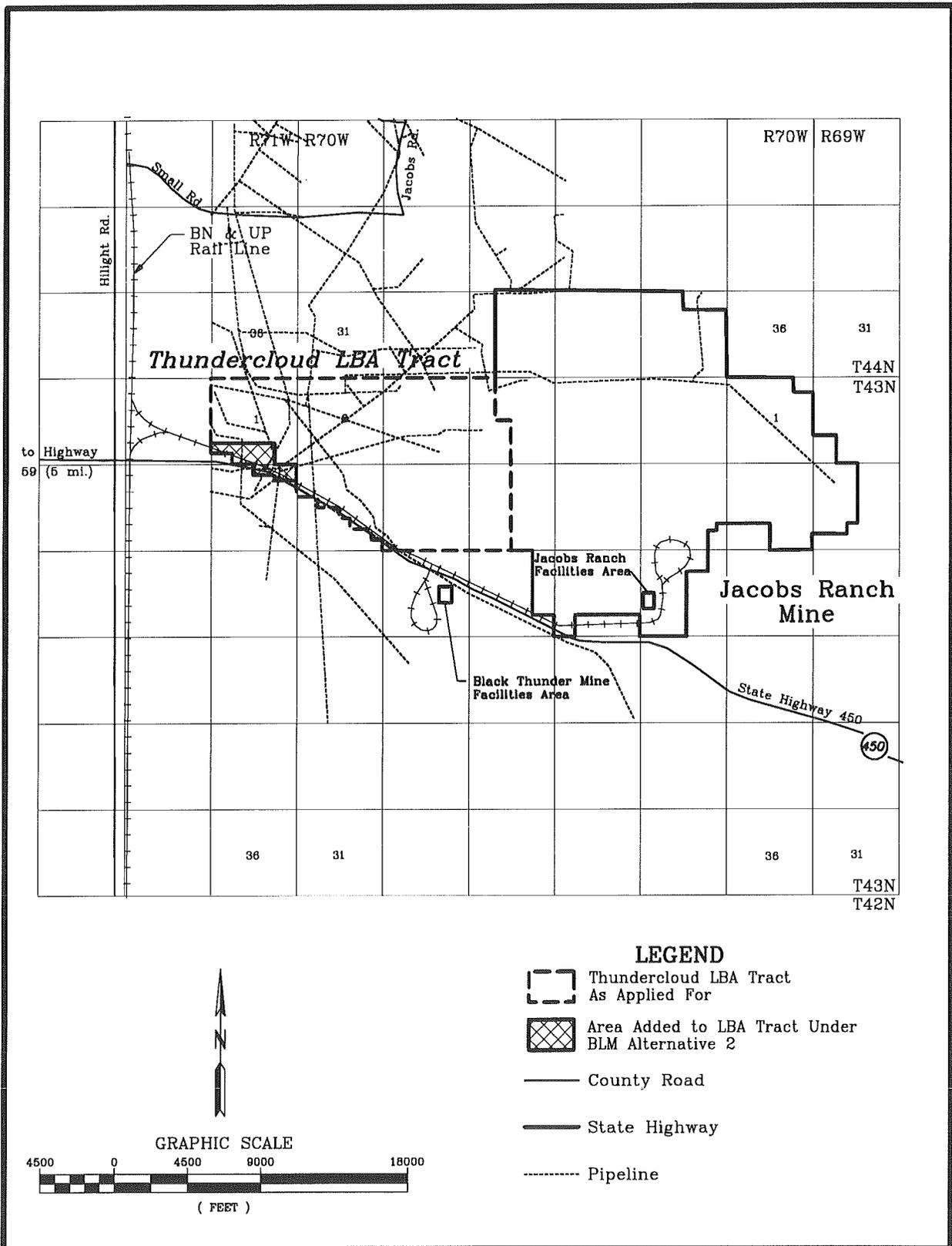


Figure 3-18. Transportation Facilities Within and Adjacent to the Thundercloud LBA Tract.

A comprehensive socioeconomic profile of the BLM Buffalo Resource Area (which includes all of Campbell County) was prepared for the BLM under contract with the Department of Agricultural Economics, College of Agriculture, through the University of Wyoming's Cooperative Extension Service (University of Wyoming 1994). Much of the following discussion is derived from this report. Additional data sources include the Wyoming Department of Commerce, Wyoming Division of Economic Analysis, Wyoming Department of Employment, Wyoming Economic Development Office, and personal communications with local community development staff.

