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[1] 1988) that could potentially be affected by the proposed actions include air quality, cultural resources, Native American religious concerns, T&E species, hazardous or solid wastes, water quality, wetlands/riparian zones, invasive non-native species and environmental justice. Five other critical elements (areas of critical environmental concern, prime or unique farmlands, floodplains, wild and scenic rivers, and wilderness) are not present in the project area and are not addressed further. In addition to the critical elements that are potentially present in the project area, this EIS discusses the status and potential effects of mining the LBA tract on topography and physiography, geology and mineral resources, soils, water quantity, alluvial valley floors, vegetation, wildlife, land use and recreation, paleontological resources, visual resources, noise, transportation resources, and socioeconomics.

[1] Refer to page viii for a list of abbreviations and acronyms used in this document.

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 (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 per year, 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 for the period 1987 through 1999 at the Jacobs Ranch Mine (Figure 3-1) was 8.9 mph. Wind speeds are highest in the winter and spring and are predominantly from the northwest and southeast. Winter gusts often reach 30-40 mph. During periods of strong wind, dust may impact air quality across the region.

There are an average of 15 air-stagnation events annually in the PRB with an average duration of two days each (BLM 1974). General

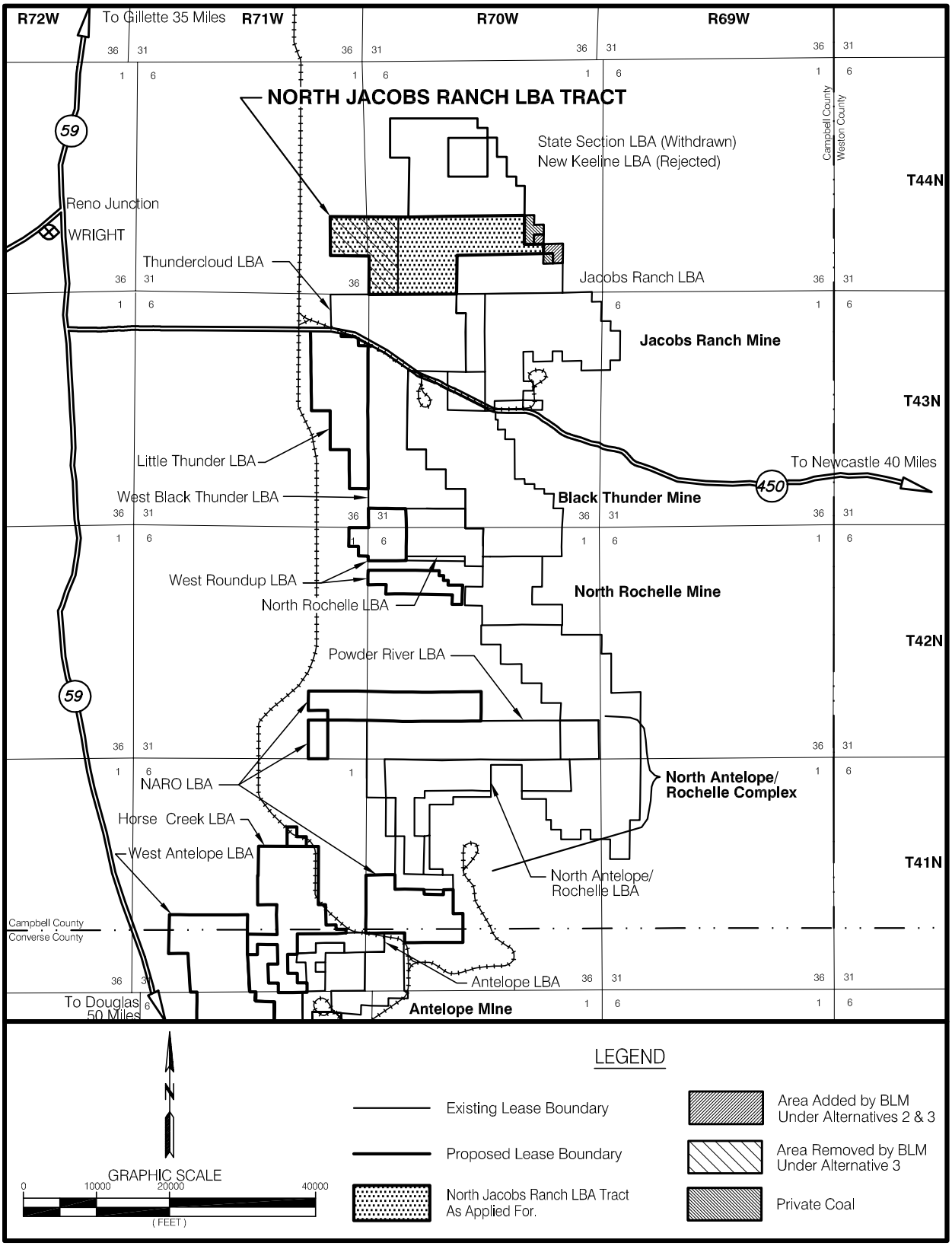

Figure 3-1. General Analysis Area.

information describing the area's resources were gathered from draft BLM Buffalo Field Office 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. It 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 on the east. The Jacobs Ranch Mine is located on the gently dipping eastern limb of the structural basin, near the southern end. The regional dip in the area of the mine is approximately 1 degree to the northwest. There are local areas where the shallow strata dip at higher angles, generally due to local folding or faulting.

The PRB landscape consists of broad plains, low hills, and tablelands. 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 are common in the basin, as are buttes and plateaus capped by clinker or sandstone. The LBA tract is in an area consisting primarily of gently rolling terrain broken by minor drainages with an elevation ranging from 4,720 to 4,930 ft. Overall, the North Jacobs Ranch LBA Tract is similar in topography to the Jacobs Ranch Mine permit area. Slopes range from flat to 14 percent and average about 2 percent. A significant portion of both the Jacobs Ranch Mine permit area and the North Jacobs Ranch LBA Tract lie within closed basins. Slope analyses would be done for the LBA tract if it is leased.

3.3 Geology

Stratigraphic units in the mine area that would be impacted if the North Jacobs Ranch LBA Tract is mined include, in descending order, recent (Quaternary age) alluvial and eolian deposits, the Eocene age Wasatch Formation (the overburden), and the Paleocene age Fort Union Formation (which contains the target coal beds). Figure 3-2 shows two geologic cross-sections drawn through the North Jacobs Ranch LBA Tract (one north-south and one east-west). These cross sections are representative of the geology in the vicinity of the LBA tract, with the primary variables being the thickness of overburden, the parting thickness between the Lower and Middle Wyodak coal seams, and the surface topography. Figure 3-3 is a chart showing the stratigraphic relationships and hydrologic characteristics of the surface and subsurface geologic units in the area of the Jacobs Ranch Mine.

Surficial deposits in the analysis area include Quaternary alluvial and eolian deposits, Wasatch Formation, clinker, and weathered Wasatch and Fort Union Formations. There is very little clinker on the LBA tract itself, although it is present in the analysis area. There are thin alluvial deposits along the ephemeral streams (Mills

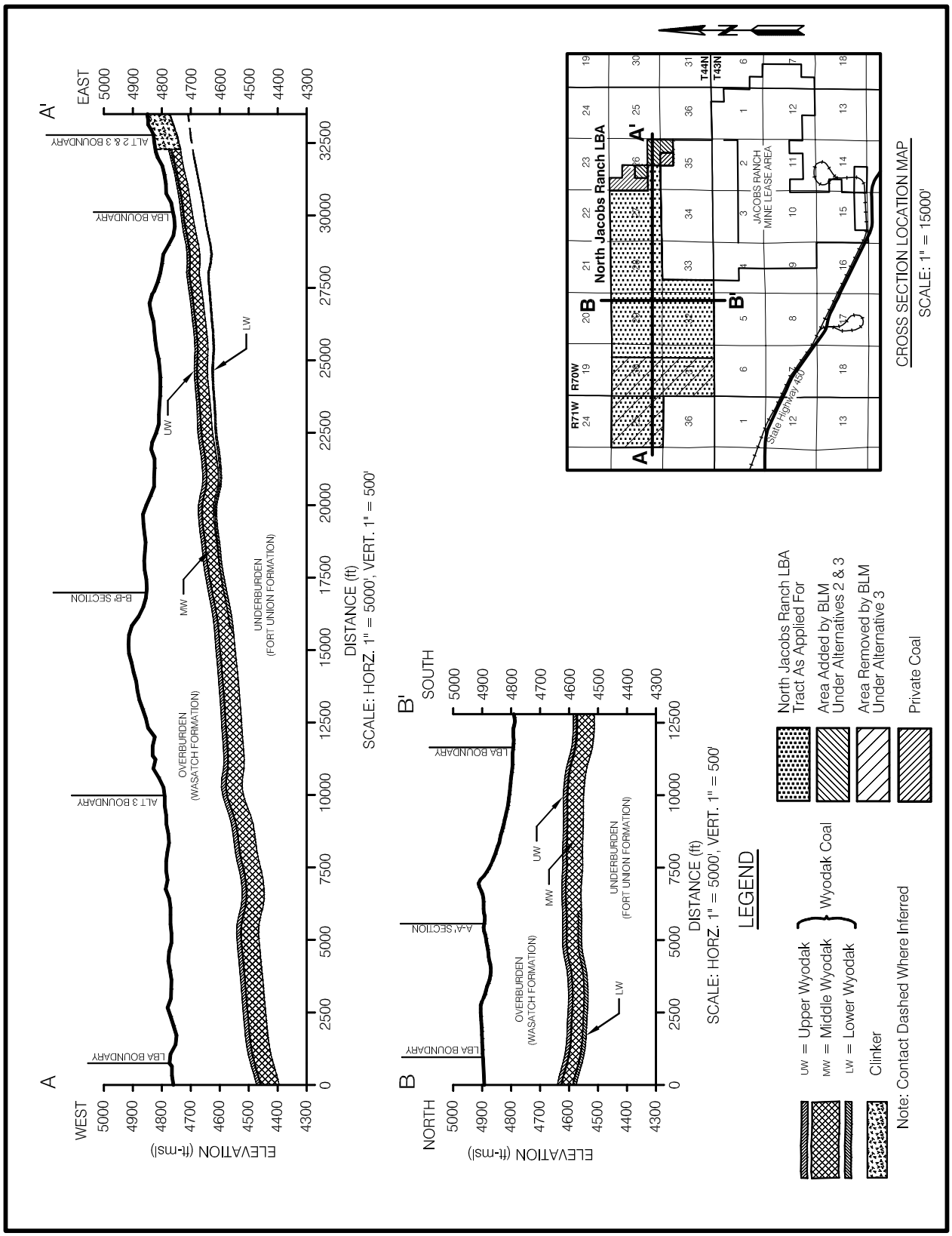

Figure 3-2. North-South and East-West Geologic Cross Sections, North Jacobs Ranch LBA Tract.

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 and 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 of considerably better quality which does meet the Class I standard.
FORT UNION FORMATION PALEOCENE	TONGUE RIVER MEMBER	The coal seams serve as regional groundwater aquifers and exhibit highly variable aquifer properties. Permeability and porosity associated with the coal arise almost entirely from fractures. Coal water typically does not meet Class I or Class II (irrigation) use standards. In most cases, water from coal wells is suitable for livestock use. The coal water is used throughout the region as a source of stock water and occasionally for domestic use.
	LEBO MEMBER	The Lebo Member, also referred to 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 gpm 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 frequently 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 predominantly 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 and sulfate as the predominant ions in solution.
* Not present in the general area of the PSO lands.		

Figure 3-3.

Stratigraphic Relationships and Hydrologic Characteristics of Upper Cretaceous, Lower Tertiary, and Recent Geologic Units, Powder River Basin, Wyoming. (Compiled from Hodson et al. 1973 and Lewis and Hotchkiss 1981).

and Shipley Draws) and the closed basin drainage channels. They typically consist primarily of poor to well-sorted, irregularly bedded to laminated, unconsolidated sand, silt, and clay with minor intervals of fine gravel. (Refer to Section 3.6.2 and Figure 3-8 for an additional discussion and location map of Mills and Shipley Draws.)

The Wasatch Formation forms most of the overburden on top of the recoverable coal seams in the Fort Union Formation in the general analysis area. It consists of interbedded lenticular sandstones, siltstones, shales, and thin discontinuous coals. There is no distinct boundary between the Wasatch Formation and the underlying Fort Union Formation. From a practical standpoint, however, the top of the mineable coal zone is considered as the contact between the two formations. The average overburden thickness on the LBA tract is about 215 feet. Overburden thickness generally increases to the west due to the westerly dip of the beds in this area. Overburden thickness decreases in stream valleys where it has been removed by erosion.

The Fort Union Formation consists primarily of shales, mudstones, siltstones, lenticular sandstones, and coal. It is divided into three members: Tongue River (which contains the target coal seams), Lebo, and Tullock, in descending order (Figure 3-3).

The Tongue River member consists of interbedded claystone, silty shale, carbonaceous shale and coal, with lesser amounts of fine-grained sandstone and siltstone.

At the Jacobs Ranch Mine, there are three mineable coal seams. JRCC personnel refer to these seams as the Upper, Middle and Lower Wyodak. In parts of sections 10 and 15 of T.43N., R.70W. these three beds coalesce to form one thick coal seam which, in the general analysis area, is referred to as the Wyodak. Several other names are applied to this coal seam, including the Wyodak-Anderson and Anderson-Canyon. The Wyodak-Anderson coal seam is mined at the Black Thunder Mine which is located immediately south of the Jacobs Ranch Mine (Figure 3-1).

On the North Jacobs Ranch LBA tract, the Upper Wyodak averages 12.5 feet in thickness, the Middle Wyodak averages 51.5 feet in thickness, and the Lower Wyodak thickness averages 8.2 feet. The Upper Wyodak occurs throughout the LBA tract, and it is separated from the Middle Wyodak by an average of 2.3 feet of parting. The Middle Wyodak merges with the Lower Wyodak at a line that trends roughly north-northwest through the centers of sections 28 and 33, T.44N., R.70W. To the east of this divergence line the Middle Wyodak and Lower Wyodak are separated by a parting that averages five feet thick but thickens to over 20 feet as it approaches the eastern edge of the tract (Figure 3-2). In the western half of the LBA tract the Middle Wyodak and Lower

Wyodak are merged with an average coal thickness of 56.7 feet.

The Lebo Shale and Tullock members of the Fort Union Formation underlie the Tongue River member (Figure 3-3). They consist primarily of sandstone, siltstone, mudstone, shale and coal. In general, the Tullock member contains more sand than the Lebo Shale member.

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 15 coal mines lying along a north/south line that parallels Highway 59 starting north of Gillette, Wyoming, and extending south for about 75 miles (Figure 1-1). Several of these mines, including the Rawhide and Coal Creek Mines, are capable of producing but are not currently active. These mines are located where the Wyodak coal is at its shallowest depths, i.e., nearest the outcrop. A 16th mine, the Dave Johnston Mine, located near Glenrock, Wyoming about 35 miles southwest of the Jacobs Ranch Mine has also shut down coal mining operations.

The Fort Union coal seams are subbituminous and are generally low-sulfur, low-ash coals. Typically, the coal being mined has a higher heating value south of Gillette than north of Gillette. According to the analyses (which were done on an as-received basis) of exploration drilling samples collected in the Jacobs Ranch Mine area, the recoverable coal reserve has an average heating value of approximately 8,600 Btu/lb and contains an average of 5.80 percent ash, 0.48 percent sulfur, 31.40 percent volatile matter, 33.87 percent fixed carbon, and 28.45 percent moisture.

Oil and Gas. Oil and gas have been produced in the PRB for more than 100 years 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. The estimated mean amounts of undiscovered hydrocarbons in the basin are 1.94 billion barrels of recoverable oil and 1.60 trillion ft^3 of gas (USGS 1995). Depth to gas and oil-bearing strata is generally between 4,000 ft and 13,500 ft, but some wells are as shallow as 250 ft.

The LBA tract overlies geologic structures that contain producible quantities of oil and gas. The Hilight Oil and Gas Field, which was discovered in 1969, underlies the LBA tract. 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. See Section 3.11 for further discussion of producing wells and their 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. 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. Without the existence of conditions which act to trap the gas in shallow coals or in adjacent sandstones, the gas escapes to the atmosphere. It is likely that a lot of methane generated by the coal beds in the PRB has gradually escaped into the atmosphere because of the relatively shallow coal burial depths. However, a large amount also remains in the coal. A recent study estimates that there are approximately 38.2 trillion cubic feet of CBM gas in place in coal beds that are thicker than 20 feet and deeper than 200 feet. This study estimates that there area 25.6 trillion cubic feet of recoverable CBM reserves (Finley and Goolsby 2000).

Historically, methane has been reported flowing from shallow water wells and coal exploration holes 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 T.54N., R.74W. which began producing gas for domestic use in 1916.

