CHAPTER 3: THE AFFECTED ENVIRONMENT

INTRODUCTION

This chapter describes the existing conditions of the physical, biological, cultural, and socioeconomic resources in the study area. The resources that are addressed here were identified during the scoping process or interdisciplinary team review as having the potential to be affected. Figure 3-1 shows the general analysis area for most environmental resources. The analysis area includes the West Hay Creek LBA tract as applied for under the Proposed Action and the action alternatives. The analysis area is also located within the current Buckskin Mine permit area. Environmental baseline studies required by WDEQ/LQD for permitting the mining of the Proposed Action, Alternative 2 (the Preferred Alternative) and Alternative 3 lands were conducted in 1999 and 2000. Annual monitoring has continued over the analysis area and 1 mile adjacent lands. All baseline studies were reviewed and approved by WDEQ/LQD as part of the Hay Creek amendment. This amendment added the lands Triton obtained in 2000 through their acquisition of the EOG Resources, Inc. coal lease exchange tract, which was assigned lease number WYW150152.

Critical elements of the human environment (BLM 1988) that could potentially be affected by the proposed actions include air quality, cultural resources, Native American religious concerns, T&E, and candidate 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, flood plains, wild and scenic rivers, and wilderness) are not present in the analysis area and are not addressed further. In addition to the critical elements that are potentially present in the analysis area, the status and potential effects of mining 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 are discussed.

GENERAL SETTING

The analysis area is adjacent to the northernmost operating mine within the Wyoming PRB, a part of the Northern Great Plains which includes most of northeastern Wyoming (figure 1-1 in chapter 1). Vegetation is primarily big sagebrush and sandy prairie grassland. The climate is semi-arid, with an average annual precipitation at the Buckskin Mine of about 10.5 inches. June (1.94 inches) and May (1.94 inches) are the wettest months, and January and February (0.12 inches) are the driest. Snowfall at the Gillette 9ESE station averages 58 inches per year, with most occurring in March (10.3 inches) and April (8.6 inches) (Western Regional Climate Center 2002). Potential evapotranspiration, at approximately 31 inches (NOAA 1969), exceeds annual precipitation (Martner 1986).

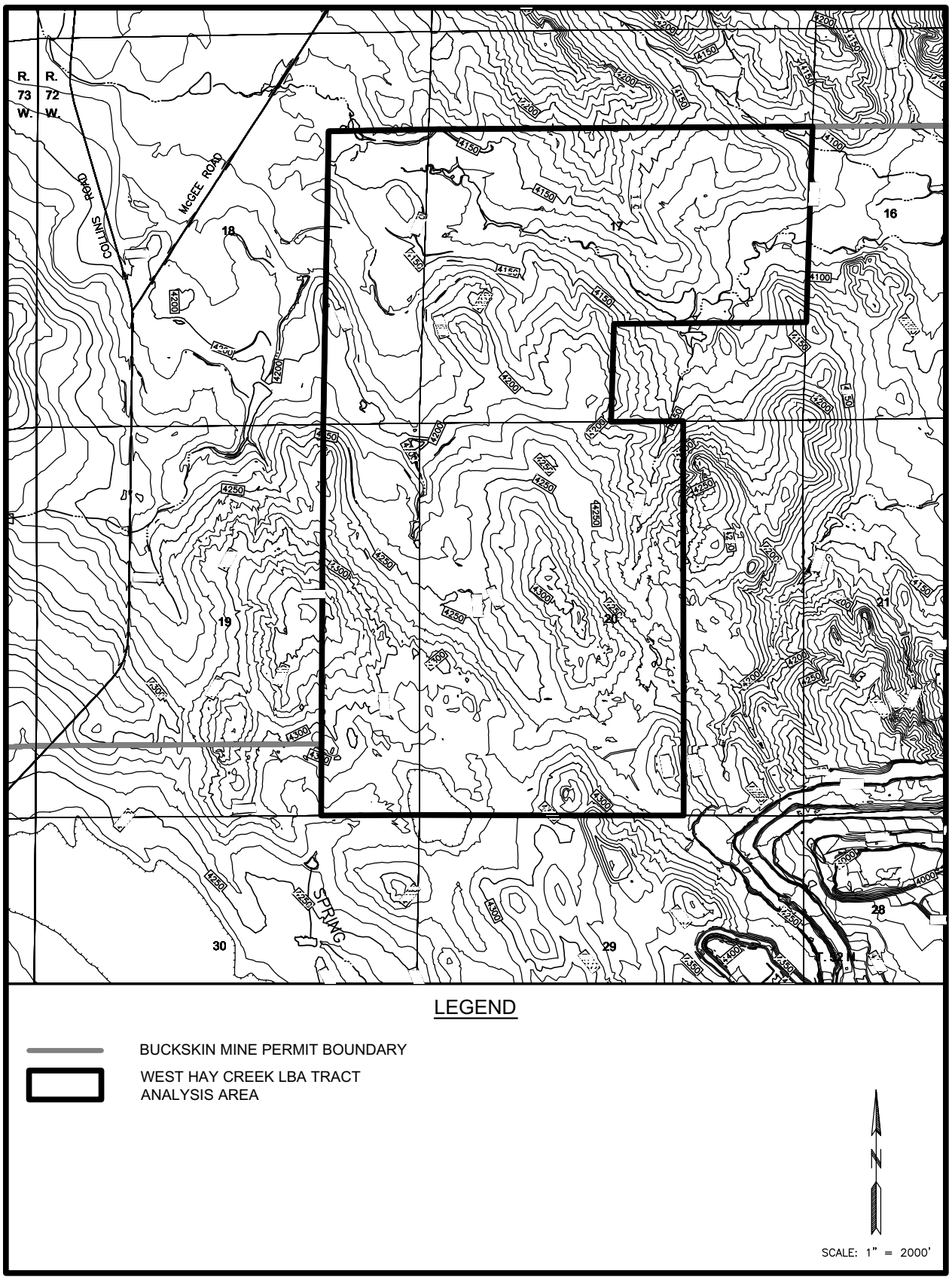


Figure 3-1. General Analysis Area.

The mean of the average hourly temperature recorded at the Buckskin Mine during the 1983-1998 time period is 44.6° F. The highest recorded hourly temperature at the mine was 102° F and the lowest was -40° F. August is the warmest month with a mean temperature of 69° F; December is the coldest (23° F). The frost-free period is 100 to 125 days.

The average annual wind speed for the period 1983 through 1998 at the Buckskin Mine (refer to figure 3-5 in the "Air Quality and Climate" section) was 10.3 mph. Wind speeds are highest in the winter and spring and are predominantly from the northwest and south-southeast. Winter gusts often reach 30 to 40 mph. During periods of strong wind, dust may affect air quality across the region.

An average of 15 air-stagnation events occur annually in the PRB and typically last two days each (BLM 1974). General information describing the area's resources was gathered from draft BLM Buffalo Field office planning documents (BLM 1996a, 1996b, 1996c, 1996d, 1996g) and a BLM coal leasing study (BLM 1996e).

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 Buckskin Mine is located on the gently dipping eastern limb of the structural basin. The regional dip in the area of the mine is approximately 1º to the northwest. There are local areas where the shallow strata dip at higher angles due to local folding or faulting.

The PRB landscape consists of broad plains, low hills, and tablelands. Generally, the topography changes from open hills and elevated ridges with 500 to1,000 feet of relief in the northern part of the PRB to plains and tablelands with 300 to 500 feet 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 elevated ridges broken by minor drainages with an elevation ranging from 4,100 to 4,340 feet.

Hay Creek crosses through the northern portion of the LBA tract, and the entire LBA tract is within the contributory drainage basin of Hay Creek. Hay Creek, which is a minor headwater stream in the regional drainage network of the Little Powder River, flows from west to east through the tract. Its confluence with the Little Powder River is about 3 miles east of the LBA tract.

Overall, the West Hay Creek LBA tract is similar in topography to the rest of the Buckskin Mine permit area. Slopes range from flat to about 22% and average about 7%.

GEOLOGY

Stratigraphic units in the mine area that would be impacted if the West Hay Creek 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 targeted coal beds). Surficial deposits in the analysis area include Quaternary alluvial and eolian deposits, Wasatch Formation, clinker, and weathered Wasatch and Fort Union formations. There is some surficial clinker exposed along the northern portion of the LBA tract analysis area, primarily in the SE¼/NE¼ of section 17. There are thin alluvial deposits along the ephemeral stream channel of Hay Creek and other neighboring tributary channels, with deposits restricted to the lower reaches. They typically consist primarily of poorly stratified and poorly sorted, irregularly bedded unconsolidated sand, silt, and fine gravel. (The "Water Resources" section and figure 3-9 contain more information about the Hay Creek alluvial deposits.)

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 204 feet. Regionally, 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 eroded.

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 3-2).

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 Buckskin Mine, there are two mineable coal seams. Triton personnel refer to these seams as the Anderson and Canyon. These coal seams are also referred to as the Roland and Smith at the nearby Rawhide and Eagle Butte mines.

Figure 3-2 shows the stratigraphic relationships and hydrologic characteristics of the surface and subsurface geologic units in the area of the Buckskin Mine. Figure 3-3 shows two geologic cross-sections drawn through the West Hay Creek LBA tract (one north-south and one east-west). These cross sections are representative of the geology near the tract, with the primary variables being the thickness of overburden, the parting thickness between the Anderson and Canyon coal seams, and the surface topography.