In late September and early October of 1997, the Gillette News-Record published a series of tables showing the results of a study comparing 52 American counties. Some of the information that was published by the newspaper is also included in the following discussion.

3.18.1 Population

According to 1990 census data, Campbell County had a population of 29,370, with Gillette accounting for 17,635 of the county's residents and Wright with 1,200. Converse County's population in 1990 was listed as 11,128, with 5,076 of the county's residents residing in Douglas. The 1995 populations of Campbell and Converse Counties were 31,668 and 11,965, respectively, indicating increases from 1990 to 1995 of 7.8% (Campbell) and 7.5% (Converse) (U.S. Bureau of Census, USA Counties 1996 CD-ROM). In the study comparing 52 American counties, Campbell County ranked fourth in population growth.

3.18.2 Local Economy

Campbell County is the fastest growing coal-producing area in the U.S. and supplies about 25% of the national coal demand (BLM 1996g). The coal industry is the driving force behind the economic activity and employment in Campbell County.

Currently, 16 coal mines are in operation in the county, with one more (Antelope Mine) located just south of Campbell County in Converse County. Much of the remainder of the county's economy is based on oil and gas exploration and production, power generation, and agriculture.

Coal production in Campbell County has shown a strong upward growth trend over the past several years. In 1990, nearly 153 million tons of coal were produced, generating nearly \$1.4 billion of economic activity, including nearly \$182 million of personal income and 8,238 full-time jobs, 2,600 of which were directly associated with mines. The indirect and induced effects of sales from the coal industry are projected to contribute nearly 33% of the total economic activity for each dollar expended in the county. In 1995, 26% of the total employment and 44% of the total payroll in Campbell County were directly attributable to mining, and the average weekly mining wage (\$931) was 71% greater than the overall average weekly wage for jobs in the county (\$543).

Tax revenues from coal production in Campbell County are presented in Table 3-12. Sales and use taxes are distributed to cities and towns within each county and to the county's general fund. Severance taxes are collected by the state for the removal or extraction of resources such as oil, natural

Table 3-12. Fiscal Revenues from Coal Production in Campbell County

Year	Sales and Use Collections	Severance Tax Collections	Ad Valorem Tax Collections	Royalty Collections	Total Collections
1990	\$6.1 million	\$61.2 million	\$38.3 million	\$107.1 million	\$212.7 million
1995	\$8.8 million	\$87.6 million	\$54.8 million	\$153.3 million	\$304.5 million

¹ Includes estimated royalties on nonfederal production.

gas, coal, and trona. The State of Wyoming retains approximately 83% of the severance tax, and the remainder is returned to the cities, towns, and counties. Ad valorem taxes, which include property taxes, are collected by the county and disbursed to schools, cities, towns, the state foundation, and various other subdivisions within the county. Mineral royalties are collected on the amount of production and the value of that production. The current royalty rate for federal coal leases is 12.5%, with half of this revenue returned to the state. Additional sources of revenue include lease bonus bids (also split with state) and annual rentals that are paid to the federal government. The total fiscal benefit to the State of Wyoming from coal mining in the PRB has recently been estimated at \$1.10/ton of coal mined (University of Wyoming 1994).

3.18.3 Employment

Coal mining has changed a great deal since the 1970's, and new technologies have been a major contributor to these changes. The local coal mining labor force grew during the 1970's, but declined during the 1980's. Since 1973, overall production has risen while employee numbers have decreased. This employment decline followed large industry capital investments in facilities and production equipment, the majority of which was aimed at increasing productivity. Direct employment in the area's coal mining industry has remained relatively constant

over the last few years at approximately 2,600 full-time employees.

As of May 1997, the total labor force in Campbell County stood at 18,590, with an unemployment rate of 4.6% (compared to 4.4% in May 1996, Wyoming Department of Employment, Research and Planning 1997). About 2,651 people were directly employed in coal mining, representing about 15% of the employed labor force (Campbell County 1997). In the study comparing 52 American counties, Campbell County ranked second in job growth and second in percent of mining jobs.