CBM has been commercially produced in the Powder River Basin since 1989 when production began at Rawhide Butte Field, west of the Eagle Butte Mine. CBM exploration and development is currently ongoing throughout the PRB in Wyoming, and there are now more than 5,000 productive wells in place.

Since the early 1990's, the BLM has completed numerous EAs and two EISs analyzing CBM projects. The last of these was the Wyodak CBM Project EIS, which was completed in 1999. It studied 3,600 square miles of mixed federal, state, and private lands. The EIS analyzed the impacts of drilling and producing up to 5,000 new federal, state, and private CBM wells in addition to the 890 wells that had been evaluated in previous NEPA documents. BLM recently completed an EA that analyzed the impacts of drilling as many as 2,500 additional federal drainage protection wells within the Wyodak CBM Project EIS area. These wells would be drilled and produced to prevent the loss of federal CBM resources and corresponding royalties from undrilled federal oil and gas leases that are adjacent to and potentially being drained by producing wells on private or state lands. BLM is also preparing a new regional EIS. It will analyze the cumulative impacts of reasonably foreseeable CBM and conventional oil and gas development within the Wyoming portion of the PRB.

CBM is currently being produced on the North Jacobs Ranch LBA Tract. Approved spacing for CBM wells is

one well per 80 acres or eight wells per section. A maximum of 60 CBM wells could be drilled on this LBA tract under any of the alternatives being analyzed in this EIS.

The ownership of oil and gas resources in the LBA tract is discussed in Section 3.11 of this EIS. Rim Operating, Inc. is the owner of most of the CBM drilling rights on the North Jacobs Ranch LBA Tract. As of January 2001, they had drilled 33 CBM wells on the North Jacobs Ranch LBA Tract. Thirteen of these wells began producing in December 2000, and thirteen wells began producing in January 2001. Rim plans more drilling in this area.

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 North Jacobs Ranch LBA Tract.

Uranium. There are substantial uranium resources in southwestern Campbell and northwestern Converse Counties. 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 reduced uranium mining activities in the early 1980's. There are currently two in-situ leach operations in the PRB. Production at another ended in 2000. No known uranium reserves exist on the North Jacobs Ranch LBA Tract.

Scoria. Scoria or clinker has been and continues to be a major source of gravel for road construction in the area. Scoria is present within the Jacobs Ranch Mine area, although scoria is not present on the LBA tract as applied for under the Proposed Action. Scoria is present within the Alternatives 2 and 3 tracts.

3.4 Soils

The soils on the North Jacobs Ranch LBA Tract are typical of the soils that occur on the adjoining Jacobs Ranch Mine. Most of the LBA tract was subjected to an order 1-2 soils survey in 1999. The area covered in the study includes the LBA tract under the Proposed Action and Alternative 2, as well as the area that would be disturbed if the tract were mined.

Based on the baseline soils studies, there is enough suitable topsoil for salvaging within the LBA tract under the Proposed Action and Alternatives 2 and 3 to redistribute suitable soils to an average depth of about two to three feet over all disturbed areas.

All soil surveys were completed to an order 1-2 resolution 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 proposed affected area associated with the North Jacobs Ranch LBA Tract under the Proposed Action, including the area added under Alternative 2 and Lot 2 of Section 35, T.44N., R.70W.

Soils developing predominantly in alluvial or colluvial fan deposits

- Arvada, thick surface – Arvada – Slickspots complex, 0 to 6 percent slopes
- Bidman loam, 0 to 6 percent slopes
- Bidman – Ulm loams, 0 to 6 percent slopes
- Bidman – Parmleed, 0 to 6 percent slopes
- Cambria – Kishona – Zigweid loams, 0 to 6 percent slopes
- Decolney – Hiland sandy loams, 0 to 6 percent slopes
- Forkwood – Cushman loams, 0 to 6 percent slopes
- Maysdorf fine sandy loam, 0 to 6 percent slopes
- Teckla very fine sandy loam, 0 to 10 percent slopes
- Ulm loam, 0 to 6 percent slopes
- Ulm clay loam, 0 to 6 percent slopes
- Ulm – Renohill complex, 0 to 6 percent slopes

Soils developing predominantly in residuum on uplands

- Felix clay, ponded, 0 to 2 percent slopes
- Hiland fine sandy loam, 0 to 6 percent slopes
- Hiland – Bowbac sandy loams, 0 to 6 percent slopes
- Hiland – Bowbac sandy loams, 6 to 15 percent slopes
- Keeline – Tullock – Niobrara complex, 3 to 30 percent slopes
- Theedle – Kishona loams, 0 to 6 percent slopes
- Theedle – Kishona loams, 6 to 20 percent slopes
- Theedle – Shingle loams, 3 to 30 percent slopes
- Wibaux – Shingle – Rock Outcrop complex, 6 to 60 percent slopes

Soils developing predominantly in eolian sand deposits

- Pugsley – Decolney sandy loams, 0 to 6 percent slopes
- Terro – Taluce sandy loam, 6 to 30 percent slopes
- Turnercrest – Keeline – Taluce sandy loams, 6 to 30 percent slopes
- Vonalee sandy loam, 0 to 10 percent slopes
- Vonalee – Terro sandy loams, 2 to 10 percent slopes

Table 3-1 provides the extent of six depth classes of suitable topsoil within the LBA tract under the Proposed Action, including the area added under Alternative 2 and Lot 2 of Section 35, T.44N., R.70W.

An average of about two feet of topsoil will be redistributed on all disturbed acres. Areas of unsuitable soils include sites with high alkalinity, salinity or clay content.

Table 3-1. Acres of Topsoil Available for Reclamation Within the North Jacobs Ranch LBA Tract Under the Proposed Action, Including the Area Added Under Alternative 2 and Lot 2 of Section 35, T.44N., R.70W.

Thickness of Suitable Topsoil (inches)	Acres	Percent
0	384.2	7.6
0 - 12	0.0	0.0
12 - 30	1431.5	28.5
30 - 48	1765.6	35.2
48 - 60	1441.4	28.7
> 60	0.0	0.0
Total	5022.7	100.0

The soil depths and types on the North Jacobs Ranch LBA Tract under the Proposed Action and Alternative 2 are similar to soils currently being salvaged and utilized for reclamation at the adjacent mine and other mines in the PRB. The tract is expected to have an adequate quantity and quality of soil for reclamation. The site-specific soil surveys have located hydric soils and/or inclusions of hydric soils. Wetland surveys are discussed in Section 3.8.

3.5 Air Quality

Wind speeds for the region average from nine to 13 miles per hour with local variations due to differences in topography. Winds are predominantly from the northwest and 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. A wind rose diagram along with the air quality and meteorological sampling locations for the Jacobs Ranch Mine are depicted on Figure 3-4.

The air quality of the PRB area is generally good. WDEQ/AQD assumes a background PM_{10} concentration of $15 \mu g/m^3$ for regulatory purposes (Judy Shamley, April 2000). Figure 3-5 is a depiction of visibility impairment measured in deciviews (dv). A dv is a general measure of view impairment caused by pollution. A dv of 13 translates to a view of approximately 60 miles, which in the PRB is common viewing distance. As can be seen from Figure 3-5, the only areas of the U.S. with less view impairment than the PRB are the Colorado Plateau (dv = 11) and the Great Divide Basin (dv = 10).

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

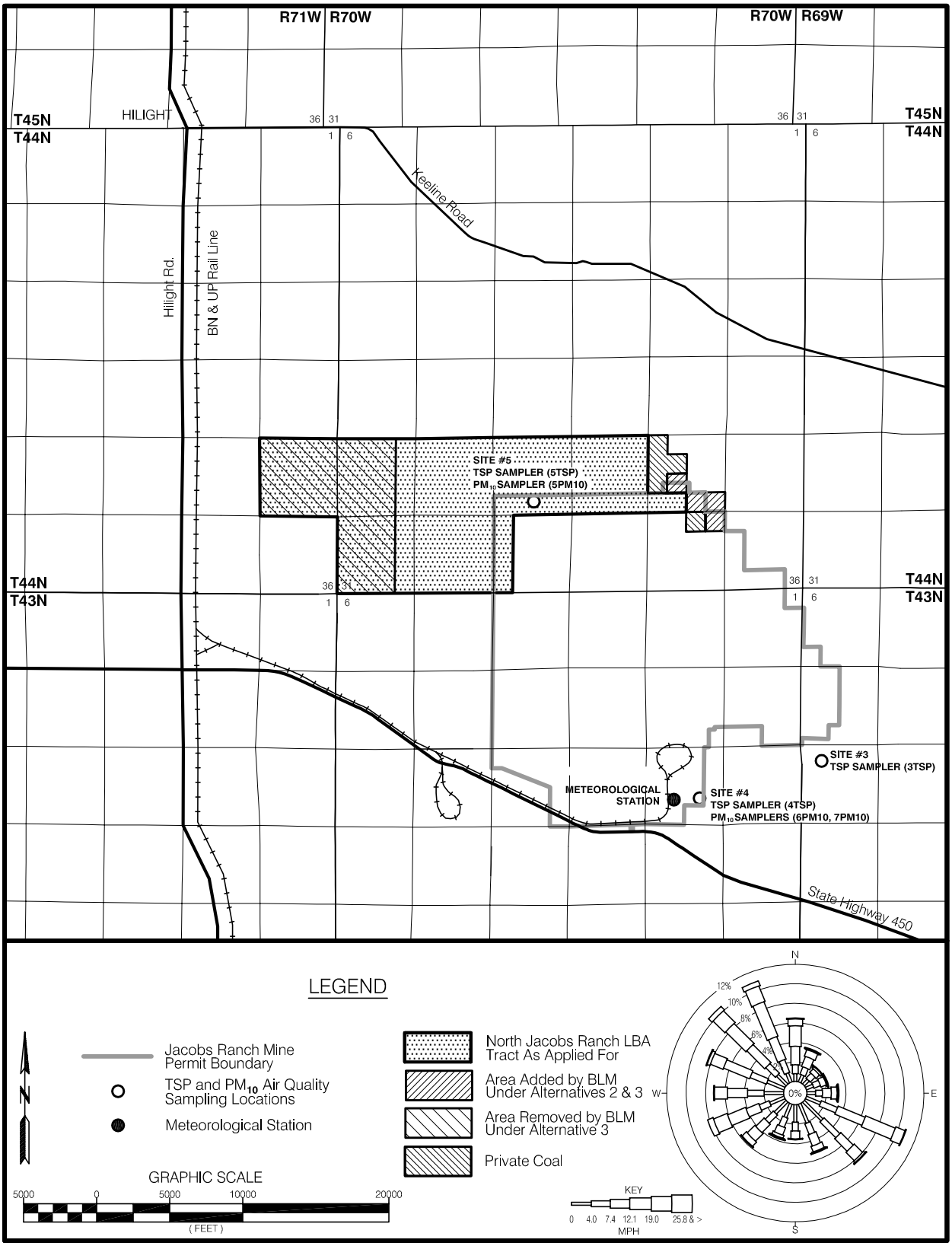

Figure 3-4. Wind Rose, Air Quality and Meteorological Stations at the Jacobs Ranch Mine.

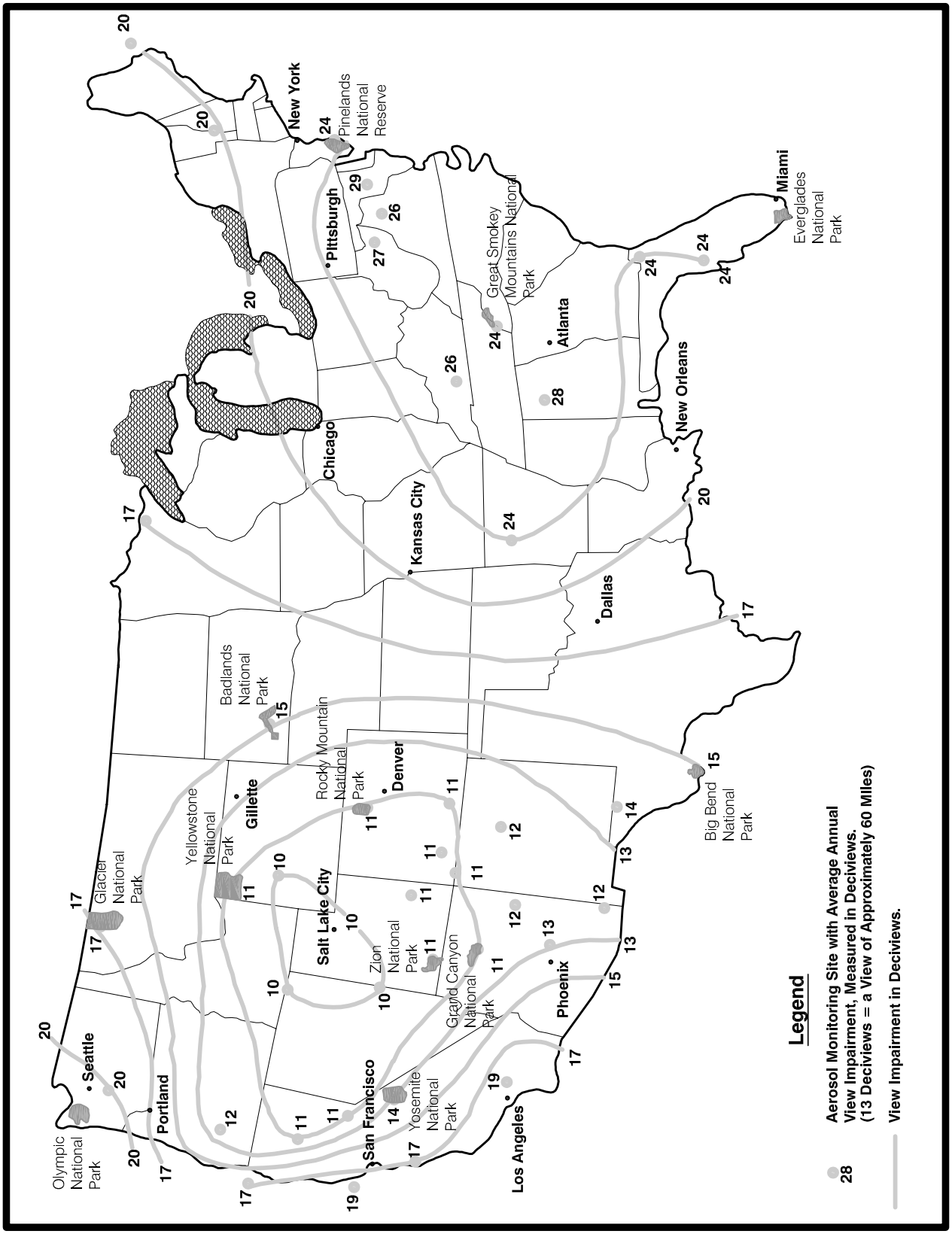

Figure 3-5. Average Annual View Impairment as a Function of Light Extinction. (From IMPROVE, 1995)

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 of air quality. Wyoming's ambient air standards are shown in Table 3-2.

The Prevention of Significant Deterioration (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 North Jacobs Ranch LBA Tract is Wind Cave National Park in southwestern South Dakota. This national park is approximately 80 miles east of the LBA tract. The next closest Class I area is Badlands National Park, which is approximately 120 miles east of the LBA tract.

Wyoming's PSD standards for particles are identical to federal standards, except that Wyoming has not adopted Class III standards (Table 3-3). Coal mining around the North Jacobs Ranch LBA Tract is not currently affected by the PSD regulations because surface coal mines are not one of the 28 EPA-

Table 3-2. Regulated Air Emissions for Wyoming.

Emissions	Averaging Period	Wyoming Standard ($\mu g/m^3$)	National Standard ($\mu g/m^3$)
PM_{10}	24-hour[1]	150	150
	annual[2]	50	50
Nitrogen Oxide (NO_x)	annual[2]	100	100
Photochemical Oxidant (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.

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

Emission	Averaging Time	Maximum Allowable Increments of Deterioration ($\mu g/m^3$) Class I	Class II	Class III[2]
PM_{10}	Annual Mean	4	17	--
	24-hour[1]	8	30	--

[1] Maximum allowable increment may be exceeded once per year at any receptor site.
[2] Wyoming has not adopted Class III standards.

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.