On the West Hay Creek LBA tract, the Anderson coal seam averages 40 feet thick, and the underlying Canyon seam averages 66 feet. The parting thickness between the

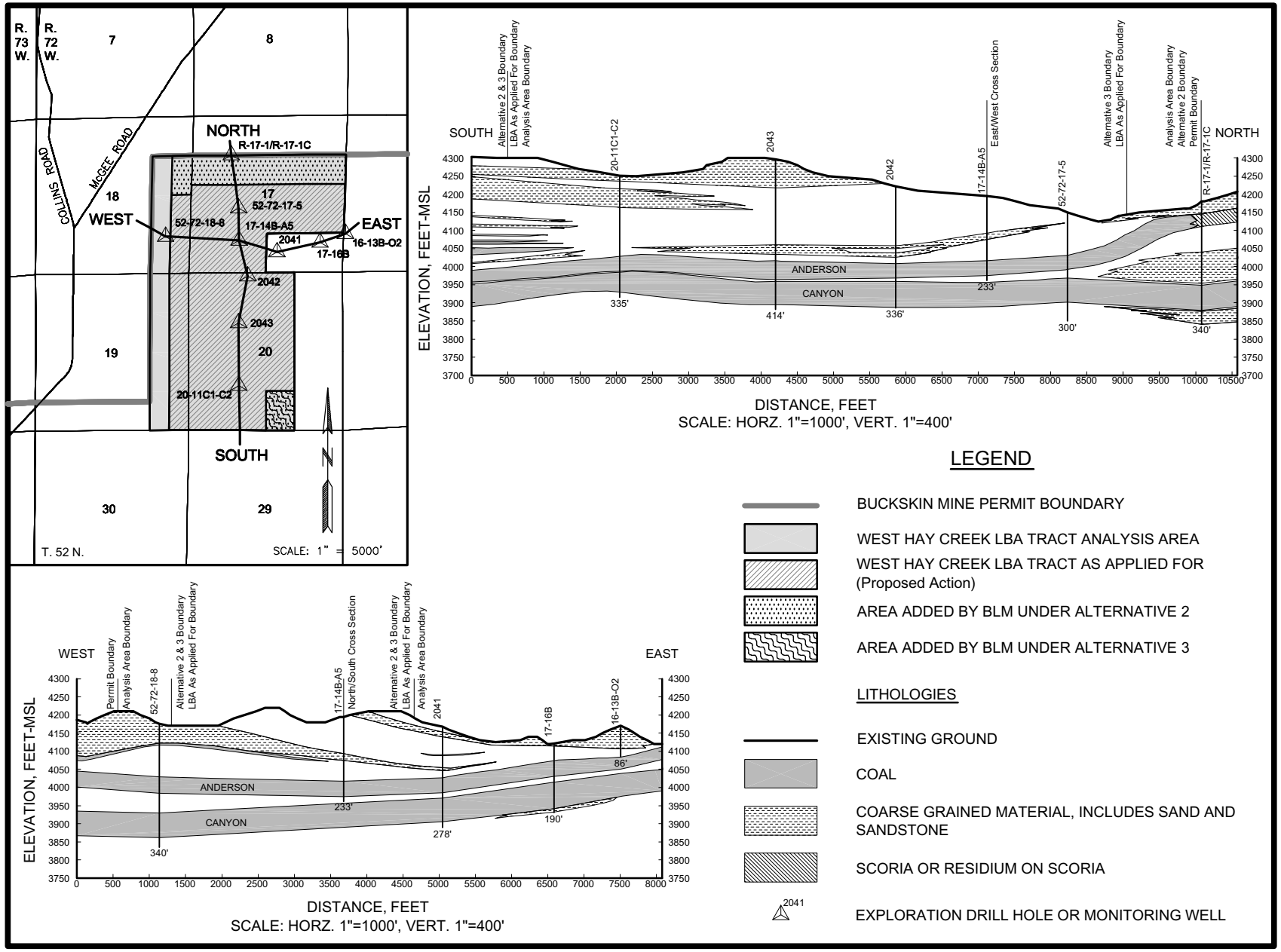


Figure 3-2. North-South and East-West Geologic Cross Sections.

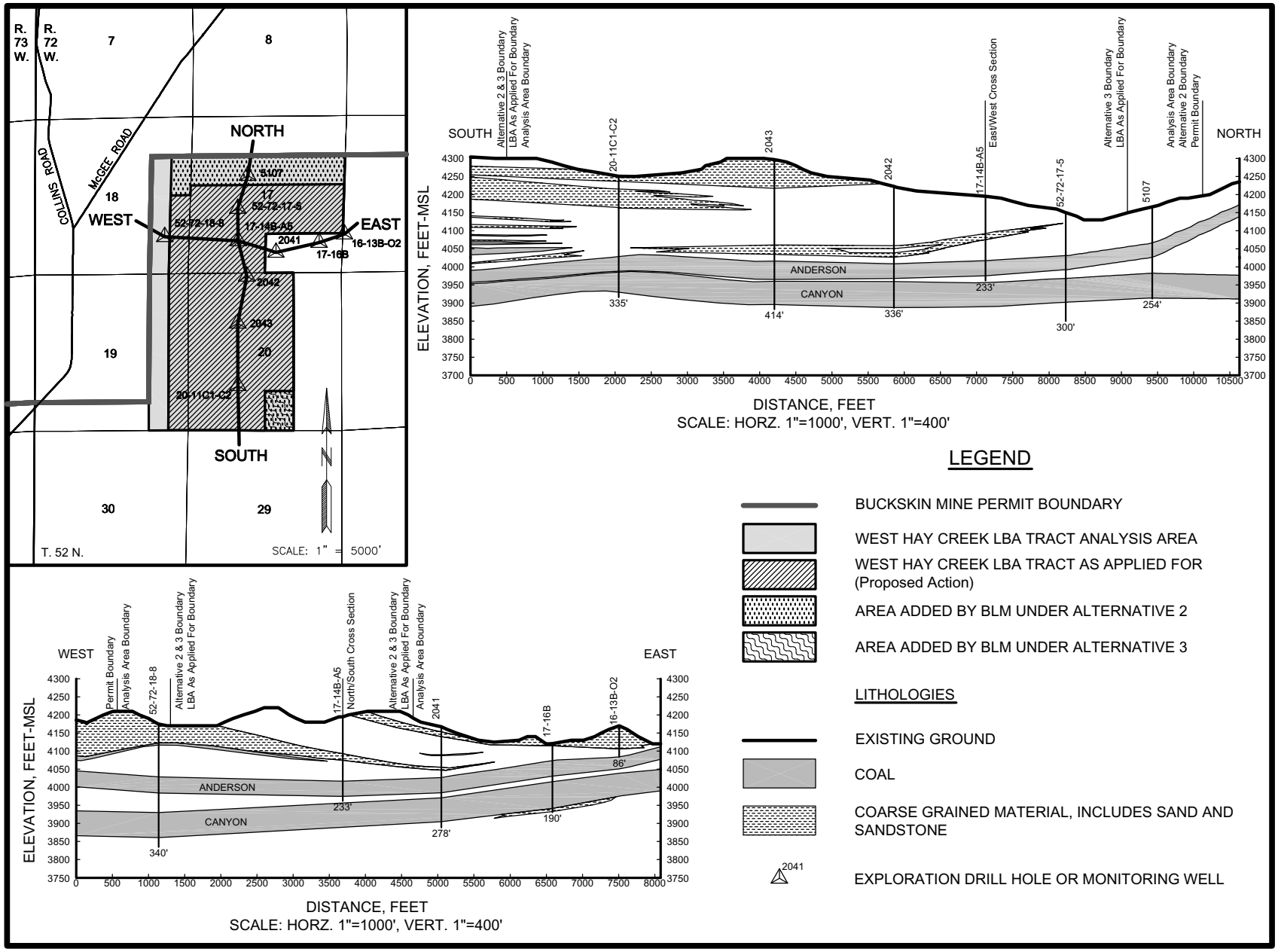


Figure 3-3. North-South and East-West Geologic Cross Sections, West Hay Creek LBA Tract.

Anderson and Canyon coal seams average about 15 feet in the tract. In the southern portion of the tract, the parting thickness averages about four feet, but it increases to the north and west. Toward the north, the parting thickness increases to about 150 feet within the Alternative 2 study area as the Anderson seam rises to within 20 feet of the ground surface, and the Canyon seam dips slightly. In the east-west direction, the Canyon seam dips to the west more uniformly than the Anderson; consequently, the parting thickness increases along the western limit of the LBA tract.

The Fort Union coal seams are subbituminous and are generally low-sulfur, low-ash coals. Typically, the coal being mined has a lower heating value north of Gillette than south of Gillette. According to the analyses (which were done on an as-received basis) of exploration drilling samples collected in the Buckskin Mine area from the adjacent Hay Creek lease, the recoverable coal reserve has an average heating value of approximately 8,140 Btu per pound and contains an average of 5.31% ash, 0.41% sulfur, and 32.09% moisture.

A geologic anomaly known as a splay deposit was encountered at the Buckskin Mine in section 28, T. 52 N., R. 72 W. during 2001. Splay deposits form when the levees bounding a river or stream channel are breached, and a portion of the river/stream flow is diverted out into the swamp. This diverted flow usually terminates some distance from the levee. The sediments of the splay sink into the peat bog allowing the repeated deposition of additional splay deposits. These events usually occur during the flood stages of the river system and may be short or long-lived in time. On occasion, a splay course may become the new course of the river system. These splays may either be syngenetic (contemporaneous) or epigenetic (post-depositional) with the peat deposition in the swamp. The geometry of the Buckskin Mine deposit suggests a syngenetic deposit with the Canyon seam. Geologic modeling indicates this feature extends from the NW¼ of section 28 onto the LBA tract in the SW¼ of section 20. Further drilling should better define the limits and characteristics of the splay, particularly within and adjacent to the LBA tract.