As of May 1997, the total Converse County labor force was 6,630, with an unemployment rate of 5.3%, compared to 4.4% a year earlier. About 657 people, or 10% of the labor force, were directly employed by area coal mines (NEWEDC 1997).

3.18.4 Housing

In 1996, Gillette contained 7,775 housing units, and Wright contained 497 housing units, according to the Campbell County Economic Development Corporation (1997 Community Profile). According to the 1990 census, Campbell County contained 11,538 housing units, 7,078 of which were in Gillette. In 1996, the average cost of a new single family home was \$165,000; the average cost of an existing family home was

3.0 Affected Environment

\$90,500. Vacant housing in Gillette is estimated at approximately 549 units.

Douglas contained 2,267 housing units in 1992, with an estimated 59 vacant units, including 24 single-family homes, 30 mobile homes, and five multi-family units. The average price of a new 3-bedroom home in Douglas in 1996 was \$89,000, while that of an existing 3-bedroom home was \$74,000 (NEWEDC 1997).

3.18.5 Local Government Facilities and Services

Gillette maintained a steady population growth from 1987, when it totaled 17,054, until 1996, when it was estimated at 21,585. According to a recent article in the Gillette News Record (1997), however, population dropped slightly in 1997, to about 21,410. Owing to the substantial revenues generated by coal production, local government facilities and services have kept pace with this growth and are adequate for the current population. The primary exception is a lack of space in the Gillette high school; however, approval of a recent bond issue will facilitate construction of a new school. The 1996 population of Douglas (5,479) is lower than its peak of 7,800 in 1982, and local government facilities and services are generally adequate for the current population. Primary exceptions include a shortage of physicians, although several physicians have recently moved to the area. The town also has limited building space (platted lots) available for future growth. Some indoor recreational facilities may also be near or at capacity.

Wright was established in 1976 by ARCO and is the nearest community to the southern group of mines. Wright's population peaked in 1985 at approximately 1,800 and decreased to 1,175 by 1994. Over the past

few years, many of the coal mines have transitioned from working 10-hour shifts to 12-hour shifts. Many miners have thus relocated to Wright to cut down on commuting time, and the population has recently increased to approximately 1,400. Several coal service companies are also cutting back on travel allotments, which is further adding to Wright's current population growth. Wright's infrastructure is more than adequate for the current and planned population, and with the current building going on, it can double in population before services become limiting.

3.18.6 Social Conditions

Despite past boom and bust cycles in the area's economy, a relatively stable social setting now exists in these communities. Most residents have lived in the area for a number of years, social ties are well established, and residents take great pride in their communities. Many of the people place a high priority on maintaining informal lifestyles and small town traditions, and there are some concerns that the area could be adversely affected by more than a modest growth in population. At the same time, there is substantial interest in enhancing the economic opportunities available in the area and a desire to accommodate reasonable levels of growth and development.

3.18.7 Environmental Justice

Environmental Justice issues are concerned with actions that unequally impact a given segment of society either as a result of physical location, perception, design, noise, etc. 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 FR 7629). The Executive Order requires federal

agencies to identify and address disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority populations and low-income populations (defined as those living below the poverty level). The Executive Order makes it clear that its provisions apply fully to Native American populations and Native American tribes, specifically to effects on tribal lands, treaty rights, trust responsibilities, and the health and environment of Native American communities.

Communities within Campbell County, entities with interests in the area, and individuals with ties to the area all may have concerns about the presence of a coal mine within the general analysis area. Communities potentially impacted by the presence or absence of a coal mine have been identified in this section of the EIS. Environmental Justice concerns are usually directly associated with impacts on the natural and physical environment, but these impacts are likely to be interrelated with social and economic impacts as well. Native American access to cultural and religious sites may fall under the umbrella of Environmental Justice concerns if the sites are on tribal lands or access to a specific location has been granted by treaty right.

Compliance with Executive Order 12898 concerning Environmental Justice was accomplished through opportunities for the public to receive information on this EIS in conjunction with the consultation and coordination described in Section 1.5 of this document. This EIS and contributing socioeconomic analysis provide a consideration of impacts with regard to disproportionately adverse impacts on minority and/or low-income groups, including Native Americans.