In the vicinity of the North Jacobs Ranch LBA Tract, the main sources of air pollution are surface coal mines, vehicle traffic, and various sources associated with oil and gas production, railroad traffic and farming and ranching activities. The closest existing power plant is approximately 35 miles southwest of the LBA tract (Dave Johnston); however, several new power plants have been proposed closer to the tract including the Two Elk and Two Elk Unit Two plants-about six miles southeast of the tract. The proposed ENCOAL plant, located about eight miles south of the tract, is currently on hold. The North American Power Group plans to start construction on the 310-megawatt Two Elk power plant near the Black Thunder Mine this year. The group is also planning to build a power transmission line (Casper Star-Tribune April 9, 2001) and a second coal fired plant near the Black Thunder Mine (Gillette News Record, April 16, 2001). With the recent power shortages nationwide, there has been considerable interest in building more power plants in the coal-rich PRB. The North American Power Group has also applied for state permission to build a 500-megawatt coal-fired plant south of Gillette next to the Cordero Rojo mine complex. The plant would burn 3 million tons of coal per year and would be completed by early 2005 if all permits can be obtained (Casper Star-Tribune April 9, 2001). Another 500-megawatt power plant would be built near an 80-megawatt plant under construction in east Gillette under Black Hills Energy Capital, Inc. (Casper Star-Tribune April 9, 2001). These projects are discussed in the Cumulative Impacts Section of Chapter 4.

The major type of emission from surface coal mining activities is fugitive dust. Blasting and moving overburden, crushing, loading, and hauling coal, and the large areas of disturbed land all produce dust. Wyoming's ambient air standards for PM_{10} are shown in Table 3-2. PM_{10} is respirable particulate matter (less than 10 microns) which can penetrate into the lungs and cause health

problems. Wyoming recently dropped their standards for TSP (total suspended particles) in favor of PM_{10} to match federal standards.

Blasting is also responsible for another type of emission from surface coal mining. Overburden blasting sometimes produces low-lying gaseous orange clouds which contain nitrogen oxides (NO_x). In response to increasing reports of public exposure to these clouds, WDEQ/LQD has directed certain PRB mines to monitor, estimate NO_2 concentrations, and develop blasting procedures that will protect public health and safety. A description of some of these measures is included in Section 4.5.4 of this EIS. Jacobs Ranch Mine has had no directives from WDEQ to monitor, estimate NO_2 concentrations, or develop blasting procedures that will protect public health and safety because there have been no reported incidences of NO_2 exposure events connected with mining at the Jacobs Ranch Mine. The nearest occupied dwelling to the North Jacobs Ranch LBA Tract is located approximately 1 mile from the boundary of the tract, in Section 23, T.44N., R.71W. Another occupied dwelling is actually located within the LBA tract, in Section 29, T.44N., R.70W., but is owned by JRCC and would be vacated prior to mining.

Vehicle traffic, both inside and outside the areas of surface coal mining, is responsible for tailpipe emissions and for the emission of fugitive dust from paved and unpaved surfaces. Vehicle emissions consist primarily of NO_x and carbon monoxide (CO), but also may include sulfur dioxide (SO_2) and, by secondary processes, ozone (O_3). The national and state standards for emissions of these substances are also shown in Table 3-2.

The compressor stations and large generators associated with oil and gas production and transport and with fossil fuel-fired power plants produce emissions of NO_x, SO_2, CO, TSP, PM_{10}, volatile organic compounds, and smaller amounts of other pollutants.

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

In order to obtain a state air quality construction and operating permit, each mine may be required to demonstrate, through dispersion modeling, that its activities will not increase PM_{10} levels above the annual standard established by the Wyoming Air Quality Standards and Regulations (WDEQ/AQD 1995). The modeling demonstration must include the estimated air pollutant emissions from other existing pollution-generating activities, including adjacent mines, so that control of overall air quality is part of the permitting process.

WDEQ/AQD has presented testimony in public hearings documenting that the air quality resource in the region including the North Jacobs Ranch LBA Tract did not diminish from 1980 through 1988, although coal

production in the region increased substantially during that period. Air quality particle data from that report is summarized in Table 3-4. To summarize the monitoring data in comparative form, averages of the geometric means from all sites were calculated for each calendar year. Over 23,000 samples are represented in Table 3-4. 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. 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 North Jacobs Ranch LBA Tract, historical particle ambient air quality data show the same result for the Jacobs Ranch Mine as described above for the PRB as a whole. Figure 3-6 presents a plot of average annual

Table 3-4. Summary of WDEQ/AQD Report on Air Quality Monitoring in Wyoming's Powder River Basin, 1980-1988.

Year	Number of Mines Producing/ Monitoring[1]	# Sites[2]	Coal Produced (MMTPY)	Overburden (MMBCY)	TSP Average of All Geometric Means ($\mu g/m^3$)
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] Some sites include more than one sampler, so the number of samplers is greater than the number of sites.

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

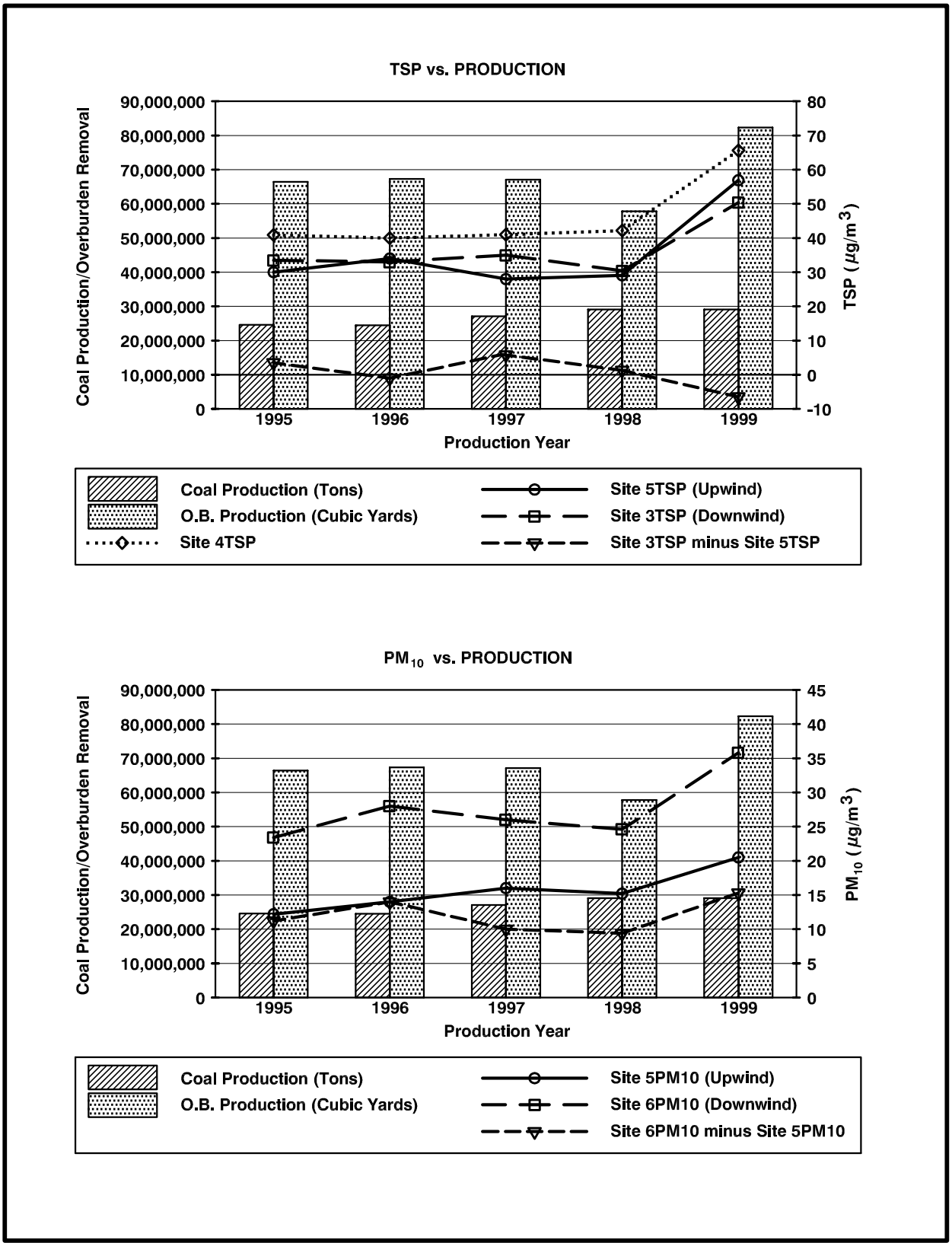

Figure 3-6. Coal Production and Overburden Removal vs. Ambient Particulates for Jacobs Ranch Mine.

TSP measured at Site #5 (predominantly upwind) and Site #3 (predominantly downwind) at the Jacobs Ranch Mine for the years 1995 through 1999. The difference in TSP at these two sites is also plotted on Figure 3-6, as are the coal and overburden production amounts for these years. Some general inferences can be made from Figure 3-6. The annual arithmetic mean TSP at both the predominantly upwind and predominantly downwind sites remained fairly constant (around 30 $\mu g/m^3$) from 1995 through 1998, while coal and overburden production also remained relatively constant. The mine's overburden production increased from 57.8 million cubic yards in 1998 to 82.3 million cubic yards in 1999. The TSP at both the predominately upwind and predominately downwind monitoring sites also increased; however, the difference in TSP between Sites #3 and #5 did not show a like increase in 1999. In fact, the annual arithmetic mean TSP concentration was greater at the predominately upwind site than at the predominately downwind site. Figure 3-6 shows that as the rate of overburden production increased there was not a proportionate increase in TSP measured at the downwind mine boundary relative to the upwind mine boundary.

Before adoption of the current annual PM_{10} standard, the annual particulate standard was 60 $\mu g/m^3$ of TSP (geometric mean). As Figure 3-6 shows, the average annual TSP at Site #4 in 1999 (which was 65.6 $\mu g/m^3$) exceeded this former standard. Of the three air quality monitoring stations at the Jacobs Ranch Mine, Site #4 is located closest to the railroad loop, truck dump, coal plant and service facilities (Figure 3-4). The average annual TSP at Sites #3 and #5 were below the former standard from 1995 through 1999.

The current annual PM_{10} standard of 50 $\mu g/m^3$ was not exceeded at the three air quality monitoring stations from 1995 through 1999. Within this five-year time period the PM_{10} arithmetic means for the Jacobs Ranch Mine at the downwind Site #4 (6PM10 and 7PM10), in micrograms per cubic meter, are as follows: 1995 = 24.5; 1996 = 28.0; 1997 = 26.0; 1998 = 25.2, and 1999 = 35.6. The Jacobs Ranch Mine received no air quality violations during the 1995 through 1999 time period.

Nitrogen dioxide (NO_2) was monitored from 1975 through 1983 and from March 1996 through May 1997 in Gillette, Wyoming. NO_2 data has also been collected at some of the mines in recent years. Table 3-5 summarizes the results of that monitoring. The North Jacobs Ranch LBA Tract is located approximately 40 miles south of Gillette and immediately north of the Black Thunder Mine (Figure 1-1).

3.6 Water Resources

3.6.1 Groundwater

Within the North Jacobs Ranch LBA Tract there are two water-bearing geologic units that could be disturbed by mining. In descending order, these units are the Wasatch

Table 3-5. Annual Ambient NO_2 Concentration Data.

Year	Gillette		Black Thunder Mine		Belle Ayr Mine	
	NO_2 ($\mu g/m^3$)[1]	% of Standard	NO_2 ($\mu g/m^3$)[1]	% of Standard	NO_2 ($\mu g/m^3$)[1]	% of Standard
1975	6	6%				
1976	4	4%				
1977	4	4%				
1978	11	11%				
1979	11	11%				
1980	12	12%				
1981	14	14%				
1982	11	11%				
1983[2]	17	17%				
1996[3]	13	13%	13	13%	16	16%
1997[4]	28	28%	23	23%	33	33%

[1] Arithmetic Average
[2] Monitoring discontinued December 1983, reactivated March 1996 to April 1997.
[3] 1996 arithmetic average-March to December
[4] 1997 arithmetic average-January to April
Source: Wyoming Ambient Air Monitoring Data, 1997. Wyoming Department of Environmental Quality.

Formation overburden and the Wyodak coal seam. The sub-coal Fort Union Formation is utilized for water supply at the Jacobs Ranch Mine but will not be physically disturbed by mining activities. The stratigraphic units beneath the North Jacobs Ranch LBA Tract and the hydrologic properties are displayed in Figure 3-3.

JRCC completed 13 monitoring wells within and near the North Jacobs Ranch LBA Tract in 1999; seven in the Wasatch Formation overburden and six in the Wyodak Coal. The locations of these new monitoring wells are shown on Figure 3-7. Data from these wells, as well as previously collected data at the Jacobs Ranch Mine, were used to prepare the following description of baseline groundwater conditions within the LBA tract.

Recent Alluvium

Within the North Jacobs Ranch LBA Tract, the surface drainages are generally dry draws and the alluvium, colluvium and playa deposits associated with these draws are generally thin and not laterally extensive enough to be considered an aquifer. In addition, these unconsolidated deposits are typically very fine-grained and have very limited permeabilities, precluding any significant storage and movement of groundwater.

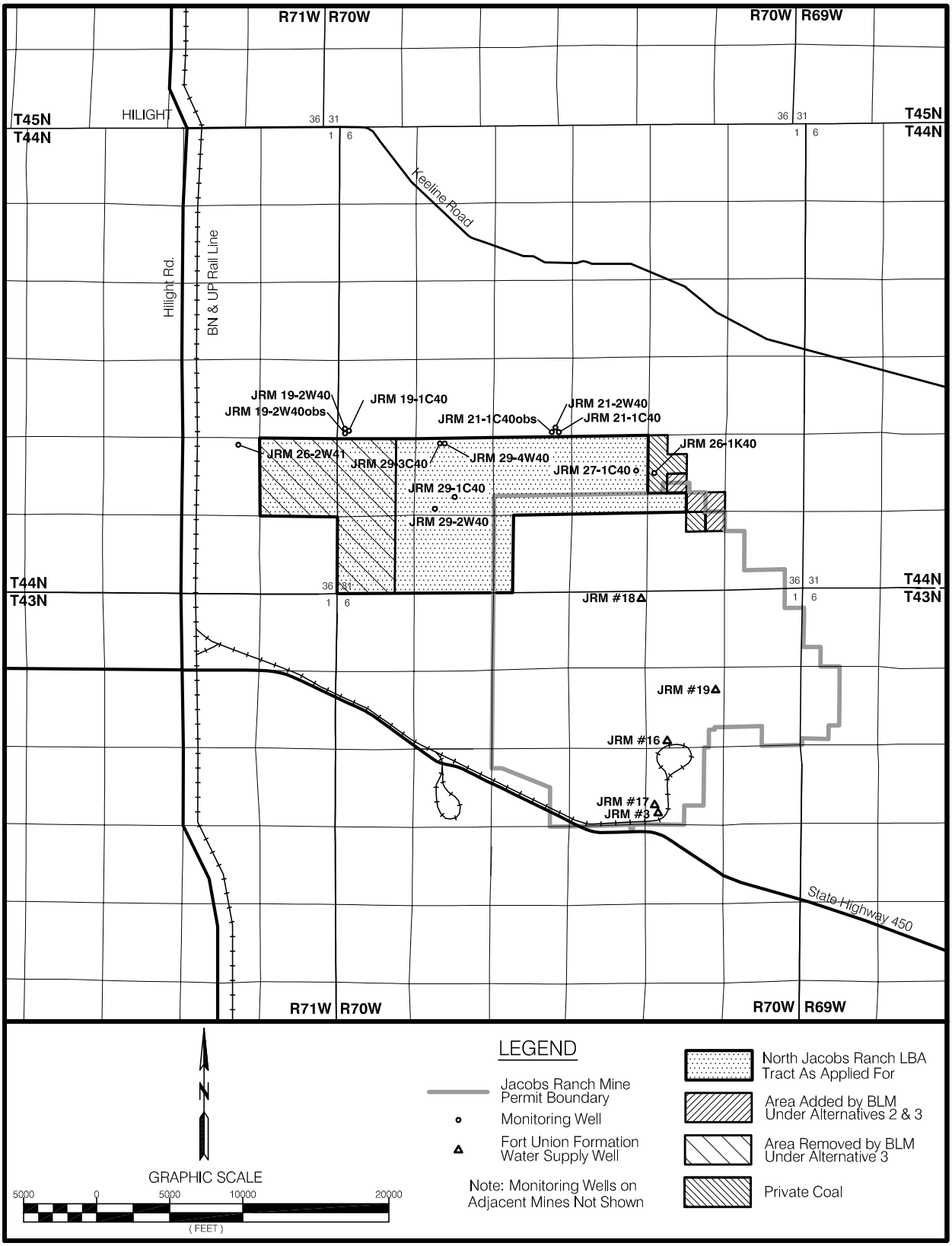

Figure 3-7. Monitoring Well Locations Within and Near the North Jacobs Ranch LBA Tract and Fort Union Formation Water Supply Well Locations at the Jacobs Ranch Mine.

Wasatch Formation

Within the PRB the Wasatch Formation consists of interbedded sandstones, siltstones and shale with occasional discontinuous coal stringers and clinker deposits, and this description basically holds true for the LBA tract. Saturated strata within the Wasatch are limited in areal extent and are typically thin, lenticular sandstones. The hydraulic connection between sandstone lenses is tenuous due to intervening shale aquitards; thus, groundwater movement through the Wasatch Formation overburden is limited. The sandstone and thin coal stringers, where saturated, will yield water to wells, and this water is primarily used for stock watering. Because the saturated sandstone and coal units within the Wasatch Formation are not continuous, the Wasatch is not considered to be a regional aquifer.