The end of the splay is characterized by numerous, narrow fingers of noncoal material interbedded with portions of the coal seam edge resulting in areas of thin or no coal deposition. In the past, this splay has frequently been misidentified as a channel or channel sandstone. Although the deposit is channel-like in appearance and geometry, the terminus features and the typical clay-silt lithology of the splay make it unlike a river/stream channel complex.

The interface edges of the splay deposit are very unstable from a rock mechanics standpoint. Differential compaction along the splay boundary has locally thinned or thickened the coal. Steep dips and slippage features such as slickensides and micro-faults are abundant in these areas. In areas where splay fingers of steep thin coals extend between thicker coals, sidewall failures might be expected.

The Lebo Shale and Tullock members of the Fort Union Formation underlie the Tongue River member (figure 3-2). 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 Wyoming Highway 59 starting north of Gillette, Wyoming, and extending south for about 75 miles (figure 1-1 in chapter 1). These mines are located where the Wyodak coal is at its shallowest depths (nearest the outcrop). Two of these mines, the Fort Union and Coal Creek mines, are capable of producing but are not currently active. The Dave Johnston Mine, located in Converse County near Glenrock, Wyoming has shut down coal mining operations and is conducting final reclamation.

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 producing oil and/or natural gas fields in the basin. The estimated mean amounts of undiscovered hydrocarbons in the basin are 1.94 billion barrels of recoverable oil and 1.60 trillion cubic feet of gas (USGS 1995). Depth to gas and oil-bearing strata is generally between 4,000 feet and 13,500 feet, but some wells are as shallow as 250 feet.

There are no active conventional oil or gas wells within the LBA tract. One pipeline owned by Western Oil Transportation Company crosses the northwest corner of the tract.

Coal Bed Methane

Methane gas generation from coal beds is a natural process. Methane 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 that 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 the coal is relatively shallow. However, a large amount also remains in the coal. One 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 are approximately 25 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. 54 N., R. 74 W. that 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 occurs in the coal beds of the Fort Union and Wasatch formations throughout the PRB in Wyoming. The predominant CBM production to date has occurred from coal beds of the Wyodak-Anderson zone (USGS 2000) in seams known as the Anderson, Canyon, Wyodak, Big George, and other locally used names. These are generally equivalent to the seams being mined by the surface mines along the eastern margin of the basin, including the Buckskin Mine, the applicant for the proposed West Hay Creek LBA tract.

CBM is produced from other, deeper seams locally throughout the PRB. Deeper seams exist in the LBA area, but they are not in production. Leasing or mining the proposed LBA tract would not directly affect CBM resources production within the underlying seams. It could delay any proposed CBM development in deeper seams in order to avoid interference with mining.

CBM development requires more extensive facilities in areas where there are splits between the coal seams. Although the Anderson and Canyon coal seams in the West Hay Creek LBA tract are continuous or separated by a thin parting throughout most of the LBA tract, in the northern and western part of the tract, shale interbeds that can be more than 100 feet thick separate the two seams. Current CBM well completion practices within the Powder River Basin generally preclude completion of two seams separated by thick shales within a single wellbore. As a result, in the areas where the parting thickness increases, two wells would be required to produce essentially the same reserve that would be produced from a single well in a single contiguous seam.

Since the early 1990s, the BLM has completed numerous EAs and two EISs analyzing CBM projects. The most recent of these was the *Final Environmental Impact Statement and Draft Planning Amendment for the Powder River Basin Oil and Gas Project* (Wyoming PRB Oil and Gas EIS) (BLM 2003a). This document analyzes the impacts of drilling, completing, and operating about 39,400 new private, state, and federal CBM wells and associated ancillary facilities in the next ten years. This is in addition to the more than 12,000 CBM wells that had been drilled or were permitted for drilling when the Wyoming PRB Oil and Gas EIS was prepared. The study area for this EIS includes an almost 8,000,000-acre area covering all or parts of Campbell, Converse, Johnson, and Sheridan counties. The cumulative impacts of reasonably foreseeable conventional oil and gas development within the Wyoming portion of the PRB are also analyzed in

the EIS.

The most extensive CBM development near the West Hay Creek LBA area occurs west of the proposed tract. On April 9, 2004, WOGCC records indicated that there were 73 active CBM wells, 8 shut in CBM wells, and 4 wells that had begun drilling or were permitted to drill within T. 52 N., R. 72 W. There were six active wells, three shut-in wells, and three wells that were permitted or had started drilling within the LBA tract itself as of April 9 2004.

CBM wells were initially drilled on 40-acres spacing in the Wyoming PRB, but the WOGCC has now established 80-acre spacing patterns as the default spacing for CBM wells in the Powder River Basin. Most CBM drilling near the West Hay Creek LBA has occurred on a 40-acre pattern, either because the wells were drilled before the spacing was changed to 80 acres or under the authorization of spacing exceptions granted by WOGCC. There are 16 remaining undrilled complete or partial 40-acre lots within the study area.

The ownership of oil and gas resources in the LBA tract is discussed in “Ownership and Use of Land” section. Majestic Petroleum Operations, LLC, Redstone Resources, and Yates Petroleum Corporation are the owners of most of the CBM drilling rights on the West Hay Creek LBA tract.

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 West Hay Creek LBA tract.

Uranium

There are substantial uranium resources in southwestern Campbell and northwestern Converse counties. Uranium exploration and mining were very active in the 1950s, when numerous claims were filed in the PRB. Uranium mining decreased in the early 1980s due to decreased demand and increased foreign supply. There are currently two *in-situ* uranium recovery operations in the PRB. Production at another ended in 2000 (WGS 2003). No known uranium reserves exist on the West Hay Creek 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 on small portions of the LBA tract as applied for and under the action alternatives.

There are no active mining claims on the West Hay Creek LBA tract.

SOILS

The analysis area, which includes the LBA tract, was subjected to two separate order 1-2 soils surveys in 1989 and 1999. The majority of the tract was surveyed in 1999. The area covered in the study includes the LBA tract under the Proposed Action and action alternatives, as well as the area that would be disturbed by mining the LBA under any of the action alternatives. Figure 3-4 illustrates the soil series within the analysis area.

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.

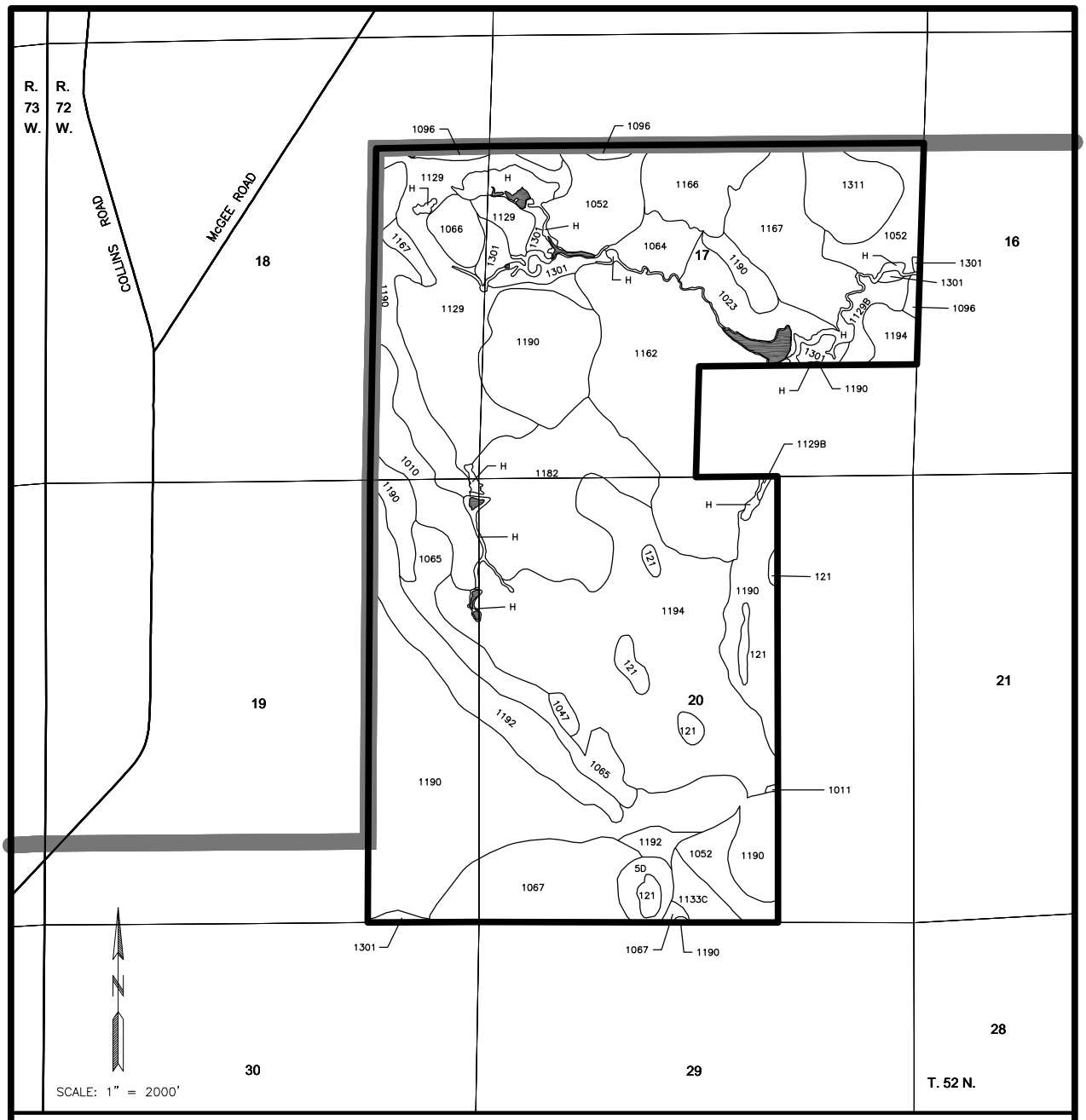
The following is a list of the soil series that comprise the various map units delineated on the proposed affected area associated with the West Hay Creek LBA tract under the Proposed Action, including the area added under the action alternatives.