Another geologic unit which may be considered a part of the Wasatch Formation is scoria, also called clinker or burn. It consists of Wasatch sediments which overlaid the coal at one time in the past before the coal burned naturally. These sediments were baked, fused and melted in place, then collapsed into the void left by the burned coal. Scoria deposits can be a very permeable aquifer and can extend laterally for miles in the eastern PRB. Scoria deposits do not occur within the LBA tract under the Proposed Action although they are present immediately east and therefore occur within the Alternative 2 and Alternative 3 tracts. The hydrologic function of scoria in the general area is to provide infiltration of precipitation and recharge to laterally contiguous overburden and Wyodak coal.

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 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 tests 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 North Jacobs Ranch LBA Tract is similar to this latter figure 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 extremely variable, with TDS concentrations ranging from approximately 1,000 mg/L to 5,500 mg/L in the vicinity of the LBA tract. Groundwater from the Wasatch Formation is predominantly a sodium sulfate type within the Jacobs Ranch Mine area and the North Jacobs Ranch LBA Tract.

Wyodak Coal

Due to its continuity, the Wyodak coal seam is considered a regional aquifer within the PRB. Within the North Jacobs Ranch LBA Tract, the Wyodak coal contains partings which in places separate the Wyodak into two or three mineable seams (the Upper, Middle, and Lower Wyodak). The total coal sequence ranges from 50 feet to 70 feet thick and dips to the west at less than 1 percent. Despite the occurrence of three separate seams the Wyodak coal is considered to be a single aquifer in the general analysis area. The partings are discontinuous and typically only the lower half of the coal sequence is saturated.

Hydraulic conductivity 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.

New monitoring wells have been installed in the Wyodak coal aquifer within and adjacent to the North Jacobs Ranch LBA Tract, although 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 Mine permit area. Coal aquifer hydraulic conductivity measured at the Jacobs Ranch Mine ranges from 0.07 to 1.60 ft/day. The U.S. Geological Survey reports an average coal aquifer hydraulic conductivity of 0.8 ft/day for the general area (Martin et al. 1988).

Only the lower half of the coal sequence is saturated within the Jacobs Ranch Mine permit area. The Wyodak coal in the vicinity of the North Jacobs Ranch LBA Tract is therefore under predominantly unconfined (water table) conditions.

The average storage coefficient reported for the Jacobs Ranch Mine is 0.01.

The chemistry of groundwater in the coal is variable within the adjacent Jacobs Ranch Mine permit area and the North Jacobs Ranch LBA Tract. In general, it is a calcium sulfate type with relatively high TDS concentrations (2,000 to 3,000 mg/L) in the eastern part of the tract and Jacobs Ranch Mine. The coal groundwater chemistry transitions to a sodium bicarbonate type with much lower TDS concentrations (500 to 1,000 mg/L) as it moves into the western part of the tract and Jacobs Ranch Mine area.

Prior to mining, the direction of groundwater flow within the coal aquifer was generally from recharge areas near the outcrop and burn zone into the basin, following the dip of the coal. Site-specific water-level data collected by JRCC in the vicinity of the LBA tract and presented in the 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 the LBA tract 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 Wyodak coal are not directly disturbed by mining, but many mines use them for water supply wells. In a few cases there have been drawdowns in the subcoal aquifer due to leakage into mine pits, dewatering, and CBM development. 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 it 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 than in the Tongue River or Lebo, 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 by OSM (1984) is 290 ft^2/day.

Near the North Jacobs Ranch LBA Tract, JRCC 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 (JRCC 1999a). Therefore, JRCC refers only to the Upper and Lower Fort Union Formation. The Upper unit consists of the Tongue River-

Lebo 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 30 to 50 ft^2/day. Transmissivities of the Lower Fort Union Formation at the Jacobs Ranch Mine range from about 180 to 380 ft^2/day. JRCC has completed five wells in the subcoal Fort Union Formation to supply water to the Jacobs Ranch Mine. The wells range in depth from 645 to 1,804 feet. The Jacobs Ranch Mine supply wells are depicted on Figure 3-7.

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.

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 Lance and Fox Hills Formations are not used by JRCC at the Jacobs Ranch Mine.

3.6.2 Surface Water

The area surrounding the North Jacobs Ranch LBA Tract consists of gently rolling topography. In general, the streams within this area 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 within and adjacent to the North Jacobs Ranch LBA Tract are displayed in Figure 3-8.

The only streams within the LBA tract are Mills Draw and Shipley Draw. These two streams are classified as ephemeral, meaning they flow only in direct response to snowmelt or precipitation runoff events. Mills Draw and Shipley Draw flow in a southerly direction within the North Jacobs Ranch LBA Tract. Only the upper reaches of these two ephemeral streams lie within the LBA tract. The topography within these two drainage basins is characterized by very gentle slopes and the stream channels are grassy swales.

Mills and Shipley Draws join approximately 2 to 3 miles downstream of the North Jacobs Ranch LBA Tract and under premining conditions flowed into the North Prong Little Thunder Creek. North Prong Little Thunder Creek, Mills Draw and Shipley Draw have been diverted around mining operations at the Black Thunder Mine. The premining drainage area of

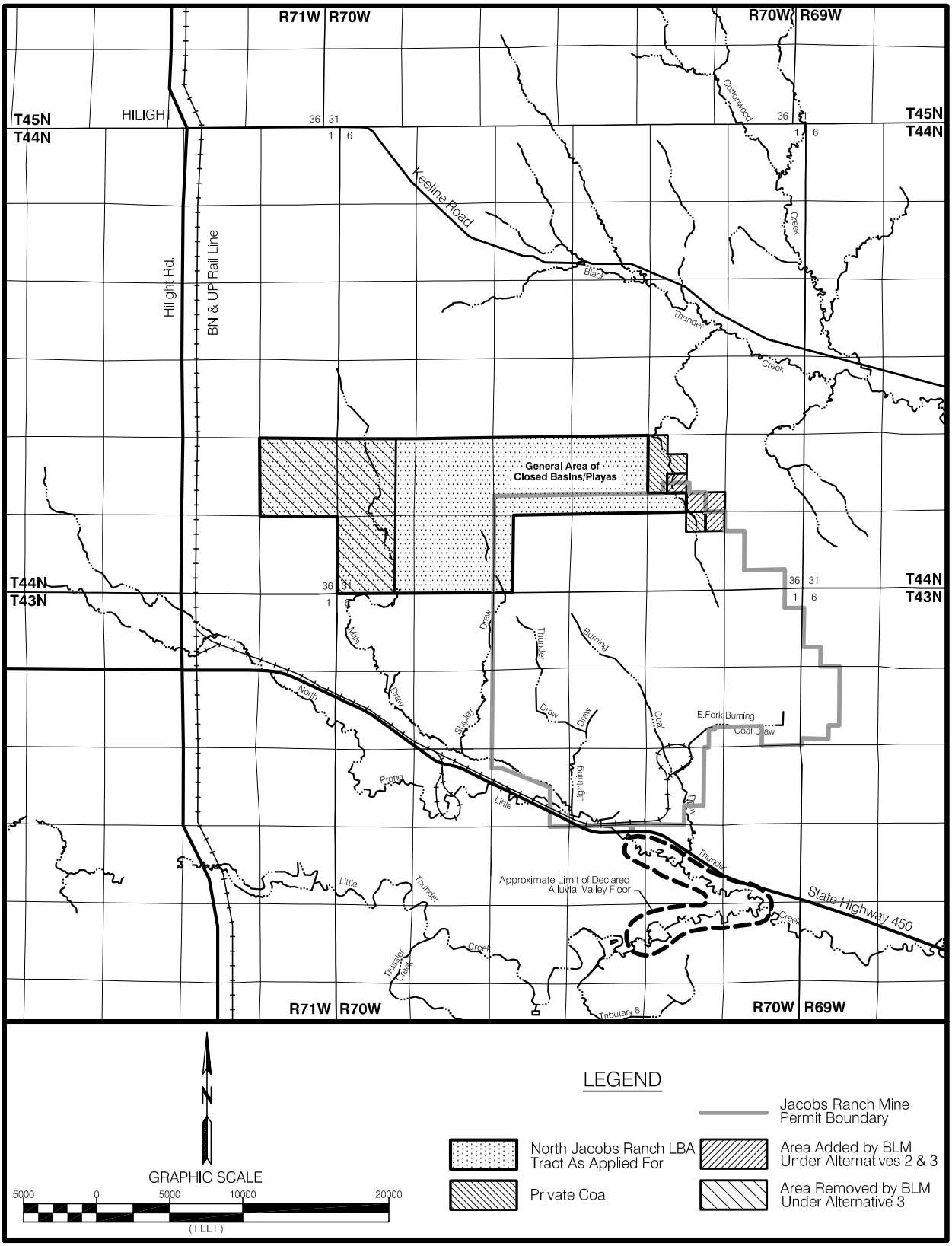

Figure 3-8. Surface Water Features Within and Adjacent to the North Jacobs Ranch LBA Tract.

Mills Draw is approximately 5.5 square miles and the mean annual runoff is roughly 50 acre-feet. The premining drainage area of Shipley Draw is approximately 3.0 square miles and the mean annual runoff is roughly 30 acre-feet. The mean annual runoff calculations were performed using relationships developed by Hadley and Schumm (1961).

The lower reaches of Mills Draw and Shipley Draw lie within the adjacent Thundercloud lease. The Thundercloud lease is contiguous to and south of the North Jacobs Ranch LBA Tract and contiguous to and west of the Jacobs Ranch Mine permit area. North Prong Little Thunder Creek flows easterly near the southern edge of the Thundercloud lease, joining Little Thunder Creek just downstream from the Jacobs Ranch Mine. Little Thunder Creek also joins Black Thunder Creek, a tributary of the Cheyenne River. Historically, North Prong Little Thunder Creek has exhibited infrequent streamflow events, generally with discharges of less than five ft^3 per second. Mills and Shipley Draws are the main streams which contribute streamflow to North Prong Little Thunder Creek in the Thundercloud lease.

A significant portion of the North Jacobs Ranch LBA Tract lies within closed drainage basins which do not contribute runoff to streams except possibly during extremely large and rare storm events. These playas, which predominate the land area within the LBA tract east of the Mills and Shipley Draw drainage divides, are hydrologically significant in that they do not contribute runoff to area streams. The water that is stored in the playas is consumed by evapotranspiration and seepage.

Flows and water quality are monitored by the Jacobs Ranch and Black Thunder Mines in the North Prong Little Thunder Creek and Little Thunder Creek as well as several minor tributaries on and near the LBA tract. These monitoring results are reported to the WDEQ/LQD annually. Most local surface waters are a sodium or calcium sulfate-type that exceeds WDEQ domestic use standards for arsenic, manganese, and TDS depending on flow rate and sample location (KMCC 1993; TBCC 1992). Surface water quality is usually unsuitable for domestic use, marginal for irrigation, and suitable for stock and wildlife.

3.6.3 Water Rights

Records of the SEO were searched for groundwater rights within a 3-mile radius of the North Jacobs Ranch LBA Tract as applied for under the Proposed Action and Alternative 2. This information is required for WDEQ permitting. SEO data indicate there are 368 permitted water wells within three miles of the tract, of which 192 are owned by coal mining companies. Of the 176 other wells, 56 are permitted for stock watering only, 45 are permitted for both CBM development and stock watering, 34 are permitted for CBM development only, 28 are permitted for monitoring or miscellaneous uses, eight are

permitted for either stock or domestic use, two are for domestic use only, two are for industrial use, and one is permitted for irrigation use. A listing of the 176 non-coal mine wells is presented in Appendix E.

SEO 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 tract and three miles downstream from the LBA tract as applied for and Alternative 2, as required for WDEQ permitting.

SEO records indicate 23 permitted surface water rights within the search area. Ten of the surface water rights are held by coal mining companies. The 13 other surface water rights are for stock watering, irrigation and domestic use. A listing of the 13 non-coal mine surface water rights is included in Appendix E.

3.7 Alluvial Valley Floors

WDEQ regulations define 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 SMCRA restricts mining activities which affect AVF's that are determined to be significant to agriculture. 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 JRCC to determine the presence of AVF's within and surrounding the Jacobs Ranch Mine. The investigations concluded, and the WDEQ concurred, that there are no AVF's within and surrounding the permit area of Jacobs Ranch Mine. The conclusion included the finding that the lower reaches of Mills and Shipley Draws within the Thundercloud lease are not AVF's. The nearest declared AVF is downstream from the Jacobs Ranch Mine near the confluence of North Prong Little Thunder Creek and Little Thunder Creek (Figure 3-8). Specific declarations of the presence or absence of AVF's on the LBA tract will be made by WDEQ if the lease is sold and a mine permit is acquired.

There is no present or historical record of agricultural use, other than undeveloped rangeland, of the streamlaid deposits within the North Jacobs Ranch LBA Tract. If WDEQ determines that an AVF is present (which is unlikely given the fact that the lower reaches of Mills and Shipley Draws are not AVF's) on the tract, it is reasonable to assume that mining would be permitted in those areas because the lack of agricultural

development in this area precludes a determination of significance to agriculture.

3.8 Wetlands

Waters of the U.S. is a collective term for all areas subject to regulation by the COE under Section 404 of the Clean Water Act. *Waters of the U.S.* include *special aquatic sites*, wetlands, and jurisdictional wetlands. *Special aquatic sites* are large or small geographic areas that possess special ecological characteristics of productivity, habitat, wildlife protection, or other important and easily disrupted ecological values (40 CFR 230.3). Wetlands are a type of *special aquatic site* which includes "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas" (33 CFR 328.3(a)(7)(b)). Jurisdictional wetlands are defined by 33 CFR 328.1 and .2 as "those wetlands which are within the extent of COE regulatory review." They must contain three components: hydric soils, a dominance of hydrophytic plants, and wetland hydrology.

Many wetland scientists consider areas that contain only one of the three criteria listed above as functional wetlands. The USFWS used this categorization in producing the National Wetlands Inventory maps. These maps were produced using aerial photo interpretation, with limited field verification.

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

Jurisdictional wetland inventories were completed in 1999 by JRCC on lands contained within the North Jacobs Ranch LBA Tract as applied for and Alternatives 2 and 3. The wetlands delineation was completed in accordance with the procedures and criteria contained in the COE 1987 Wetland Delineation Manual. A total of 10.13 acres of waters of the U.S. have been identified, of which 5.22 acres are jurisdictional wetlands. Identified jurisdictional wetlands include manmade stockponds (2.81 acres) and portions

of ephemeral stream channels (2.41 acres). The additional 4.91 acres of waters of the U.S., which did not qualify as jurisdictional wetlands, include stockponds (2.39 acres) and ephemeral stream channels (2.52 acres). These sites did not possess wetland characteristics because they pond water or contain water for insufficient periods of time. There is an additional 58.23 acres of non-jurisdictional wetlands also contained in the tract that include stockpond, playa, ephemeral stream, isolated channel, and roadside wetlands.

Currently, the COE and EPA are undertaking revisions to the 404 permit program in light of recent court decisions. The revisions to the Section 404 program are likely to result in revised definitions for waters of the U.S. to include wetlands. This may result in a revised designation of jurisdictional wetlands in the North Jacobs Ranch LBA Tract.

3.9 Vegetation

A vegetation baseline study was completed by JRCC within and adjacent to the lands contained within the North Jacobs Ranch LBA Tract as applied for under the Proposed Action and Alternatives 2 and 3 in 1999. The baseline study area is located north and northwest of the Jacobs Ranch Mine permit boundary. The vegetation communities in this area were delineated, mapped and sampled in accordance with the current WDEQ/LQD requirements. The vegetation study areas include the LBA tract as applied for, Alternatives 2 and 3, and a buffer area around the tract sufficient to mine and reclaim the tract as a part of the existing mine operation.

A total of 11 vegetation types have been preliminarily identified and mapped within the LBA tract as applied for and Alternatives 2 and 3. Table 3-6 presents the acreage and percent of the area encompassed by each vegetation type. The vegetation types include Big Sagebrush Shrubland, Crested Wheatgrass, Cultivated, Upland Grassland, Playa Grassland, Disturbed Lands, Playa Wetlands, Mixed Shrub, Bottomland Grassland, Reservoir and Rough Breaks. These vegetation types are described as follows:

The **Big Sagebrush Shrubland** vegetation type is the largest mapping unit identified within the LBA tract, occupying approximately 2,218.3 acres, or 44.17 percent of the tract's area. This vegetation type typically occurs in upland positions throughout the study area. Major perennial species include big sagebrush (Artemisia tridentata), western wheatgrass (Agropyron smithii), prairie junegrass (Koeleria macrantha) and blue grama (Bouteloua gracilis). Annual species that are common on this vegetation type include Japanese chess (Bromus japonicus) and cheatgrass brome (Bromus tectorum).