Soils developing predominantly in alluvium and residuum from mixed sources

- Forkwood-Cushman loams, 0 to 6% slopes
- Hiland-Bowbac fine sandy loam, 0 to 6% slopes
- Lawver-Teckla-Wibaux complex, moist, 0 to 10% slopes
- Spottedhorse-Lieter Complex, 0 to 6% slopes
- Theedle-Kishona-Shingle loams, 3 to 30% slopes
- Theedle-Shingle loams, 3 to 30% slopes
- Ulm-Renohill association, clay loam, 0 to 6% slopes
- Vonalf-Xema-Mittenbutte fine sandy loam, 3 to 30% slopes
- Rauzi fine sandy loam, 0 to 3% slopes
- Ustic Torripsamment, sandy, 0 to 30% slopes

Soils developing predominantly in alluvial or colluvial fan deposits and fan remnants from mixed sources

- Cambria-Kishona-Aigweid loams, 6 to 15% slopes
- Decolney-Hiland fine sandy loams, 0 to 6% slopes
- Heldt-Bidman complex, saline, 0 to 3% slopes
- Ironbutte-Fairburn-Mittenbutte complex, 6 to 40% slopes
- Platmak loam, 0 to 6 percent and 6 to 15% slopes
- Vonalee-Terro-Taluce fine sandy loam, 3 to 30% slopes



LEGEND

BUCKSKIN MINE PERMIT BOUNDARY

WEST HAY CREEK LBA TRACT ANALYSIS AREA

SOIL SERIES w / SALVAGE DEPTH

121	0"	ROCK OUTCROP
1010	18"	ARWITE-ELWOP SANDY LOAMS, 0-6 %
1023	18"	CAMBRIA-KISHONA-ZIGWEID LOAMS, 6-15 %
1047	6"	FELIX CLAY, PONDED, 0-2 %
1052	18"	FORKWOOD-CUSHMAN LOAMS, 0-6 %
1064	12"	HELDT-BIDMAN COMPLEX, SALINE, 0-3 %
1065	19"	HILAND-BOWBAC SAND LOAMS, 0-6 %
1066	19"	HILAND-BOWBAC SAND LOAMS, 6-15 %
1067	22"	DECOLNEY-HILAND SANDY LOAMS, 0-6 %
1096	22"	LAWVER-TECKLA-WIBAUX COMPLEX, 0-10 %
1129	18"	PLATMAK LOAM, 0-6 %
1162	12"	SPOTTEDHORSE-LIETER COMPLEX, 0-6 %
1166	13"	THEEDLE-KISHONA-SHINGLE LOAMS, 3 TO 30 %
1167	12"	THEEDLE-SHINGLE LOAMS, 3 TO 30 %
1182	10"	ULM-RENOHILL CLAY LOAMS, 0-6 %
1190	13"	VONALEE-TERRO-TALUCE SANDY LOAMS, 3 TO 30 %
1192	12"	VONALEE, SANDY LOAM, 0-6 %
1194	12"	VONALF-XEMA-MITTENBUTTE, FINE SANDY LOAM, 3-30 %
1301	14"	HAVERDAD-BORUFF COMPLEX, 0 TO 6 %
1311	8"	IRONBUTTE-FAIRBURN-MITTENBUTTE COMPLEX, 6-40 %
1129B	18"	PLATMAK LOAM, 6-15 %
1133C	18"	RAUZI FINE SANDY LOAM, 10-30 %
5D	12"	USTIC TORRIPSAMMENT, 10-30 %
H	19"	MOLLIC FLUVAQUENT, 0-3 %
	0"	WATER

Figure 3-4. Soil Series Within the West Hay Creek LBA Tract Analysis Area.

Soils developing predominantly in alluvium and eolian deposits derived from mixed sources

- Arwite-Elwop sandy loam, 0 to 6% slopes
- Haverdat-Boruff loams, 0 to 6% slopes
- Mollic Fluvaquent, hydric, 0 to 1% slopes
- Vonalee fine sandy loam, 0 to 6% slopes

Table 3-1 provides the extent of six depth classes of suitable soil within the LBA tract analysis area.

According to the baseline soils studies, enough suitable soil exists for salvaging within the LBA tract to redistribute suitable soils to an average depth of approximately 15 inches over all disturbed areas. This is true for the Proposed Action and the action alternatives. This depth would be redistributed on all disturbed acres. Areas of unsuitable soils include sites with high alkalinity, salinity or clay content.

The soil depths and types on the West Hay Creek LBA tract analysis area are similar to soils currently being salvaged and used for reclamation at the adjacent mine and other mines in the PRB. The site-specific soil surveys have located hydric soils and/or inclusions of hydric soils, which are one component used in identifying wetlands. Please see the "Wetlands" section for discussion of wetland surveys.

TABLE 3-1

ACRES OF SOIL AVAILABLE FOR RECLAMATION WITHIN THE WEST HAY CREEK LBA TRACT ANALYIS AREA

Suitable Soil Thickness	Acres	Percent
0	19.0	1.6
1 - 6	2.5	0.2
7 - 12	484.8	41.8
13 - 18	533.5	46.0
19 - 24	120.9	10.4
Total	1,160.8	100.0

AIR QUALITY AND CLIMATE

Air quality of any region is controlled primarily by the magnitude and distribution of pollutant emissions and the regional climate. The transport of pollutants from specific source areas is strongly affected by local topography. Generally, local effects are superimposed on the general overall weather pattern and are most important when the large-scale wind flow is weak.

Topography

The West Hay Creek LBA tract analysis area (figure 1-1 in chapter 1) is located in the PRB, a part of the Northern Great Plains that includes most of northeastern Wyoming. The topography is primarily rolling plains and tablelands of moderate relief (with occasional valleys, canyons and buttes). The LBA tract is in an area consisting primarily of elevated ridges broken by minor drainages with an elevation ranging from 4,100 to 4,340 feet. Slopes in the analysis area range from flat to greater than 22%.

Climate and Meteorology

The climate in the analysis area is semi-arid, with an average annual precipitation at the Buckskin Mine of about 10.5 inches per year. Snowfall at the Gillette 9ESE Station averages 58 inches per year, with most occurring in March and April. Evaporation exceeds annual precipitation, with relatively short warm summers and longer cold winters. The average daily mean temperature is around 45ºF. The highest recorded hourly temperature at the mine was 102ºF and the lowest was -40ºF. August is the warmest month, with a mean daily temperature of 69ºF, and December is the coldest (23ºF). The frost-free period is between 100 and 125 days.

The average annual wind speed for the period from 1983 through 1998 at the Buckskin Mine was 10.3 mph with local variations in speed and direction due to differences in topography. Winds are predominantly from the northwest and south-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. The air quality and meteorological sampling locations and associated wind rose diagrams for the Buckskin Mine are shown in figure 3-5.

Regulatory Framework

Air quality and pollutant emissions to the air are regulated under the federal CAA and Wyoming Air Quality Standards and Regulations (WAQSR) administered by the WDEQ/AQD. A fundamental requirement of both federal and state regulations is that ambient concentrations for specific criteria pollutants not exceed allowable levels, referred to as the ambient air quality standards (AAQS). These standards have been established by the EPA and the WDEQ at levels deemed necessary to preclude adverse impacts on human health and welfare. The National AAQS (or NAAQS) set nationwide thresholds for maximum acceptable concentrations of various pollutants. The Wyoming AAQS (or WAAQS) must be at least as stringent as NAAQS. Selected Wyoming and national ambient air standards are shown in table 3-2. The NAAQS and WAAQS set the absolute upper limits for specific air pollutant concentrations at all locations where the public has access.