The **Crested Wheatgrass** vegetation type is the second largest mapping unit comprising approximately 1133.7 acres, or 22.57 percent of the area. This vegetation type occurs

Table 3-6. Vegetation Types Identified and Mapped Within the North Jacobs Ranch LBA Tract Baseline Study Area.

Vegetation Type	Acres	Percent of Area
Big Sagebrush Shrubland	2218.3	44.17
Crested Wheatgrass	1133.7	22.57
Upland Grassland	709.2	14.12
Cultivated (Crested Wheatgrass Pasturelands)	658.0	13.10
Playa Grassland	90.3	1.80
Disturbed Land	90.3	1.80
Playa Wetland	43.3	0.86
Mixed Shrub	33.6	0.67
Bottomland Grassland	21.8	0.43
Reservoir	16.3	0.32
Rough Breaks	7.9	0.16
Total	5022.7	100.00

throughout the study area. Crested wheatgrass (Agropyron cristatum) was the most common perennial species recorded on this vegetation type. Needleandthread (Stipa comata), red threeawn (Aristida longiseta) and blue grama were also common perennial grasses recorded on this vegetation type. Common annual species recorded on this vegetation type include cheatgrassbrome and sixweeksgrass (Vulpia octoflora).

The **Upland Grassland** vegetation type makes up approximately 709.2 acres or about 14.12 percent of the study area and is found throughout the LBA tract. This vegetation type is dominated primarily by perennial grasses, which include needleandthread, western wheatgrass, blue grama and prairie junegrass. Common annual species include cheatgrass brome, Japanese brome and fluffweed (Filago arvensis).

The **Cultivated** vegetation type occurs throughout the study area and makes up approximately 658.0 acres, or 13.10 percent of the study area. Common species for this vegetation type include crested wheatgrass and alfalfa (Medicago sativa).

The **Playa Grassland** vegetation type was mapped on approximately 90.3 acres or about 1.80 percent of the study area. The dominant species on these playas is western wheatgrass. Spikerush (Eleocharis spp.), foxtail barley (Hordeum jubatum) and dandelion (Taraxacum officinale) was also present.

The **Disturbed Lands** type made up approximately 90.3 acres (1.80 percent of the study area). This type

is made up of past disturbance from oil and gas production in the area.

The **Playa Wetlands** vegetation type on the LBA tract area makes up approximately 43.3 acres, or about 0.86 percent of the study area. Dominant species are spikerush and foxtail barley.

The **Mixed Shrub** vegetation type makes up approximately 33.6 acres, or about 0.67 percent of the study area. This map unit was dominated by western wheatgrass, big sagebrush, Sandberg bluegrass (Poa secunda) and black greasewood (Sarcobatus vermiculatus).

The **Bottomland Grassland** vegetation type makes up approximately 21.8 acres, or about 0.43 percent of the LBA tract study area. The most common species recorded on this vegetation type include: western wheatgrass, Kentucky bluegrass (Poa pratensis), green needlegrass (Stipa viridula) and inland saltgrass (Distichlis stricta).

The **Reservoir** map unit occupies approximately 16.3 acres, or about 0.32 percent of the study area.

The **Rough Breaks** vegetation type on the LBA tract makes up approximately 7.9 acres or about 0.16 percent of the total study area. Dominant plant species found on this vegetation type include big sagebrush, bluebunch wheatgrass (Agropyron spicatum) and western wheatgrass.

Threatened, Endangered, and Candidate Plant Species

Refer to Appendix G.

3.10 Wildlife

3.10.1 Wildlife Resources

Background information on wildlife in the vicinity of the North Jacobs Ranch LBA Tract was drawn from several sources including: Thundercloud coal lease application (BLM 1998), WGFD and USFWS records and personnel contacts with WGFD and USFWS biologists.

Site-specific data for the entire proposed LBA lease area were obtained from sources including WDEQ/LQD permit applications and annual reports for nearby mines. Baseline and monitoring surveys cover large perimeters around each mine's permit area. Consequently, a majority of the LBA tract has been surveyed during annual wildlife monitoring for the Jacobs Ranch Mine. The eastern half of the North Jacobs Ranch LBA Tract has been monitored by the Jacobs Ranch Mine annually for the past 12 years. The western half of the tract has been monitored by the Jacobs Ranch Mine annually for the last five years. The entire area of the North Jacobs Ranch LBA Tract under the Proposed Action and the alternative configurations has undergone a baseline wildlife survey, which was conducted in January through August of 1999.

The LBA tract and adjacent area consists primarily of uplands. The

topography is level to rolling, with some areas sloping to steeply sloping. Big sagebrush shrubland habitat dominates the tract. This habitat is characterized by level ground to rolling hills that are well vegetated. Crested wheatgrass and upland grassland habitats also occur within the LBA tract. Bottomland grassland habitat types are found on the LBA tract along drainage channels. All streams on the LBA tract are ephemeral. Several ponds exist on the LBA tract, most of them being stock ponds and a few playa lakes. The majority of the trees on the tract were planted around ranch buildings.

Other isolated trees exist on the tract along drainages.

3.10.2 Big Game

Three big game species occur in the vicinity of the LBA tract: pronghorn (Antilocapra americana), mule deer (Odocoileus hemionus) and elk (Cervus elaphus). WGFD big game herd unit maps show this area is out of the normal white-tailed deer (Odocoileus virginianus) range. The WGFD has classified the entire tract as yearlong pronghorn range. The majority of the tract is classified as yearlong deer range. No crucial big game habitat or migration corridors are recognized by the WGFD in this area.

Pronghorn are by far the most common big game species in the area. The LBA tract is within the Hilight Herd Unit with approximately 2,909 acres of the proposed lease area within yearlong range and the remaining 1,912.2 acres within winter-yearlong range. None of the area within two miles has been classified as crucial or critical pronghorn habitat. Data obtained for the Hilight Herd Unit indicate the WGFD estimated population averaged approximately 17 animals per mi^2 of occupied habitat from 1980 through 1995. The yearly big game monitoring surveys completed for the adjacent Jacobs Ranch Mine also covered a majority of the LBA tract. The Jacobs Ranch Mine surveys averaged 11 pronghorn per mi^2 for the same period of 1980 through 1995. This indicates that pronghorn numbers are lower in this portion of the herd unit.

The North Jacobs Ranch LBA Tract is located within the western portion of the WGFD Thunder Basin Mule Deer Herd Unit. The WGFD maps show the proposed lease area includes approximately 3,374.7 acres of yearlong mule deer range and 1,446.5 acres of land 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 permit area. WGFD data from 1980 through 1995 for the entire herd unit show an average of 4 animals per mi^2 of occupied habitat while data collected by Jacobs Ranch Mine averaged less than one mule deer per mi^2 for the same 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 North Jacobs Ranch 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 LBA tract over the past several years. Elk have been observed spending time wintering on adjacent grasslands southeast of the LBA tract in recent years. None of the lease area or areas within two miles have been classified as crucial or critical elk habitat. The nearest crucial elk habitat is just over 2 miles to the southeast on Jacobs Ranch Mine reclaimed areas. The WGFD (Oedekoven 1994) has designated an approximately five square mile area on reclaimed or adjacent lands as crucial winter habitat for the Rochelle Hills elk herd.

3.10.3 Other Mammals

A variety of small and medium-sized mammal species occur in the vicinity of the LBA tract. These include predators and furbearers, such as coyote (Canis latrans), red fox (Vulpes vulpes), striped skunk (Mephitis mephitis) and raccoon (Procyon lotor). Prey species include rodents (such as mice, voles, chipmunks and prairie dogs) and lagomorphs (jackrabbits and cottontails). Surveys for prairie dog towns were conducted on the LBA tract and adjacent lands. No prairie dog towns were observed on the LBA tract. The closest prairie dog town to the LBA tract is located in the NE1/4 SE1/4 of Section 23 and the NW1/4 SW1/4 of Section 24 T.43N., R.71N. A second prairie dog town located near the LBA tract is found in the NW1/4 SW1/4 of Section 26 T.44N., R.71W. Several other prairie dog towns are known to exist approximately four miles south of the LBA tract. Prairie dog towns within the vicinity of the LBA tract are shown on Figure 3-9. These species are cyclically common and widespread throughout the region. They are important prey for raptors and other predators.

3.10.4 Raptors

Numerous raptor species have been observed on or adjacent to the North Jacobs Ranch LBA Tract. These species include the golden eagle (Aquila chrysaetos), bald eagle (Haliaeetus leucocephalus), northern harrier (Circus cyaneus), Swainson's hawk (Buteo swainsoni), red-tailed hawk (Buteo jamaicensis), ferruginous hawk (Buteo regalis), rough-legged hawk (Buteo lagopus), prairie falcon (Falco peregrinus), American kestrel (Falco sparverius), turkey vulture (Carthartes aura), great horned owl (Bubo virginianus), short-eared owl (Asio flammeus) and burrowing owl (Athene cunicularia). 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 3-9 shows the locations of raptor nest sites that have been identified since monitoring began for Jacobs Ranch Mine in an area which includes the North Jacobs Ranch LBA Tract. The figure shows a total of 44 nest sites. As of 1999, 26 of those nest sites were still intact but only represented 17 pairs of birds because many had alternate nest sites. Of the 18 nest sites that were no longer present, 16

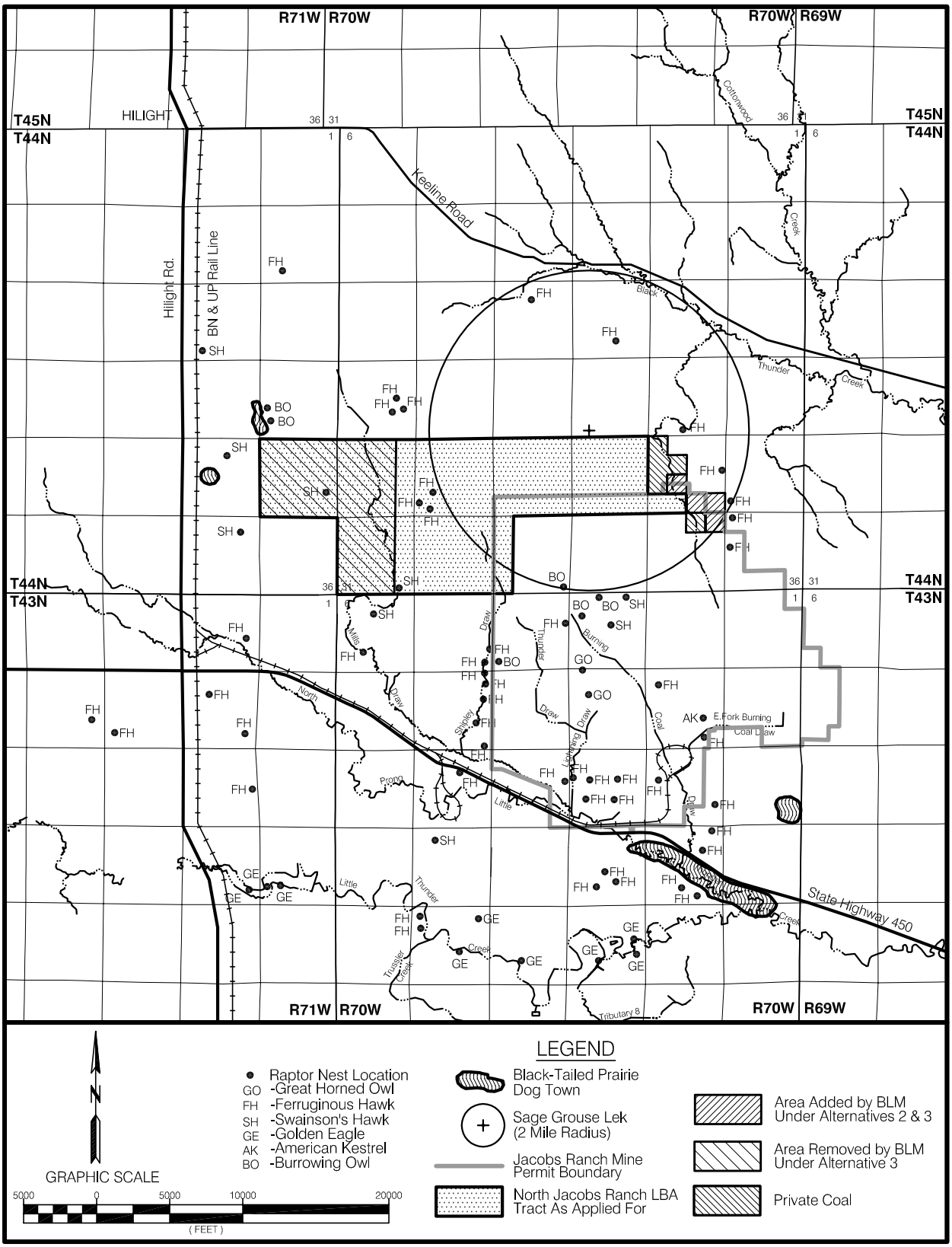

Figure 3-9. Raptor Nest Sites, Sage Grouse Leks, and Prairie Dog Towns Within and Adjacent to the North Jacobs Ranch LBA Tract.

were destroyed by natural events and 2 were removed by mining activities. Five of the intact nest sites were created to mitigate other sites impacted by mining by the surrounding mining companies. These sites consist of either platforms or nests placed on rock piles or on the ground for ferruginous hawks. A total of five raptor species have been identified nesting within two miles of the LBA tract. These species include the burrowing owl, great horned owl, ferruginous hawk, Swainson's hawk and American kestrel. In 1999, only five nest sites were active and included one ferruginous hawk nest, two Swainson's hawk nests and two burrowing owl nests.

Only two raptor species have been recorded nesting on the LBA tract.

The ferruginous hawk had the most nest sites, but all of those nests belonged to the same pair of birds.

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

3.10.5 Game Birds

Several upland bird species have been observed on the North Jacobs Ranch LBA Tract or adjacent areas, including sage grouse (Centrocercus urophasianus) and migratory mourning doves (Zenaida macroura). Based on field observations, the mourning dove was the most common of the two species. The mourning dove only inhabits the area for breeding and reproduction from late spring to early fall.

The sage grouse is a yearlong resident and was found on lands adjacent to the LBA tract. Sage grouse lek surveys in April and May of 1999 found an active sage grouse strutting ground within two miles of the LBA tract. Figure 3-9 shows the location of this active lek with a two-mile radius which research identified as the area in which most hens will nest. The lek is located in the SW1/4 of Section 22, T.44N., R.70W. This particular lek was active from 1993 through 1999 with the maximum number of males recorded at 27 in 1999.

Sage grouse brood surveys were conducted on the LBA tract along ephemeral stream drainages in July of 1999. These surveys covered approximately two miles. Adult sage grouse or broods were not observed during the 1999 survey. However, three broods of eight, eight, and three, respectively, were observed east of the LBA tract area. Two biologists spent a total of 12 man-days in July 1999 conducting various surveys on the LBA tract. Sage grouse were rarely observed on the study area during surveys completed during 1999 but were observed on lands adjacent to the North Jacobs Ranch LBA Tract.

3.10.6 Migratory Birds of High Federal Interest

Table 3-7 provides a list of the MBHFI species that may occur on the North

Table 3-7. MBHFI Status in Northeast Wyoming and Expected Occurrence on or near the North Jacobs Ranch LBA Tract.

Species	Seasonal Status/Breeding Records in NE Wyoming[1]	Documented on or near the LBA Tract	Expected in the LBA Tract
Common Loon	Summer/nonbreeder	No	Uncommon
American Bittern	Summer/nonbreeder	No	Uncommon
White-faced Ibis	Summer/nonbreeder	No	Uncommon
Northern Harrier	Summer/breeder	Yes	Common
Ferruginous Hawk	Summer/breeder	Yes	Common
Bald Eagle	Winter/nonbreeder	Yes	Common in winter
Golden Eagle	Resident/breeder	Yes	Common
Mountain Plover	Resident/breeder	No	Uncommon
Upland Sandpiper	Summer/breeder	Yes	Uncommon
Long-billed Curlew	Resident/breeder	Yes	Uncommon
Black Tern	Resident/breeder	Yes	Uncommon
Barn Owl	Never recorded	No	Very rare
Burrowing Owl	Summer/breeder	Yes	Uncommon
Short-eared Owl	Summer/breeder	Yes	Occasional
Veery	Summer/breeder	No	Uncommon
Loggerhead Shrike	Summer/breeder	Yes	Common
Dickcissel	Summer/breeder	No	Rare
Cassin's Sparrow	Summer/breeder	No	Rare
Baird's Sparrow	Summer/breeder	No	Uncommon
Brewer's Sparrow	Summer/breeder	Yes	Common
Lark Bunting	Summer/breeder	Yes	Common
Grasshopper Sparrow	Summer/breeder	Yes	Common
McCown's Longspur	Summer/breeder	Yes	Common
Chestnut-collared Longspur	Summer/breeder	Yes	uncommon

[1] Complied from Oakleaf et al. (1997). Includes Campbell County and adjacent counties.