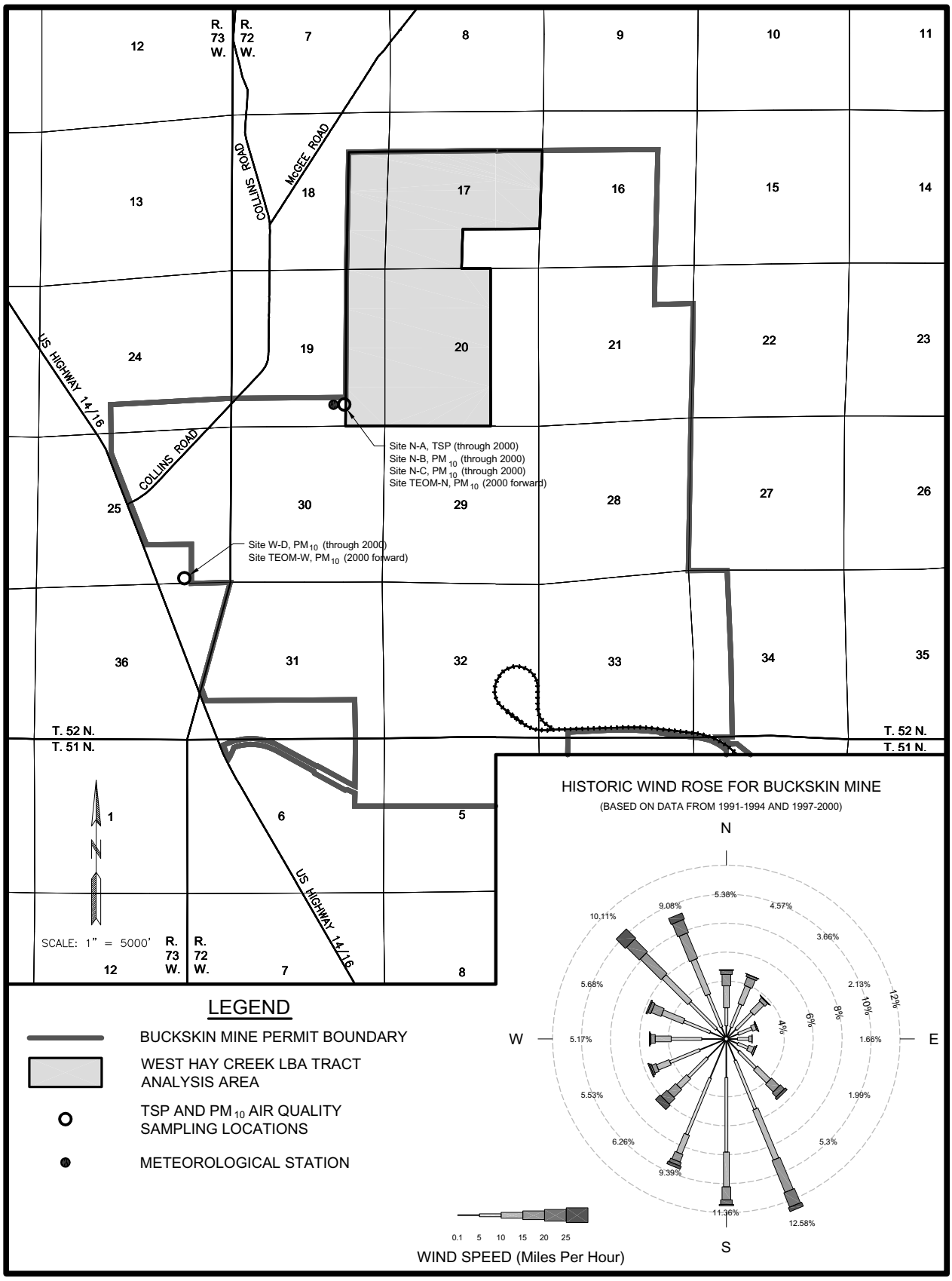


Figure 3-5. Wind Rose, Air Quality, and Meteorological Stations at the Buckskin Mine.

The assumed background pollutant concentrations included in table 3-2 were derived by Argonne National Laboratory based on a review of available monitoring data measured throughout northeastern Wyoming and southeastern Montana. The assumed background pollutant concentrations are below applicable NAAQS and WAAQS for all criteria pollutants and averaging times.

Pursuant to the CAA, the EPA has developed classifications for distinct geographic regions known as air basins and for major metropolitan statistical areas (MSAs). Under these classifications, for each federal criteria pollutant, each air basin (or portion of a basin or MSA) is classified as in “attainment” if the area has “attained” compliance with (that is, not exceeded) the adopted NAAQS for that pollutant, or is classified as “non-attainment” if the levels of ambient air pollution exceed the NAAQS for that pollutant. Areas for which sufficient ambient monitoring data are not available are designated as “unclassified” for those particular pollutants. States designate areas within their borders as being in “attainment” or “non-attainment” with the AAQS. Existing air quality throughout most of the PRB in Wyoming is in attainment with all ambient air quality standards, as demonstrated by the relatively low concentration levels presented in table 3-2. However, the Sheridan, Wyoming area has been designated as a federal non-attainment area (PM_{10} - moderate) where the applicable standards have been violated in the past.

Future development projects which have the potential to emit more than 250 tons per year (tpy) of any criteria pollutant (or certain listed sources that have the potential to emit more than 100 tons per year) would be required to undergo a regulatory PSD increment consumption analysis under the federal new source review permitting regulations. Development projects subject to the PSD regulations must also demonstrate the use of the best available control technology (BACT) and show that the combined impacts of all PSD sources will not exceed the allowable incremental air quality impacts for NO_2, PM_{10}, or SO_2. The PSD increments are shown in table 3-2.

Existing surface coal mining operations in the PRB, including the Buckskin Mine, are not currently affected by the PSD regulations for two reasons. Surface coal mines are not on the EPA list of 28 major emitting facilities for PSD regulation and point-source emissions from individual mines do not exceed the PSD emissions threshold. A new mine would be classified as a major source and subject to PSD review if potential emissions of any regulated pollutant equal or exceed 250 tpy. Fugitive emissions are not included in the definition of potential emissions except for certain specified source types [40 CFR 52.21, (b)(1)(iii)]. Mining related fugitive emissions are exempt from the applicability determination.

The WDEQ/AQD administers a permitting program to assist the agency in managing the state's air resources. Under this program, anyone planning to construct, modify, or use a facility capable of emitting designated pollutants into the atmosphere must obtain an air quality permit to construct. Coal mines fall into this category.

TABLE 3-2

ASSUMED BACKGROUND AIR POLLUTANT CONCENTRATIONS, APPLICABLE AMBIENT AIR QUALITY STANDARDS, AND PSD INCREMENT VALUES

(in µg/m3)

Pollutant	Averaging Time[1]	Background Concentration	Primary NAAQS[2]	Secondary NAAQS[2]	Wyoming Standards	PSD Class I Increments	PSD Class II Increments
Carbon monoxide	1-hour	3,500[3]	40,000	40,000	40,000	-----	-----
	8-hour	1,500	10,000	10,000	10,000	-----	-----
Nitrogen dioxide	Annual	16.5[4]	100	100	100	2.5	25
Ozone	1-hour	82[5]	235	235	235	-----	-----
	8-hour	130[5]	157	157	157	-----	-----
PM_{10}	24-hour	42[7]	150	150	150	8	30
	Annual	17[7]	50	50	50	4	17
$PM_{2.5}$	24-hour	19[7]	65	65	65	-----	-----
	Annual	7.6[7]	15	15	15	-----	-----
Sulfur dioxide	3-hour	8[6]	-----	1,300	1,300	25	512
	24-hour	8[6]	365	-----	260	5	91
	Annual	3[6]	80	-----	60	2	20

[1]Annual standards are not to be exceeded; short-term standards are not to be exceeded more than once per year.
[2]Primary standards are designed to protect public health; secondary standards are designed to protect public welfare.
[3]Amoco Ryckman Creek collected for an 8-month period during 1978-1979, summarized in the Riley Ridge EIS (BLM 1983).
[4]Data collected in Gillette, WY (1996-1997).
[5]Data collected in Pinedale, WY (1992-1994).
[6]Data collected at Devil's Tower, WY (1983).
[7]Data collected in Gillette, WY (1999).

Source: Argonne 2002

In addition to the designations relative to attainment of the NAAQS, the CAA requires the EPA to place each airshed within the US into one of three PSD area classifications. PSD Class I is the most restrictive air quality category. It was created by Congress to prevent further deterioration of air quality in national parks and wilderness areas of a given size which existed prior to 1977 or those additional areas which have since been designated Class I under federal regulations (40 CFR 52.21). All remaining areas outside of the designated Class I boundaries were designated Class II areas, which

allow a relatively greater deterioration of air quality over that in existence in 1977, although still within the NAAQS. No Class III areas, which would allow air quality to degrade to the NAAQS, have been designated. The federal land managers have also identified certain federal assets with Class II status as “sensitive” Class II areas for which air quality and/or visibility are valued resources. The federal CAA also provides specific visibility protection of mandatory federal Class I areas. Mandatory federal Class I areas were designated by Congress on August 7, 1977 and include wilderness areas greater than 5,000 acres in size and national parks greater than 6,000 acres in size. Table 3-3 is a list of mandatory federal Class I areas, tribal Class I areas, and federal Class II areas in the region and their distance from the general analysis area. Wind Cave National Park, Badlands Wilderness Area, and the Northern Cheyenne Indian Reservation are the closest mandatory federal Class I areas. Table 3-3 also lists other areas which are more distant but were included in the cumulative air quality impact analysis discussed in chapter 4. As shown in table 3-3, the allowable incremental impacts for NO_2, PM_{10}, and SO_2 within PSD Class I areas are very limited. Most of the PRB in Wyoming is designated as PSD Class II with less stringent requirements. Even though the development activities being considered in this EIS would occur within areas designated PSD Class II, the potential impacts are not allowed to cause incremental effects greater than the stringent Class I thresholds to occur inside any distant PSD Class I area.

Existing Air Quality

WDEQ detects changes in air quality through monitoring and maintains an extensive network of air quality monitors throughout the state. Particulate matter is most commonly measured as particles finer than 10 microns or PM_{10}. The eastern side of the Powder River Basin has one of the most extensive networks of monitors for PM_{10} in the nation due to the density of coal mines (figure 3-6). In addition, there are also monitors in Sheridan and Gillette, Wyoming, and the WDEQ installed monitors in Arvada and Wright, Wyoming in November 2002.

WDEQ uses monitoring located throughout the state to anticipate issues related to air quality. These monitoring stations are located to measure ambient air quality and not located to measure impacts from a specific source. Monitors located to measure impacts from a specific source may also be used for trends. These data are used to pro-actively arrest or reverse trends towards air quality problems. When WDEQ became aware that particulate readings were increasing due to increased coal bed methane activity and aggravated by prolonged drought, the WDEQ approached the counties, coal mines, and coal bed methane industry. A coalition involving the counties, coal companies and coal bed methane operators have made significant efforts towards minimizing dust from roads. Measures taken have ranged from the implementation of speed limits to paving heavily traveled roads.

Monitoring is also used to measure compliance. The WDEQ can take a range of enforcement actions to remedy the situation where monitoring shows a violation of any standard. Where a standard is exceeded specific to an operation, the enforcement

TABLE 3-3

APPROXIMATE DISTANCES AND DIRECTIONS FROM THE WEST HAY CREEK ANALYSIS AREA TO PSD CLASS I AND CLASS II SENSITIVE RECEPTOR AREAS

Receptor Area	Distance (miles)	Direction to Receptor
Mandatory Federal PSD Class I		
Badlands Wilderness Area[1]	160	SE
Bridger Wilderness Area	215	SW
Fitzpatrick Wilderness Areas	205	SW
Gates of the Mountains Wilderness Area	350	NW
Grand Teton National Park	260	SW
North Absaroka Wilderness Area	205	NW
Red Rock Lakes Wilderness Area	255	W
Scapegoat Wilderness Area	320	NW
Teton Wilderness Area	210	W
Theodore Roosevelt National Park (North Unit)	235	NE
Theodore Roosevelt National Park (South Unit)	210	NE
U. L Bend Wilderness Area	195	NW
Washakie Wilderness Area	180	SW
Wind Cave National Park	115	SE
Yellowstone National Park	210	W
Tribal Federal PSD Class I		
Fort Peck Indian Reservation	215	N
Northern Cheyenne Indian Reservation	70	NW
Federal PSD Class II		
Absaroka-Beartooth Wilderness Area	190	NW
Agate Fossil Beds National Monument	160	SE
Bighorn Canyon National Recreation Area	135	NW
Black Elk Wilderness Area	105	SE
Cloud Peak Wilderness Area	75	W
Crow Indian Reservation	70	NW
Devils Tower National Monument	40	NE
Fort Belknap Indian Reservation	240	NW
Fort Laramie National Historic Site	160	SE
Jewel Cave National Monument	100	SE
Mount Rushmore National Memorial	110	E
Popo Agie Wilderness Area	205	SW
Soldier Creek Wilderness Area	160	SE

[1]Congress designated the wilderness area portion of the Badlands National Park as a mandatory federal PSA Class I area. The remainder of the national park is a PSD Class II area.

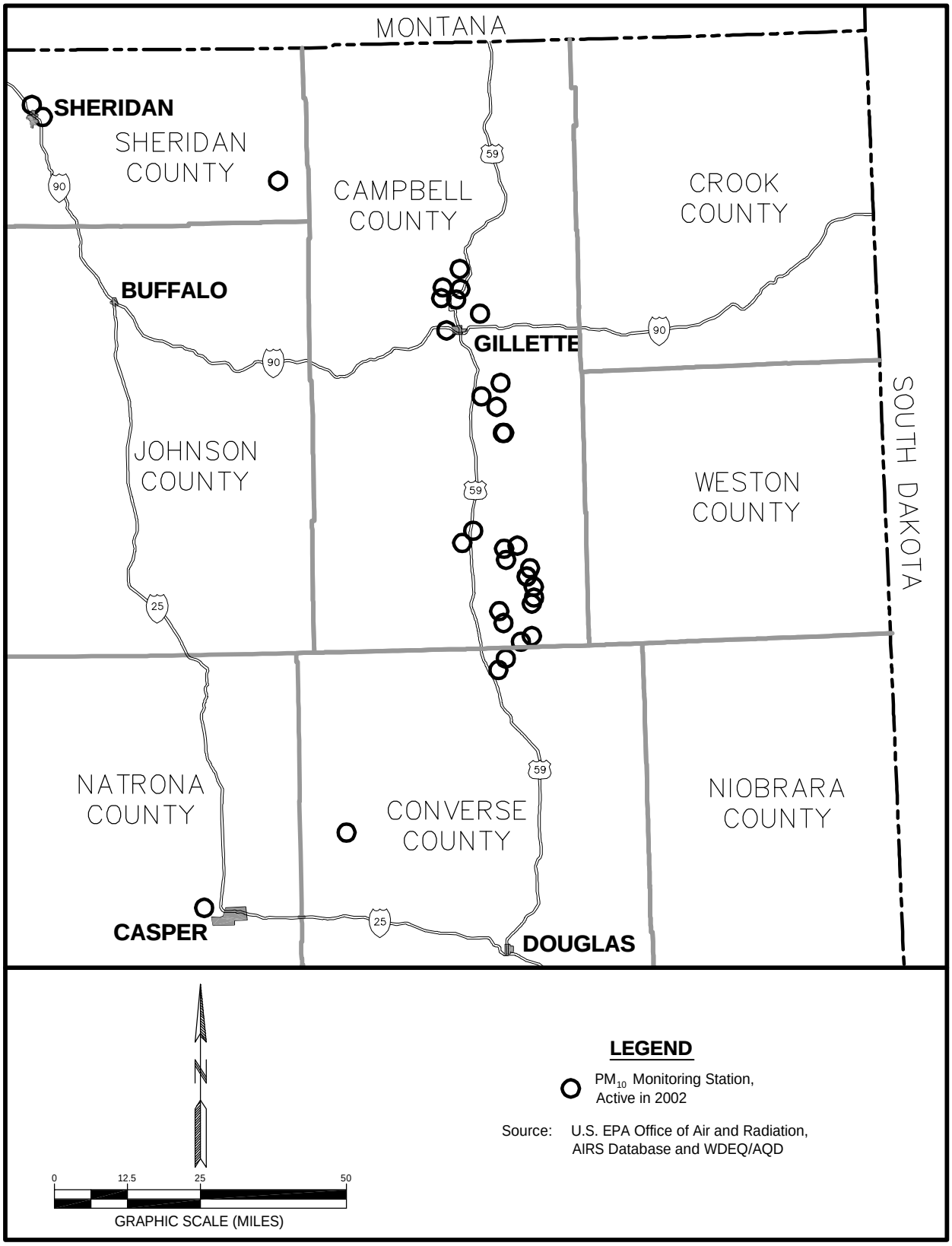


Figure 3-6. Active PM_{10} Monitoring Stations in Northeastern Wyoming.

action is specific to the facility. For many facilities, neither the cause nor the solution is simple. The agency normally uses a negotiated settlement in those instances.

WDEQ has also located two visibility monitoring stations in the PRB. One of these sites is 32 miles north of Gillette and includes a nephelometer, a transmissometer, an aerosol monitor (IMPROVE protocol), instruments to measure meteorological parameters (temperature, RH, wind speed, wind direction), a digital camera, instruments to measure ozone, and instruments to measure nitrogen oxides (NO, NO_2, NO_x). The other visibility monitoring station is located 14 miles west of Buffalo and includes a nephelometer, a transmissometer, an aerosol monitor (IMPROVE protocol), instruments to measure meteorological parameters (temperature, RH, wind speed, wind direction), and a digital camera.

Other air quality monitoring in the PRB includes NO_2 monitoring along the east side of the PRB, Wyoming air resources monitoring system (WARMS) monitoring of sulfur and nitrogen concentrations near Buffalo, Sheridan, and Newcastle, and National Atmospheric Deposition Program (NADP) monitoring of precipitation chemistry in Newcastle.

Air quality conditions in rural areas are likely to be very good, as characterized by limited air pollution emission sources (few industrial facilities and residential emissions in the relatively small communities and isolated ranches) and good atmospheric dispersion conditions, resulting in relatively low air pollutant concentrations. Occasional high concentrations of carbon monoxide (CO) and particulate matter may occur in more urbanized areas (for example, Buffalo, Gillette, and Sheridan) and around industrial facilities, especially under stable atmospheric conditions common during winter.

The major types of emissions that come from surface coal mining activities are in the form of fugitive dust and tailpipe emissions from large mining equipment. Activities such as blasting, loading and hauling of overburden and coal and the large areas of disturbed land all produce fugitive dust. Stationary or point sources are associated with coal crushing, storage, and handling facilities. In general, particulate matter (PM_{10}) is the major significant pollutant from coal mine point sources.

Blasting is responsible for another type of emission from surface coal mining. Overburden blasting sometimes produces gaseous orange-colored clouds that contain NO_2. Exposure to NO_2 may have adverse health effects, which are discussed in chapter 4. NO_2 is one of several products resulting from the incomplete combustion of explosives used in the blasting process. Wyoming's ambient air standards for NO_2 are shown in table 3-2.