Jacobs Ranch LBA Tract or disturbance areas. Thirteen MBHFI species have been documented in the area.

Nesting habitat for the northern harrier exists within the LBA tract and adjacent areas. There is also documented northern harrier nesting on reclaimed mine areas, and in some instances reclaimed lands can provide better nesting habitat than native lands. The ferruginous hawk nests in the area, generally using ground nests. Nesting habitat for the ferruginous hawk is present on adjacent areas and nest sites have also been constructed on lands already reclaimed by JRCC.

The golden eagle does not have nesting habitat on or within one mile of the LBA tract but frequents the site in search of prey. Nesting habitat for the golden eagle is found in adjacent areas. Trees on reclaimed areas are not yet large enough to provide nesting habitat. The bald eagle is a common winter resident but does not nest in the area due to lack of suitable nesting habitat.

There is documented nesting of the upland sandpiper on the LBA tract, and there is nesting habitat available on adjacent areas and mine reclamation as well. The long-billed curlew has only been documented as a migrant, although there is nesting habitat available on the LBA tract, adjacent to the tract, and on reclaimed lands as well. The black tern has only been documented as a migrant, although there is marginal nesting habitat available on the LBA tract, adjacent to the tract, and on reclaimed lands as well.

Nesting habitat for the burrowing owl has been documented in badger dens and prairie dog holes adjacent to the tract. Nesting sites have been constructed on mine reclamation as well. The short-eared owl has not been documented nesting on the LBA tract, although there is nesting habitat on and adjacent to the tract, including reclaimed mine lands.

The loggerhead shrike does not have abundant nesting sites available on the LBA tract, but has been documented to nest on and adjacent to the tract. Reclaimed mine lands that include tree and shrub plantings provide nesting habitat. The brewer's sparrow nests on the lease area, and nesting habitat is present on adjacent lands. Reclaimed mine lands that include shrub planting provide nesting habitat for this species. The lark bunting, McCown's longspur, and the chestnut-collared longspur all nest within the LBA tract, and nesting habitat is present on adjacent lands and reclaimed mine lands as well.

3.10.7 Other Species

Wildlife surveys completed specifically for the North Jacobs Ranch 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 observed include

eight carnivores, 19 rodents, five lagomorphs, 61 waterbirds, 13 raptors, 59 other bird species and 11 herptiles.

Under current natural conditions the LBA tract provides limited waterfowl and shorebird habitat. This habitat is primarily provided during spring migration as ponds, playas and ephemeral streams. These waterbodies generally dry up during the summer. The Hansen Lakes, which are found within the northern part of the LBA tract, can sustain waterfowl and shorebird populations in a very wet year but during most years these lakes dry up during the summer and are always dry by fall. With the addition of produced water from CBM wells in the area, an increase in habitat for waterfowl and shorebirds may occur if sufficient water is produced to fill ponds and drainages.

Fish species are not normally found on the LBA tract as all bodies of water and perennial flows are established from CBM discharges. For fish species to migrate up Mills Draw and Shipley Draw from the North Prong and survive, the CBM wells must produce sufficient and perennial flows of water. There would not be the possibility of any sensitive fish species migrating onto the LBA tract since they are not known to exist downstream within a reasonable distance.

3.10.8 Threatened, Endangered and Candidate Animal Species

Refer to Appendix G.

3.11 Ownership and Use of Land

The surface on the North Jacobs Ranch LBA Tract as applied for and under the Alternative 2 configuration is owned by Jacobs Land and Livestock Company and Ark Land Company (Figure 3-10). The principal land use within the tract is domestic grazing and wildlife habitat (JRCC 1998). Secondary land use is oil and gas production.

Areas of disturbance within the North Jacobs Ranch LBA Tract include oil and gas wells and associated production equipment. In addition to the production equipment at each well site, there are numerous bladed oil field roads and buried oil and gas pipelines in and near the tract. The original Jacobs Ranch ranching headquarters and support facilities are located in the north-central part of the tract. Portions of three county roads, the Small Road, the Jacobs Road, and the Little Thunder Road, pass through the tract.

The oil and gas rights within the North Jacobs Ranch LBA Tract as applied for are both federally and privately owned (Figure 3-11). The majority (about 61 percent) are federal. Federally owned oil and gas rights included in the tract are leased, and a list of the lessees of record is included as Table 3-8.

Twenty-nine wells have been drilled and completed in conventional oil and gas reservoirs as producing wells on lands included in the LBA tract as applied for under the Proposed Action.

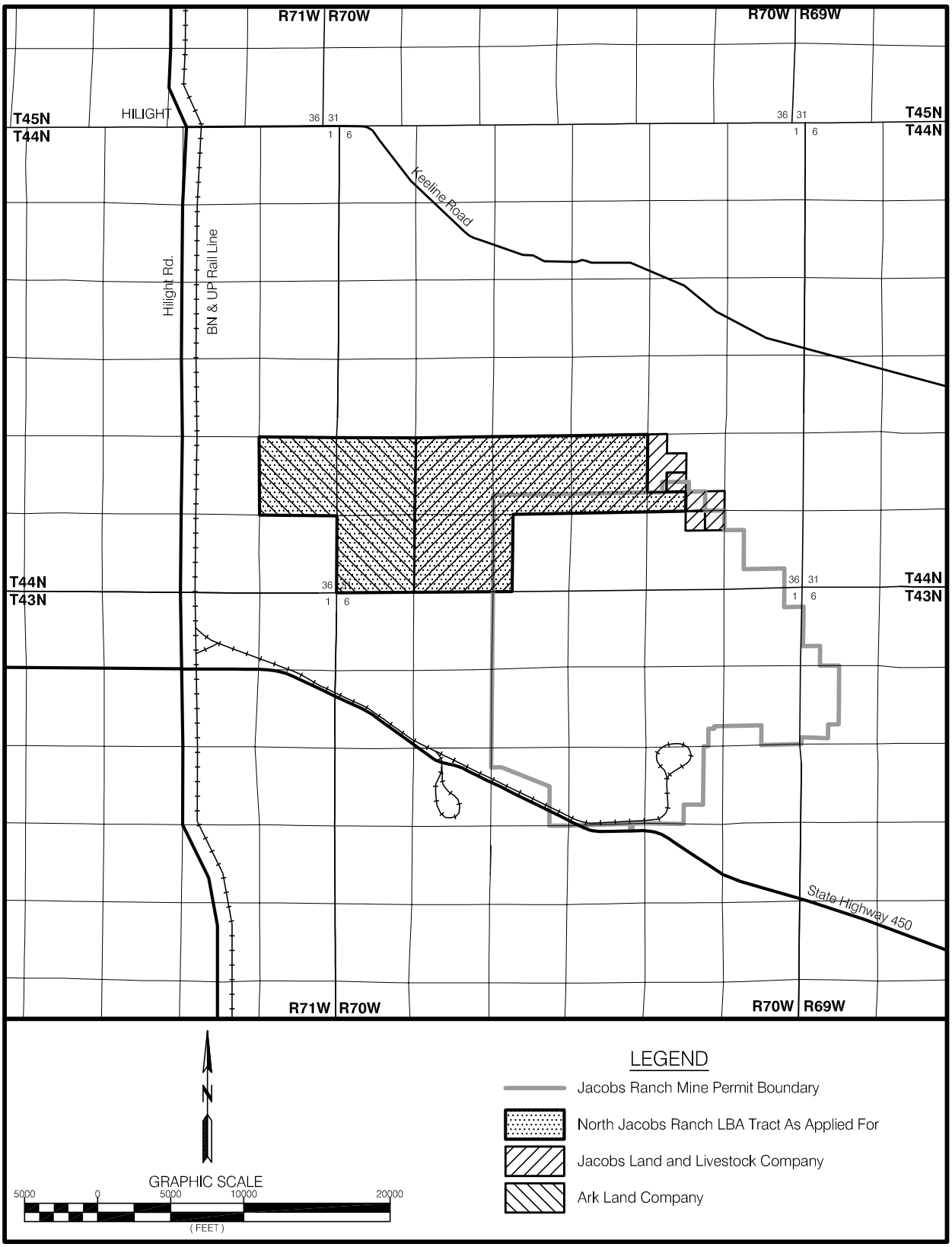

Figure 3-10. Surface Ownership Within the North Jacobs Ranch LBA Tract.

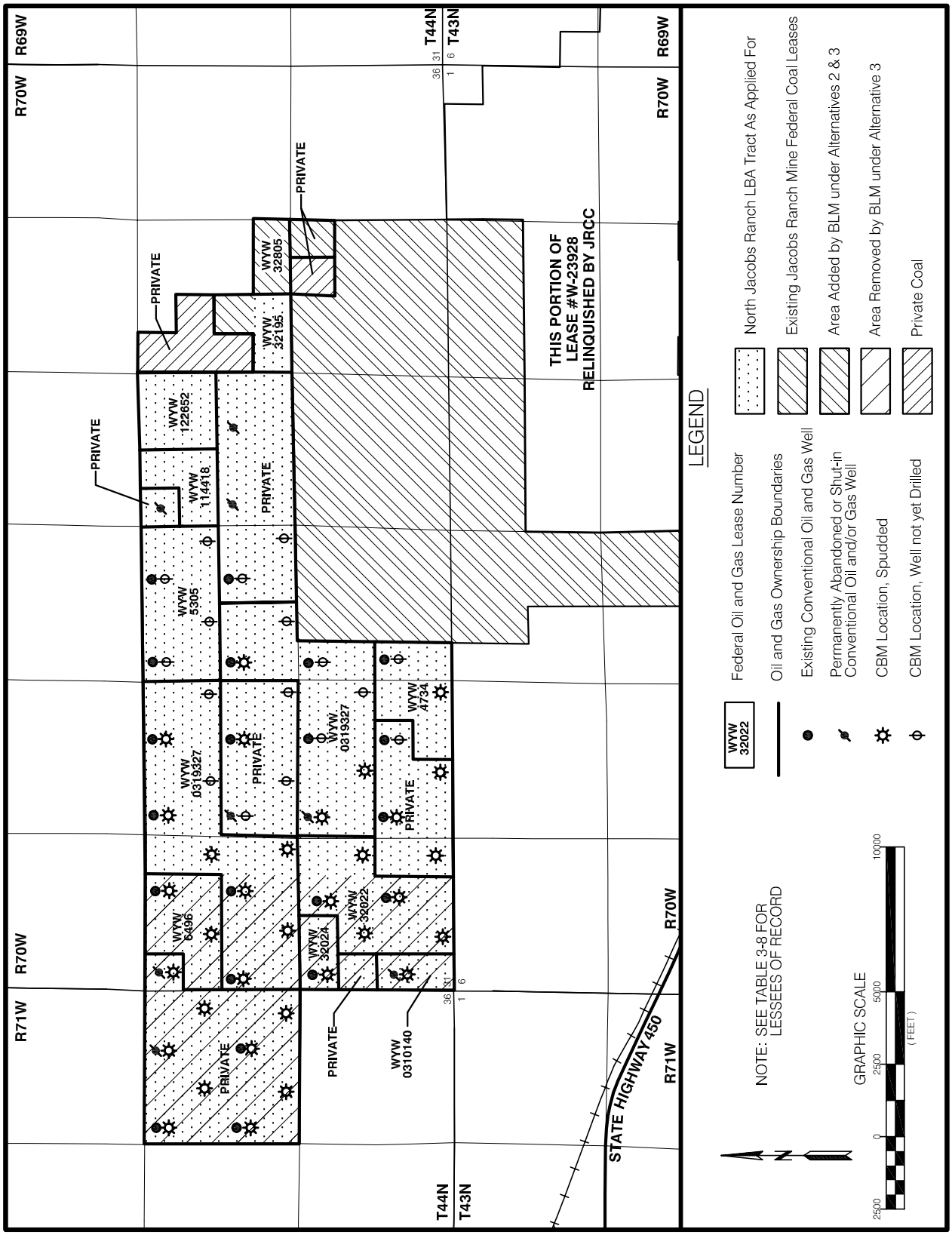

Figure 3-11. Oil and Gas Ownership on the North Jacobs Ranch LBA Tract.

Table 3-8. North Jacobs Ranch LBA Tract Oil and Gas Ownership.

For the following locations, both the oil and gas rights (including coal bed methane) and coal rights are owned by the federal government.

Location	**Lease Number**	**Lessees of Record**	
T. 44 N., R. 70 W.			
Section 26	WYW 32195	APD Energy Co.	Langham Petroleum Exp.
Lots 8, 9, 10		Citation 1994 Investment	Oilfield Salvage Co.
		Davis Oil Co	PIP Energy IV-80
		Citation 1998 Investment	Tom Brown Inc.
		George C. Kennedy	Dean Unruh
		Key Production Co.	
Section 26	WYW 32805	Citation 1994 Investment	
Lots 11, 12		Citation 1998 Investment	
		Key Production Co.	
		Sempra Energy Production Co.	
		Tom Brown, Inc.	
Section 27	WYW 122652	Lasmo Oil & Gas Inc.	
Lots 1, 2, 7, 8	Expired 12/31/1995	Louisiana Land & Exploration	
Section 27	WYW 114418	John Behrmann	
Lots 3, 5, 6	Terminated 2/1/1993		
Section 28	WYW 5305	Citation 1994 Investment	
Lots 1-8		Key Production Co.	
		M&K Oil Co. Inc.	
Section 28	WYW 0319327	Key Production Co.	
Lots 11-14		Richard K. Lisco	
Section 29		M&K Oil Co. Inc.	
Lots 1-8			
Section 30			
Lots 5, 12-20			
Section 32			
Lots 1-8			
Section 33			
Lots 4, 5			
Section 30	WYW 6496	Richard K. Lisco	
Lots 6, 7, 9, 10, 11		Wellstar Corporation	
Section 31	WYW 32022	Inexco Oil Co.	
Lots 5, 6, 10, 11, 12, 14,		Merit Energy Partners	
15, 18, 19		Merit Energy Partners III	
Section 31	WYW 32024	M&K Oil Co. Inc.	
Lots 7, 8		Chisholm Trail Ventures	
		Questar Exploration & Production Co.	
Section 31	WYW 0310140	M&K Oil Co. Inc.	
Lots 16, 17		Chisholm Trail Ventures	
		Questar Exploration & Production Co.	
Section 32	WYW 4734	Citation 1994 Investments	
Lots 9, 10, 15, 16		Key Production Co Inc.	
Section 33		M&K Oil Co. Inc.	
Lots 12, 13			

Note: For the rest of the LBA tract, the oil and gas rights (including coal bed methane) are privately owned. All of the coal rights are federally owned.

This would be the same for the Alternative 2 configuration. Of these, 21 wells still produce and 8 have been permanently abandoned or are shut in (Figure 3-11). Fourteen of these 21 producing wells are on federal oil and gas leases (Figure 3-11).

Seventeen wells have been drilled and completed in conventional oil and gas reservoirs as producing wells on lands under the Alternative 3 configuration. Of these, 12 wells still produce and 5 have been permanently abandoned or are shut in. Eight of these 12 producing wells are on federal oil and gas leases (Figure 3-11).

All of the conventional oil and gas wells were originally drilled between 1970 and 1971. They produce from the Lower Cretaceous Muddy Sandstone (WOGCC 2000).

The Supreme Court has ruled that CBM rights belong to the owner of the oil and gas rights (98-830). Therefore, the oil and gas lessees have the right to develop the CBM in the coal as well as the right to develop conventional oil and gas on the tract.

CBM is currently being produced on the North Jacobs Ranch LBA Tract. The WOGCC recently approved a well spacing pattern of one well per 80 acres for development of CBM resources in the PRB. Under the Proposed Action, there would potentially be 58 CBM well locations on the North Jacobs Ranch LBA Tract if all the 80-acre spacing units within the tract were drilled. Two potential well sites would be added under Alternatives 2 and 3, and 20 potential well sites would be outside the tract under Alternative 3. Under Alternative 1, the No Action Alternative, the coal would not be leased at this time and CBM production would continue on and adjacent to the tract.

As discussed in Section 3.3, Rim Operating, Inc. is the owner of most of the CBM drilling rights on the North Jacobs Ranch LBA Tract. As of January 2001, they had drilled 33 CBM wells on the North Jacobs Ranch LBA Tract as it is configured under the Proposed Action and Alternative 2. Thirteen of these wells began producing in December 2000, and thirteen wells began producing in January 2001. Sixteen of these wells would be outside of the tract under Alternative 3. Rim plans more drilling.

Facilities associated with oil and gas 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), underground pipelines which gather the oil and gas produced by the individual wells and carry it to a larger transportation pipeline or collection facility, and compressor stations associated with the pipelines. Numerous oil and gas pipelines cross the LBA tract (Section 3.17 and Figures 3-12 and 3-13). As new CBM wells are drilled and completed on the tract, additional facilities will be constructed to produce and transport

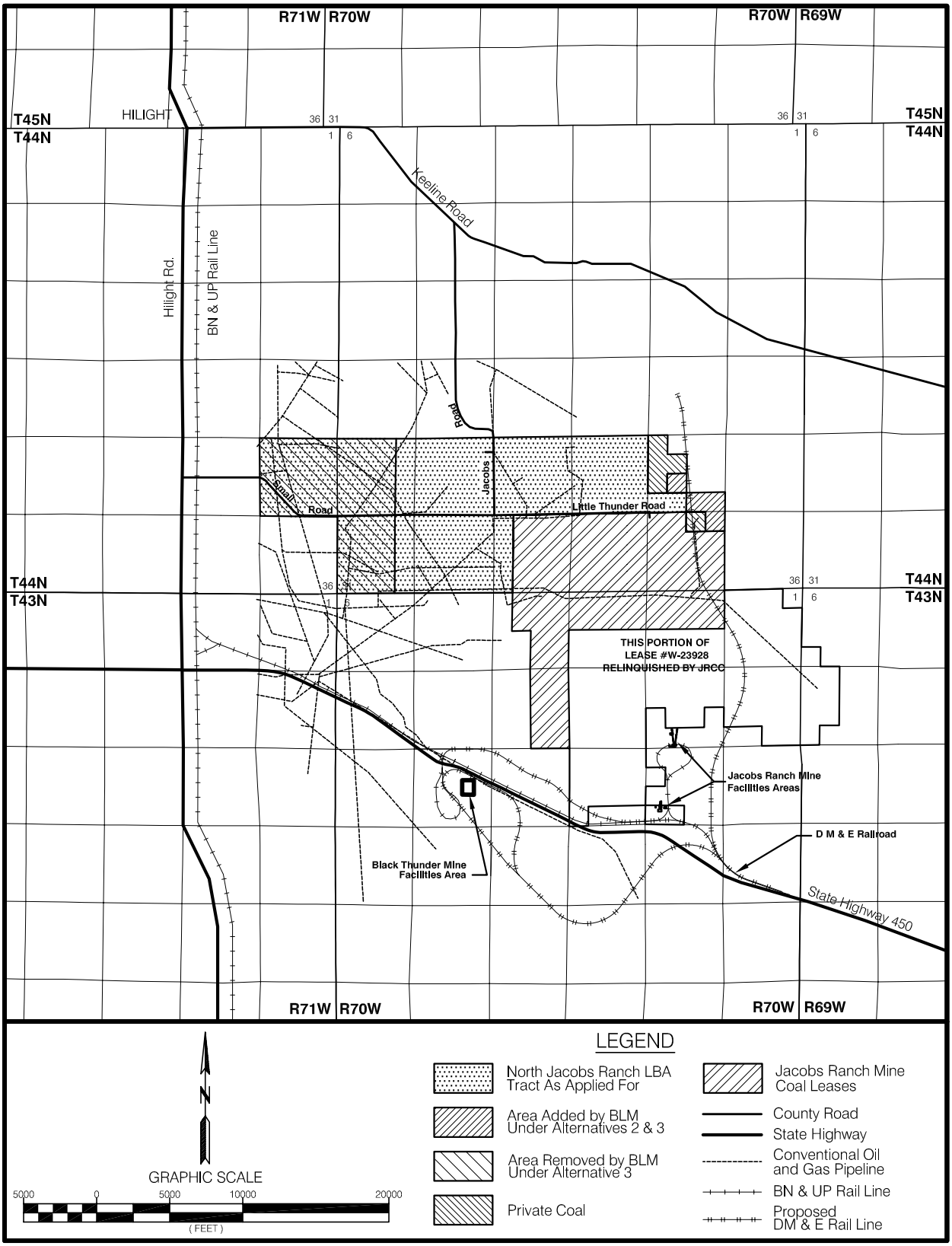

Figure 3-12. Transportation Facilities Within and Adjacent to the North Jacobs Ranch LBA Tract.

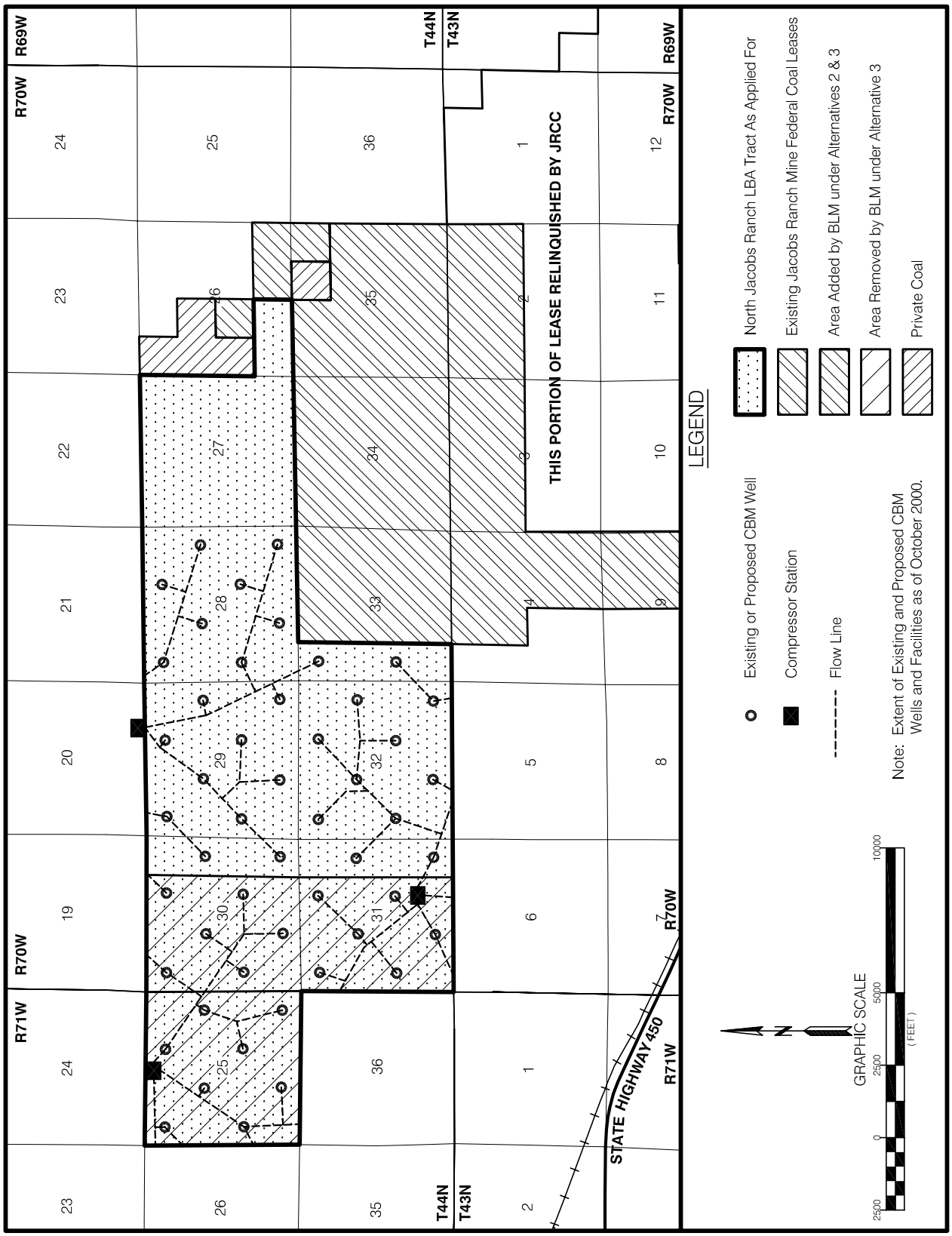

Figure 3-13. CBM Wells, Pipelines, and Compressor Stations on the North Jacobs Ranch LBA Tract.

the CBM and the associated produced water.

Coal mining is a dominant land use in the area surrounding the LBA tract. The existing Jacobs Ranch Mine is within a group of five operating surface coal mines located in southern Campbell and northern Converse counties (Figure 3-1). Coal production at these five mines increased by 154 percent between 1990 and 1999 (from about 70 million tons in 1990 to nearly 178 million tons in 1999). Since 1992, eight maintenance coal leases have been sold within this group and applications have been submitted for six more maintenance tracts in this same group, including the LBA being evaluated in this EIS (Tables 1-1 and 1-2). The North Jacobs Ranch LBA was previously applied for in 1996 by Evergreen Enterprises as part of the New Keeline LBA. The New Keeline LBA was rejected by the BLM in 1997. Evergreen Enterprises appealed the rejection of the New Keeline LBA to the Interior Board of Land Appeals in 1997 and submitted a new application, which covered the same area, in January 2000 (State Section LBA). Evergreen Enterprises withdrew their appeal of the New Keeline rejection and their application for the State Section LBA in September 2000.

Campbell County has no applicable county-wide land use plans, and the LBA tract has 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.

Big game hunting is the principal recreational use in the analysis area. Land ownership within the PRB is largely private (approximately 80 percent), 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 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 TBNG, BLM lands, and state school sections (normally Sections 16 and 36) are generally open to hunting if legal access is available. As shown in Figure 3-10, there are no public surface lands included in the North Jacobs Ranch LBA Tract.

The surface of all of the lands within the LBA tract under the Proposed Action and the alternative configurations is currently privately owned and recreational use is allowed only with landowner permission. Sport hunting in varying degrees is conducted on the LBA tract.

Pronghorn, mule deer, and elk occur on and adjacent to the LBA tract. Sage grouse, mourning dove, waterfowl, 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 1998).

The WGFD classifies the entire LBA tract 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 tract or areas within two miles adjacent classified as crucial or critical pronghorn habitat. Pronghorn are widely scattered throughout the Hilight Herd Unit. The North Jacobs Ranch LBA Tract is within pronghorn antelope Hunt Area 24, which contains the Hilight Herd Unit. The population was fairly stable and near the objective of 11,000 antelope prior to 1997. The herd then suffered significant losses during the severe winter of 1996-97 and blue-tongue losses in September 1998. Lower than average fawn survival for the past three years has also kept the population from increasing at a more normal rate. These factors have resulted in a drop in the population below the objective level. The 1998 postseason population model estimate for this herd is about 8,000 antelope (30 percent below the objective).

In 1995, the WGFD issued 2,000 licenses for the Hilight Herd, Hunt Area 24. In the years 1991 – 1995, hunters on average harvested about 1,150 animals, with better than 85 percent 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 the lack of public access in the hunt area. According to the WGFD, the primary problems associated with the management of this herd include achieving an adequate harvest and hunter distribution. Hunt Area 24 contains mostly privately owned surface lands with poor access to the limited publicly owned surface lands. Those lands having access generally have lower antelope numbers.

In an effort to increase antelope numbers, the WGFD placed a limited quota on the number of licenses issued for Hunt Area 24 for the 1997-99 seasons. Antelope harvest in 1998 for Hunt Area 24 was only 171 animals, representing one of the lowest in over a decade as the below-objective population forced significant reductions in the license quotas for this herd unit to only 200 licenses. Hunter success was fairly high, but days per animal harvested was also quite high indicating that hunters had to work harder to bag an antelope. The harvest for the next few seasons is expected to remain about the same with continued conservative seasons for this herd.

The North Jacobs Ranch LBA Tract is located within the western portion of the WGFD Thunder Basin Mule Deer Herd Unit. The WGFD maps show the proposed lease area includes approximately 3,375 acres of yearlong mule deer range. Crucial or critical mule deer ranges do not occur on or within several miles of the LBA tract. The LBA tract is in mule deer Hunt Area 21, part of the Thunder Basin Herd Unit, which also includes Hunt Areas 7, 8, 9, 10, and 11. The Thunder Basin Herd Unit encompasses 3,642 square miles; of this 71 percent is privately owned. Access fees are common, resulting in heavy hunting pressure on accessible public land. Much of the public owned surface lands are scattered and inaccessible without crossing private land. In 1998, 1,421 mule deer were harvested from the Thunder Basin Herd Unit and the hunter success rate was 54 percent. The success rate declined from 79 percent in 1997 and was well below the five-year average of 63 percent. The days spent per animal harvested were 6.4 in 1998, above the five-year average of 4.9 days.

Since 1983 the postseason population objective for this herd has been 13,000. The population has consistently been above this objective. The 1998 postseason population was estimated at 17,298, which is 33 percent above the objective. To address this concern, the population objective was reviewed in 1998 and it was discovered that the model being used when the objective was set had some flaws. It appears that the deer population was likely closer to 25,000 when the population model was created. WGFD field personnel, hunters and landowners indicate that mule deer numbers in the Thunder Basin Herd Unit have declined from several years ago, yet indications are this population is greater than the objective of 13,000 head. The WGFD has therefore recommended that the objective be increased to 20,000 head. Landowners and the public have commented that they would like to see more deer in the area. The population model indicates the population is currently growing slowly.

The Rochelle Hills Elk Herd is located in southeastern Campbell County, southwestern Weston County, and north central Converse County. This herd has been steadily growing since its origination in the early 1950's, and WGFD management efforts have been directed at stabilizing herd growth around a population objective of 400 head. The 1998 postseason population was estimated to be 400. Elk Hunt Area 123 extends into the North Jacobs Ranch 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 tract. The WGFD designated roughly a five square mile area on Jacobs Ranch Mine reclaimed land as crucial winter habitat for the Rochelle Hills Elk Herd. Much of the occupied range of this herd is located on the Thunder Basin National Grassland, which is administered by the USFS. Hunting seasons within this herd have been permitted every 2 or 3

years, for a total of only six times in its history. Bull quality is very good for this herd, and many taken have scored in the record books. Owing to their habituation to humans, many people enjoy observing these elk along Highway 450 and within accessible Forest Service land; thus, they provide nonconsumptive recreational use opportunities. These elk are not causing significant damage to private lands and most area landowners as well as hunters generally desire a high quality herd. Elk have been observed dispersing from the designated herd boundary, possibly due to increasing population density and habitat limitations.

The WGFD big game herd unit maps show the LBA tract is out of the normal white-tailed deer range, although they are occasionally seen in the vicinity.

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 the LBA tract.

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 sheepherder 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 in the NRHP. That determination is made by the managing federal agency in consultation with SHPO. Consultation with SHPO must be completed prior to approval of the MLA mining plan.

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.

The North Jacobs Ranch LBA Tract and buffer zone was subjected to a Class III cultural resource inventory and assessment in 1999. The JRCC contracted with GCM Services, Inc. of Butte, Montana to conduct the survey. The project area covered approximately 7,315 acres of land proposed for coal lease and a buffer zone that would include all disturbance assuming the area is mined as a maintenance tract for the existing adjacent mine. The goal of the inventory was to locate and evaluate for the NRHP all cultural resources 50 years and older within the study area.

Previous cultural resource inventories have been conducted in the project area in association with oil field development. The surrounding area has also been inventoried in association with coal mine permitting. There are six previously recorded sites in the project area. Two were not relocated during this new inventory; both were recommended as not eligible for the NRHP. The four other previously recorded sites were relocated, and updated site records were prepared in the new inventory. The new inventory resulted in the location of 30 new sites. Therefore, the total number of cultural sites

encountered during the project and reported is 34. Of this total, there are: 9 homesteads; 2 homesteads with modern ranch complexes; 1 multi-component site having both a homestead and a prehistoric lithic scatter; 1 multi-component site having both a prehistoric lithic scatter and a historic debris scatter; 1 historic graffiti site; 1 historic cairn site; 15 lithic scatters; 3 lithic scatters and campsites; and 1 lithic scatter and cairn. Twenty-six isolated finds were also recorded during the inventory. These include 22 prehistoric isolated artifacts and four historic isolated artifacts.

Based on the new inventory, one prehistoric lithic scatter and campsite, 48CA341, is recommended as NRHP eligible under Criterion D. The cultural resource inventory report recommended that prior to any ground disturbing activities, a formal and extensive testing program should be undertaken at site 48CA341, and a mitigation contingency plan should be prepared and approved along with the testing plan. If the testing program reveals that no significant remains exist, the eligible status of the site would be changed to not eligible. All remaining sites have been recommended not eligible.

Table 3-9 summarizes the distribution of cultural sites by type.

Data recovery plans are required for those sites recommended eligible to the NRHP following testing and consultation with the SHPO. Until consultation with SHPO has occurred and agreement regarding NRHP eligibility has been reached, all sites should be protected from disturbance. Full consultation with SHPO will be completed prior to approval of the MLA mining plan. Those sites determined to be unevaluated or eligible for the NRHP through consultation would receive further protection or treatment.

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, stone circles, 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 Native American heritage sites have been identified to date.