Other existing air pollutant emission sources within the region include:

- Exhaust emissions (primarily CO and oxides of nitrogen [NO_x]) from existing natural gas fired compressor engines used in production of natural gas and coal bed methane; gasoline and diesel vehicle tailpipe emissions of combustion

pollutants (volatile organic compounds [VOC], CO, NO_x, inhalable particulate matter less than 10 microns in effective diameter [PM_{10}], fine particulate matter less than 2.5 microns in effective diameter [$PM_{2.5}$], and sulfur dioxide [SO_2]);

- Dust (particulate matter) generated by vehicle travel on unpaved roads, windblown dust from neighboring areas and road sanding during the winter months;

- Transport of air pollutants from emission sources located outside the region;

- Emissions from railroad locomotives used to haul coal (primarily NO_2 and PM_{10}); and,

- SO_2 and NO_x from power plants.

Historical Ambient Air Quality: Particulates

Until 1989, the federally regulated particulate matter pollutant was measured as TSP. This measurement included all suspendable dust (generally less than 100 microns in diameter). In 1989, the federally regulated particulate matter pollutant was changed from a TSP based standard to a PM_{10} based standard. PM_{10} is particulate matter with an aerodynamic diameter of 10 microns or less that can potentially penetrate into the lungs and cause health problems. Wyoming added PM_{10} based standards to match the federal standards in 1989 and retained the TSP based standards as state standards until March 2000. Wyoming's ambient air standards for PM_{10} are shown in table 3-2. Wyoming adopted a $PM_{2.5}$ standard in March 2000. However, the state of Wyoming will not enforce that standard until EPA has completed its review of the $PM_{2.5}$ standard and has determined to retain and enforce the standard as promulgated on July 18, 1997.

Regional. WDEQ/AQD requires the collection of information documenting the quality of the air resource at each of the PRB mines. Each mine monitored air quality for a 24-hour period every six days at multiple monitoring sites through the end of 2001. All PM_{10} monitors are now required by WDEQ/AQD to sample air quality for a 24-hour period every three days beginning in 2002. Data for TSP dates back to 1980; data for PM_{10} dating back to 1989. This has resulted in over 55,000 TSP and 14,000 PM_{10} samples collected through 2002 and makes the eastern PRB one of the most densely monitored areas in the world (figure 3-6). Table 3-4 uses the annual arithmetic average of all sites to summarize these data.

As indicated in table 3-4, the long-term trend in particulate emissions remained relatively flat through 1998. TSP concentration from 1980 through 1998 averaged 33.1 Pg/m^3, ranging between 27.8 Pg/m^3 and 39.4 Pg/m^3. There were increases in 1988 and 1996, which may have been the result of fires in the region during those years. PM_{10} concentration from 1989 through 1998 averaged 15.4 Pg/m^3, ranging between 12.9 and 16.5 Pg/m^3.

TABLE 3-4

SUMMARY OF AIR QUALITY MONITORING IN WYOMING'S POWDER RIVER BASIN, 1980-2000

Year	Coal Produced (mmtpy)	Yards Moved (mmbcy)	Number of Mines Operating/ Monitoring TSP/ Monitoring PM_{10}[1]	Number of Sites TSP/PM_{10}[2] ($\mu g/m^3$)	TSP Average ($\mu g/m^3$)	PM_{10} Average ($\mu g/m^3$)
1980	58.7	105.3	10/14/0	34/0	35.5	na[3]
1981	71.0	133.4	11/13/0	35/0	39.4	na
1982	76.1	141.1	11/14/0	40/0	31.2	na
1983	84.9	150.9	13/14/1	41/1	32.6	11.2
1984	105.3	169.5	14/16/1	42/1	33.9	11.1
1985	113.0	203.4	16/17/0	49/0	32.3	na
1986	111.2	165.7	16/17/0	45/0	29.3	na
1987	120.7	174.6	16/17/0	43/0	31.7	na
1988	138.8	209.7	16/17/0	43/0	37.7	na
1989	147.5	215.6	15/17/3	40/3	32.1	15.9
1990	160.7	223.5	17/17/5	47/5	34.3	14.8
1991	171.4	245.9	17/17/5	46/6	32.7	16.5
1992	166.1	296.0	17/17/7	41/7	31.7	15.9
1993	188.8	389.5	17/17/8	40/11	27.8	14.5
1994	213.6	483.9	17/18/8	44/11	31.7	15.5
1995	242.6	512.7	16/18/8	41/12	29.6	12.9
1996	257.0	605.4	17/18/8	41/12	35.4	16.0
1997	259.7	622.0	16/17/10	39/15	33.3	15.9
1998	308.6	710.7	16/17/12	36/17	33.9	15.9
1999	317.1	758.0	15/17/12	36/18	55.3	21.6
2000	322.5	845.3	15/15/12	31/17	56.1	23.4
2001	354.1	927.1	12/11/12	29/29	57.5	27.2
2002	359.7	1,032.1	13/11/13	23/38	56	23.3

[1]Includes Buckskin, Rawhide, Eagle Butte, Dry Fork, Fort Union, Clovis Point, Wyodak, Caballo, Belle Ayr, Caballo Rojo, Cordero, Coal Creek, Jacobs Ranch, Black Thunder, North Rochelle, North Antelope, Rochelle, and Antelope mines.
[2]Some sites include more than one sampler, so the number of samplers is greater than the number of sites.
[3]Not applicable because no monitoring was done for PM_{10}.

Sources: 1980 through 1996 emissions and production data from April 1997 report prepared by WMA for WDEQ/AQD; 1997 through 2000 emissions data from EPA AIRData database, and production data from WDEQ/AQD.

This period (1980-1998) was associated with significant growth in the surface coal mining industry. Coal production increased from about 59 mmtpy to over 308 mmtpy (an increase of over 249 mmtpy), and associated overburden production increased from 105 mmbcy to over 710 mmbcy per year (a 605 mmbcy per year increase). From 1990 through 2002, the average annual increase in coal production was 7%, while annual overburden production increased an average of 13.9% over the same period. The larger annual increase in overburden production is probably because mines are gradually moving into deeper coals as the shallower reserves are mined out.

The relatively flat trend in particulate emissions from 1980 through 1998 is due in large part to the Wyoming air quality program that requires BACT control measures at all permitted facilities. These control measures include watering and chemical treatment of roads, limiting the amount of area disturbed, temporary revegetating disturbed areas to reduce wind erosion, and timely final reclamation.

The average annual TSP concentration increased from 33.9 Pg/m^3 in 1998 to 55.3 Pg/m^3 in 1999 and 57.5 µg/m^3 in 2001. The 2002 average annual TSP concentration was 56.0 µg/m^3. The average annual PM_{10} concentration increased from 15.9 µg/m^3 in 1998 to 21.6 µg/m^3 in 1999 and 27.2 µg/m^3 through 2001. In 2002, the average annual concentration was at 23.3 µg/m^3. There were no major fires in the region during this time. The increases in coal production over those four years (3.8% per year and 12.8 mmtpy over the four-year period) and associated overburden production (9.8% per year and 72 mmbcy over the four-year period) were not larger than the four-year increases during some of the previous 18 years, but the particulate concentration increase was much larger than in previous years.

Site Specific. For the Buckskin Mine monitoring locations, historical particulate matter ambient air quality data generally show the same results as described above for the PRB as a whole. TSP and monitoring locations are shown on figure 3-5. Figure 3-7 presents the average annual TSP and PM_{10} measured at sites within the West Hay Creek LBA analysis area. These data were collected for 1995 through 2001. Cumulative coal and overburden production for the Buckskin Mine for these years are also shown on figure 3-7.

As discussed above, TSP was the federally regulated pollutant until 1989 and was retained as a state regulated pollutant until 2000. PM_{10} became a federal standard in 1989 and was adopted by the state of Wyoming. There were no violations of the TSP standard at the Buckskin Mine when TSP was the federally regulated pollutant. After 1989 and until recently, TSP measurements were used as a surrogate for PM_{10} in lieu of having to replace and/or co-locate an existing TSP sampler with a new PM_{10} sampler. There were no violations of the PM_{10} standards anywhere in the PRB through the first quarter of 2001. Between April 2001 and June 2003 there were 21 monitored exceedances of the 24-hour PM_{10} standard at four mines in the Wyoming PRB. The Buckskin Mine was responsible for one of these exceedances