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

Native American tribes were consulted at a general level in 1995-1996 as part of an effort to update

Table 3-9. Sites and Isolated Finds in the Class III Cultural Resource Inventory of the North Jacobs Ranch LBA Tract and Buffer Zone.

Prehistoric sites:	
Lithic scatter:	48CA339; 3544; 3547; 3548; 3549; 3551; 3552; 3553; 3554; 3555; 3556; 3557; 3562; 3567; 3570
Lithic scatter and campsite:	48CA341; 3543; 3545
Lithic scatter and cairn:	48CA3569
Isolated finds:	22 lithic items
Historic sites:	
Homestead:	48CA3542; 3546; 3550; 3558; 3560; 1666; 2988; 3568; 3571
Homestead with modern ranch:	48CA3559; 3566
Historic graffiti:	48CA3565
Historic cairn:	48CA3561
Isolated finds:	Abandoned Hay Wagon, Abandoned Chisel Plow, Buggy or Automobile Part, Modified Tin Can
Multicomponent sites:	48CA3563; 3564

the BLM Buffalo RMP. Tribes that have been potentially identified as having concerns about actions in the Powder River Basin include: the Crow, Northern Cheyenne, Shoshone, Arapaho, Oglala Lakota, Rosebud Sioux, Flandreau Santee Sioux, Santee Sioux, Crow Creek Sioux, Lower Brule Sioux, Standing Rock Sioux, and Cheyenne River Sioux. These tribal governments and representatives were sent copies of the draft EIS. They are also being provided with maps showing the location of the North Jacobs Ranch LBA Tract and more specific information about the known sites on this tract and their help is being requested in identifying potentially significant religious or cultural sites on the LBA tract to support a leasing decision on the tract.

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 near the North Jacobs Ranch LBA Tract.

A paleontological survey has been conducted within and adjacent to the North Jacobs Ranch LBA Tract to determine the potential for recovery of significant fossils prior to disturbance. These lands include approximately 7,300 acres in T.44N., R.71W., Sections 23-26, 35 and 36; T.44N., R.70W., Sections 19-32 and 36.

No vertebrate or invertebrate fossils were discovered within the entire study area. The lack of good rock outcrops contributes to the lack of animal fossils, as does the low preservation potential and conditions of deposition of the Fort Union and Wasatch Formations. In contrast to the lack of fossil animal material, fossil plant material occurs frequently, although no localities produced exceptional examples. Most leaf impressions were found in fine sandstone and siltstone laminations, and woody debris generally occurs within channel sandstone.

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 50 mi. Other man-made intrusions include ranching activities (fences, homesteads, livestock), oil and gas development (pumpjacks, pipeline ROW's, CBM well shelters, CBM compressor stations), transportation facilities (roads and railroads) and electric power transmission lines. The natural scenic quality in the immediate lease area is fairly low because of the industrial nature of the adjacent existing mining operations.

The Jacobs Ranch Mine and Black Thunder Mine facilities and some mining activities are currently visible from the Keeline Road, the Hilight Road and State Highway 450. This would also be true for the LBA tract.

For management purposes, BLM evaluated the visual resources on lands under its jurisdiction in the Buffalo and Platte River RMPs. The inventoried lands were classified into VRM classes. These classifications range from I to V as follows:

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

Class II - Changes in any of the basic elements (form, line, color, texture) caused by an activity

should not be evident in the landscape.

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

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

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

The lands in the North Jacobs Ranch LBA Tract are generally classified as VRM Class IV. The existing mining activity is visible from most sites on the LBA tract.

3.16 Noise

Existing noise sources in the area include adjacent coal mining activities, traffic on State Highway 450 and nearby county roads, 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 North Jacobs Ranch LBA Tract are estimated to be 40-60 dBA, with the noise level increasing with proximity to active mining at the Jacobs Ranch Mine. Mining activities are characterized by noise levels of 85-95 dBA at 50 ft from actual mining operations and activities (BLM 1992b). The nearest occupied dwellings to the LBA tract are located approximately 1 mile from the northwestern corner of the tract, in Section 23, T.44N., R.71W. Another occupied dwelling is actually located within the LBA tract, in Section 29, T.44N., R.70W., but is owned by JRCC and would be vacated prior to mining. Figure 3-14 presents noise levels associated with some commonly heard sounds.

3.17 Transportation Facilities

Transportation resources in the vicinity of the North Jacobs Ranch 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; compressor stations; numerous pipelines; and local roads and accesses. Access to the LBA tract is on Highway 450 via the paved Hilight Road or State Highway 59. Two-track roads also occur within the LBA tract.

Current transportation facilities within and adjacent to the LBA tract are depicted on Figures 3-12 and 3-13. Since the North Jacobs Ranch LBA Tract as applied for would be an extension of the existing Jacobs Ranch Mine operations, the existing coal transportation facilities and infrastructure would be used during mining of the North Jacobs Ranch LBA Tract.

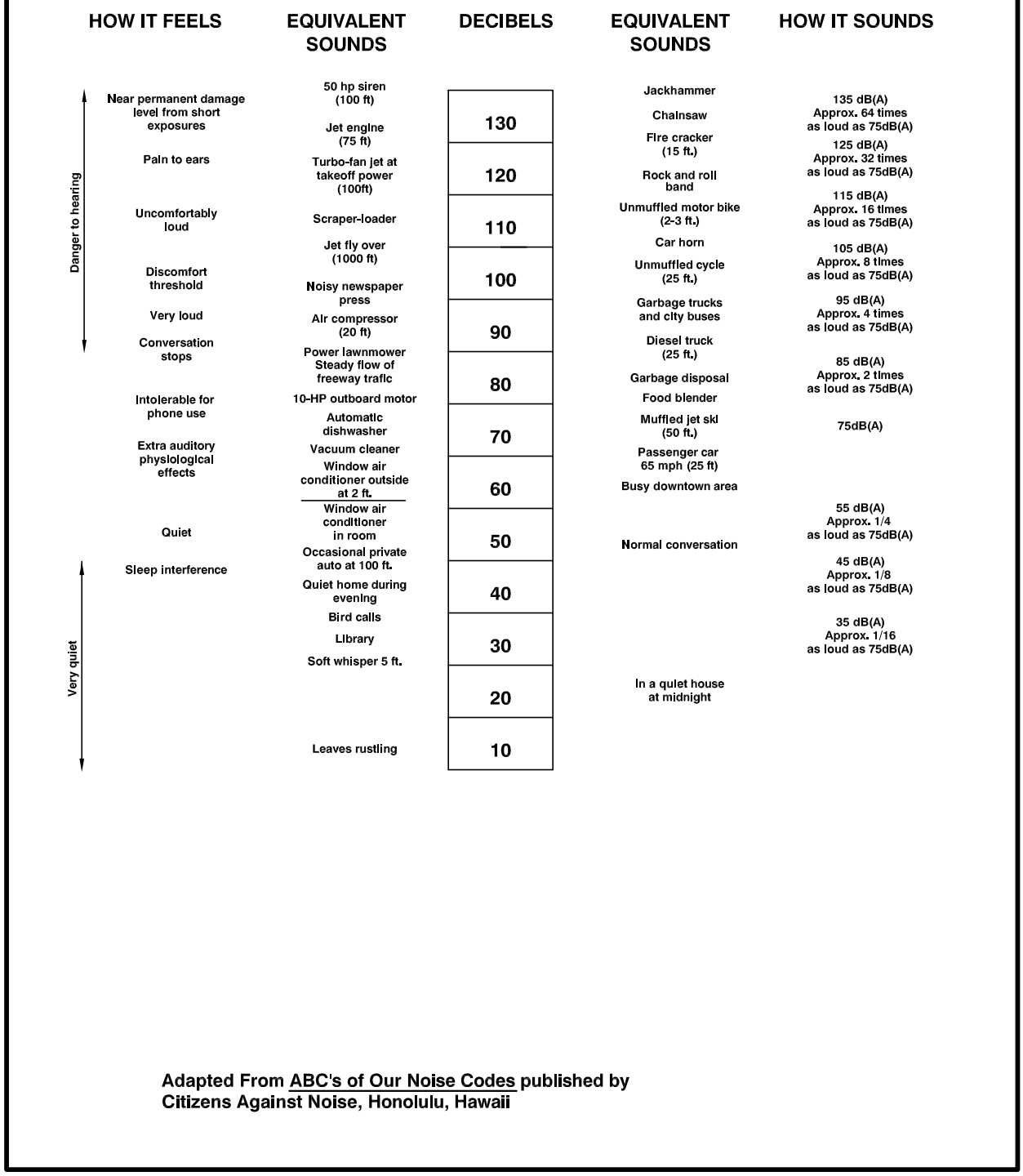

Figure 3-14. Relationship Between A-Scale Decibel Readings and Sounds of Daily Life.

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. The communities of Gillette and Douglas would most likely attract the majority of any new residents due to their current population levels and the availability of services and shopping amenities.

A comprehensive socioeconomic profile of the BLM Field Office Area (formerly the 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). The portion of the following discussion that deals with Campbell County is derived from this report. Converse County socioeconomic data and additional Campbell County data were obtained from 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.

3.18.1 Population

According to 2000 census data, Campbell County had a population of 33,698, with Gillette accounting for 19,646 of the county's residents and Wright with 1,347. The 1990 population of Gillette was 17,635, indicating a growth rate of 11.4% in the past 10 years. Wright grew by 111 persons or 9% during this time frame.

Converse County's population in 2000 was 12,052, with 5,288 of the county's residents residing in Douglas. Douglas grew from 5,076 persons in 1990 to 5,288 in 2000, an increase of 212 people or 4.2% (Wyoming Department of Administration and Information Division April 2001).

CBM-spurred population growth is occurring in both Gillette and Douglas. The current CBM boom is contributing to low housing vacancy and a tight labor market. To date, however, enrollments in Gillette-area schools have not increased as a result of CBM development due to a mobile, relatively young work force (Boyd Brown, Campbell County High School, personal communication October 16, 2000).

3.18.2 Local Economy

Coal production, as reported by the Wyoming State Inspector of Mines, showed the State's coal producers set a new yearly production record of 336.5 million tons in 1999. This was an increase of 6.5 percent over the 315.0 million tons produced in 1998. Campbell County coal production (13 active mines) increased by 7.4 percent (274.1 million tons to 294.3 million tons) from 1998 to 1999, while production in Converse County (2 mines, including Antelope) increased by 9.7 percent (23.4 million

tons to 25.6 million tons). The combined 1999 production from the surface coal mines in these two counties was 95.1 percent of the total production in the State (Wyoming State Inspector of Mines 1999).

In 1997, 24 percent of the total employment and 28 percent of the total personal income in Campbell County were directly attributable to mining which also includes oil and gas employment. In Converse County for that year, 11 percent of the employment and 16 percent of the total personal income were directly attributed to mining (Wyoming Department of Employment 1999).

Approximate tax revenues from coal production in Campbell and Converse counties are presented in Table 3-10. 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 gas, coal, and trona. The State of Wyoming retains approximately 83 percent 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 percent, with half of this revenue returned to the state. Additional sources of revenue include lease bonus bids (also split with the 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 was estimated at $1.10/ton of coal mined in a 1994 study conducted for BLM by the University of Wyoming (University of Wyoming 1994).

Nationally, the minerals industry is 1.3 percent of the GNP. In Wyoming, the minerals industry (including oil and gas) is 31 percent of the GSP, which makes it the largest sector of the Wyoming economy. Coal mining alone accounts for 9 percent of the Wyoming GSP (Wyoming Department of Administration and Information Division March 1999).

Table 3-10. Estimated 2000 Fiscal Revenues from 1999 Coal Production in Campbell County and Converse County.

County	Sales and Use Collections[1, 3]	Severance Tax Collections[1]	Ad Valorem Tax Collections[1]	Royalty Collections[2]	Total Collections
Campbell	$22.2 million	$64.4 million	$57.2 million	$168.1 million	$311.9 million
Converse	$ 1.9 million	$ 5.6 million	$ 4.9 million	$ 14.6 million	$ 27.0 million

[1] Estimated tax receipts are based on most recent published records of Wyoming Department of Revenue.
[2] Royalties are based on 12 ½ percent of sales price on 1999 production, with sales price being the average for northeastern Wyoming (Wyoming Geo-Notes No. 67 September 2000).
[3] From all mining, which includes oil and gas.

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 two counties' coal mining industry has remained relatively constant over the last few years at approximately 3,100 full-time employees.

As of January 2001, the total labor force in Campbell County stood at 20,240 with an unemployment rate of 3.3 percent, compared to 4.6 percent in January 2000 (Wyoming Department of Employment, Research and Planning 2001). At the beginning of 1999 around 2,808 people were directly employed in coal mining, representing about 15 percent of the employed labor force (Wyoming Department of Employment 1999).

Total employment in Campbell County peaked in 1985 at 21,668, the same year that mining employment (which in this case includes oil and gas workers) peaked at 6,312. Total employment declined to a low of 18,103 in 1988, and has generally increased since that time. The current CBM development has resulted in a tight local labor market for both skilled and unskilled labor; however the mining industry has no difficulty filling positions, even in a tight labor market. The mining industry is the employer of choice in Campbell County due to attractive wage and benefit packages and predictable schedules (Betsy Hockert, Wyoming Employment Center, Gillette, personal communication October 17, 2000).

As of January 2001, the total Converse County labor force was 6,706, with an unemployment rate of 5.0 percent, compared to 6.5 percent in January 2000 (Wyoming Department of Employment, Research and Planning 2001). At the beginning of 1999 around 356 people, or 5 percent of the labor force, were directly employed by area coal mines (WCIC 1998). Total employment in Converse County declined from 7,643 in 1981 to a low of 5,988 in 1990, and has been increasing since that time. Mining employment in Converse County declined from 2,129 in 1981 to a low in 1991 of 723, and has been slowly increasing since that time.

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 early 2000, the average cost of a new 3-bedroom home in Gillette was

$130,000; the average cost of an existing 3-bedroom home was $89,000. In Wright, the average 2000 prices of new and existing 3-bedroom homes were $88,000 and $72,000, respectively. Residential building permits in Campbell County rose from 15 in 1987 to 82 in 1992 to 100 in 1998 (the last year that data are available). Due to population growth associated with CBM development, the housing vacancy rate in Gillette is less than 1 percent (Judy Bayles, Bayles Realty, personal communication, March 7, 2000).

In Converse County, residential building permits varied between zero and two per year from 1987 to 1992, rose to 27 in 1997 and fell to 12 in 1998. In March of 2000, Douglas contained approximately 2,400 housing units. Douglas is also experiencing a shortage of housing due to methane development with a vacancy rate approaching zero (Deirdre Hollaway, Horizon Realty, personal communication, March 7, 2000).

3.18.5 Local Government Facilities and Services

Gillette has generally maintained a steady population growth since 1987, when it totaled 17,054. Owing to the substantial revenues generated by mineral production, local government facilities and services have kept pace with growth and are adequate for the current population. The opening of the new South Campus of Campbell County High School has helped to alleviate overcrowding at the "North Campus." South Campus opened on February 1, 1999 with approximately 300 students and 22 teachers. Beginning with the 1999-2000 school year the numbers have increased to approximately 600 students and 33 teachers.

The 2000 population of Douglas (5,288) is lower than its peak of 7,800 in 1982, and local government facilities and services are generally adequate for the current population. 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 the Atlantic Richfield Company and is the nearest community to the southern group of PRB mines. Wright's population peaked in 1985 at approximately 1,800 and decreased to 1,285 by 1994. The 2000 population of Wright was 1,347. As of October 2000 the town of Wright was not experiencing population growth due to CBM development (Tammie Buresh, Wright Water and Sewer District, personal communication October 17, 2000). 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.

Wyoming's economy reached the bottom of an energy bust in 1987 and started to recover (Wyoming Department of Administration and Information, March 1999). That recovery began to slow in 1996. The forecast is for slow growth through 2008; Wyoming's population is projected to increase at 0.5 percent per year. Non-agricultural employment is projected to increase by 22 percent by 2008, increasing 1.4 percent in 2000 and then slowing to 1.1 percent per year by 2006. Mining employment is projected to decline by 8.2 percent by 2008. In 1998 there were 17,000 jobs in the mining sector. This dropped to 15,600 in 1999, with 1,000 jobs lost in oil and gas extraction, 300 in non-metallic minerals and 100 in coal mining (Wyoming Department of Administration and Information, February 2000).

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 and Converse counties, 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.

3.19 Hazardous and Solid Waste

Potential sources of hazardous or solid waste on the North Jacobs Ranch LBA Tract would include spilling, leaking, or dumping of hazardous substances, petroleum products, and/or solid waste associated with mineral, coal, oil and/or gas exploration and development or agricultural or livestock activities. No such hazardous or solid wastes are known to be present on the LBA tract. Wastes produced by current mining activities at the Jacobs Ranch Mine are handled according to the procedures described in Chapter 2.