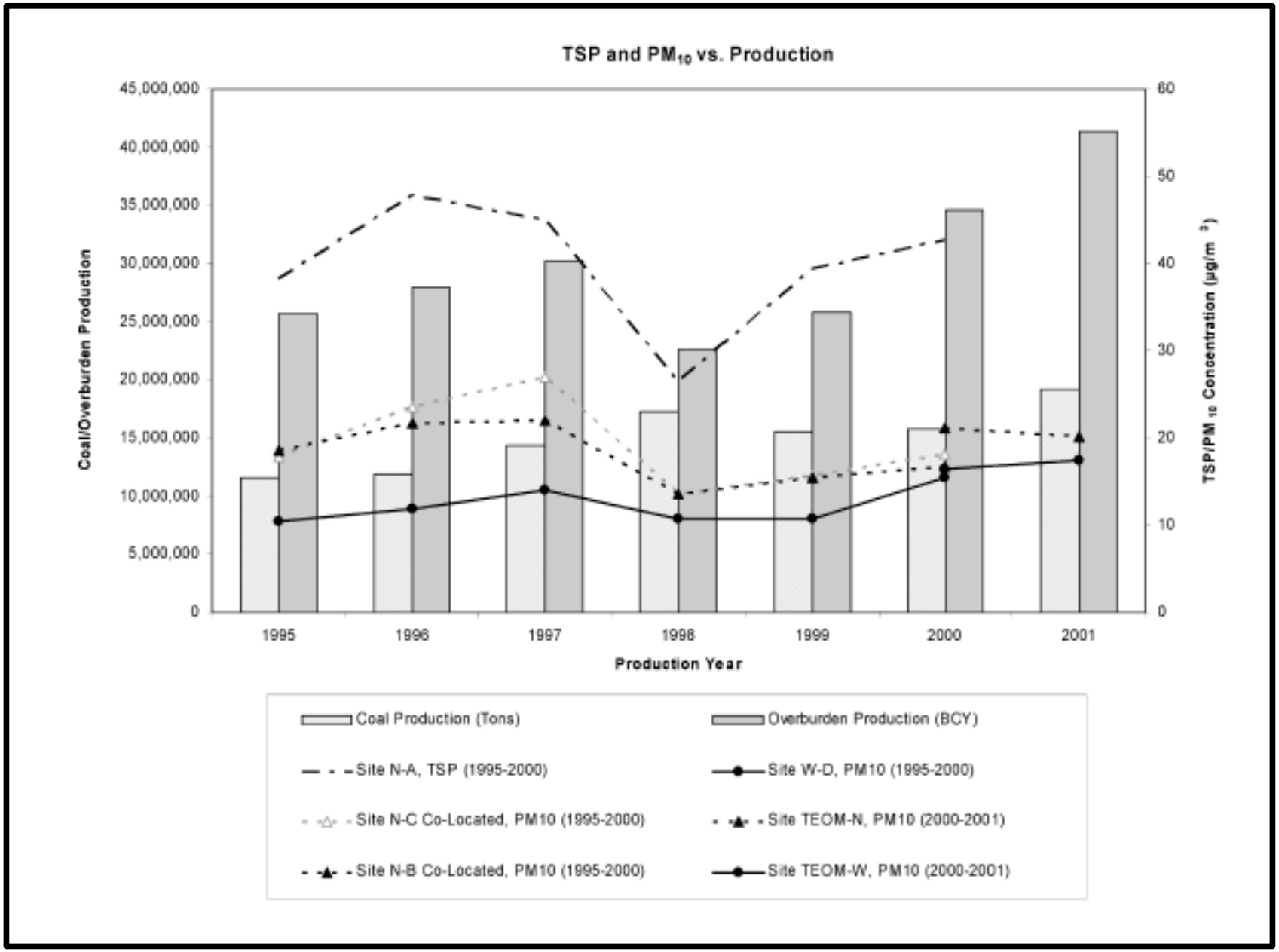


Figure 3-7. Coal Production and Overburden Removal vs. Ambient Particulates for Buckskin Mine

Control Measures. Control of particulate emissions at the southern PRB mines is accomplished with a variety of measures. Emissions at coal crushing, storage, and handling facilities (point sources) are controlled with baghouse dust collection systems, passive enclosure control systems (PECs), or atomizers/foggers. These are all considered BACT controls by WDEQ/AQD.

Fugitive emissions are also controlled with a variety of measures that the agency considers BACT. Typically, mine access roads have been paved and water trucks are used to apply water and chemical dust suppressants on all haul roads used by trucks and/or scrapers. Haul truck speed limits are imposed to further help to reduce fugitive emissions from roads. Material drop heights for shovels and draglines (bucket to truck bed or backfill) are limited to the minimum necessary to conduct the mining operations. Timely permanent and temporary revegetation of disturbed areas is used to minimize wind erosion. Fugitive emissions from the coal truck dumps are controlled with stilling sheds. Some of the mines have participated in the control of fugitive emissions from some nearby unpaved county roads by applying dust suppressants. All of these control measures are employed at the Buckskin Mine.

The WDEQ/AQD is continually reviewing the data and considering regulatory options. WDEQ/AQD has increased monitoring frequency requirements and required installation of continuous monitors at all PRB coal mines. Other regulatory options may include enforcement actions such as a notice of violation resulting in a consent decree and/or modified permit condition. WDEQ/AQD is also coordinating with EPA to develop additional monitoring requirements in CBM development areas, high PM_{10} mitigation action plans in permits, and additional mitigation measures under the State Implementation Plan.

Some of the coal mines are actively participating in a dust control coalition formed to help address dust from more than 20 miles of regional county roads. The coalition includes the Campbell County Commission and several regional CBM and oil producing companies as well as the coal mine operators. The coalition has used chemical treatments to control dust as well as closing roads where appropriate or necessary and rebuilding existing roads to higher specifications.

Other operational control measures that WDEQ/AQD may require at specific mines when exceedances occur include, but are not limited to, watering inactive areas and problem areas; relocating overburden truck-dumping operations; deferring blasting; curtailing topsoil stripping, reclamation dozer operations, and/or production operations; requiring windrows in areas stripped of topsoil; requiring treatment of windrow areas with chemical dust suppressants; interseeding of topsoil stockpiles, and soil stabilization. The mines are experimenting with dust control treatments, including magnesium chloride, surfactants, and petroleum-based products. In addition, WDEQ/AQD may require additional monitoring, action levels based on continuous monitoring, expedited reporting of monitored exceedances, detailed reporting of contributing factors (meteorological conditions, control steps implemented) for monitored exceedances, and continual evaluation of activity plans when exceedances are monitored at surface coal mines.

Historical Ambient Air Quality: NO_2

Regional. NO_2 was monitored from 1975 through 1983 in Gillette and from March 1996 through April 1997 at four locations in the PRB. Table 3-5 summarizes the results of that monitoring. Beginning in 2001 the coal industry in cooperation with WDEQ/AQD installed a network of NO_2 monitors in the PRB. The 2001 and 2002 data from this regional network are summarized in table 3-6.

TABLE 3-5

ANNUAL AMBIENT NO_2 CONCENTRATION DATA

Site	Gillette	Black Thunder Mine	Belle Ayr Mine	Bill
Year	**Percent of Standard[1]**	**Percent of Standard[1]**	**Percent of Standard[1]**	**Percent of Standard[1]**
1975	6			
1976	4			1
1977	4			5
1978	11			
1979	11			
1980	12			
1981	14			
1982	11			
1983[2]	17			
1996[3]	16	16	22	22

[1]Based on arithmetic averaging of data.
[2]Monitoring discontinued December 1983, reactivated March 1996 to April 1997.
[3]Arithmetic average - actual sampling ran from March 1996 to April 1997.
*Inadequate number of samples for a valid annual average.

Source: McVehil-Monnett 1997

Annual NO_2 levels measured in the March 1996 to April 1997 timeframe were below applicable standards. The highest reading was 22 Pg/m^3 as compared to the 100 Pg/m^3 standard. All 2001 annual mean NO_2 concentrations are well below the standards of 100 µg/m^3.

Site Specific. As discussed above, NO_2 monitoring results are available from several sites in the PRB. The Gillette monitoring site is located approximately 12 miles south of the West Hay Creek LBA tract, the Belle Ayr Mine site is located approximately 24 miles south, the Black Thunder Mine site is located approximately 53 miles south, and the Bill site is located approximately 73 miles south.

TABLE 3-6

2001 ANNUAL AMBIENT NO_2 CONCENTRATION DATA

Monitor	2001Annual Mean NO_2 Concentration ($\mu g/m^3$)[1,2]	2002 Annual Mean NO_2 Concentration ($\mu g/m^3$)[3,4]
Antelope Mine	7	6
Belle Ayr Mine	14	14
Black Thunder Mine	5*	6
TBNG	6**	5

* Data for the 3rd quarter is questionable; therefore, it was not used in determining the annual mean for the site.
** Data for May through December 2001. Monitor was not operational until May 2, 2001.
[1]Mine Data (WDEQ/AQD 2002)
[2]TBNG Site (ARS 2002)
[3]Mine Data (WDEQ/AQD 2003a)
[4]TBNG Site (ARS 2003)

Control Measures. To date, there have not been any reported events of public exposure to blasting clouds or NO_2 releases at the Buckskin Mine. Buckskin has voluntarily committed to limit the size of individual shots to control emissions. As a result, the WDEQ/LQD has not required the Buckskin Mine to implement any specific measures to control or limit public exposure to NO_2 from blasting.

Some of the mines in the PRB have implemented programs designed to control/limit public exposure to the intermittent, short-term NO_2 releases associated with blasting. All mines comply with the blasting plan publication and notification requirements associated with the permits to mine issued by WDEQ/LQD.

Voluntary measures that have been instituted by some mines include:

- x telephoning neighbors and workers in the general area of the mine prior to large blasts;
- x monitoring weather and atmospheric conditions prior to the decision to detonate a large blast;
- x minimizing blast size to the extent possible; and
- x posting signs on major public roads that enter the general mine area and on all locked gates accessing the active mine area.

WDEQ has received several reports of public exposure to NO_2 from blasting operations at

several mines in the PRB. Measures to prevent future such incidences have been instituted at those mines when large overburden blasts are planned. These measures are required by permit and include:

- x notification of neighbors and workers in the general area of the mine prior to the blast;
- x blast detonation between 12:00 p.m. and 3:00 p.m. whenever possible to avoid temperature inversions and minimize inconvenience to neighbors;
- x monitoring of weather and atmospheric conditions prior to the decision to detonate a blast;
- x posting of signs on major public roads that enter the general mine area and on all locked gates accessing the active mine area; and
- x closing public roads when appropriate to protect the public.

Mine operators in the eastern PRB have also been working with blasting agent manufacturers to reduce NO_x emissions by changing the size of the blasts and using different blasting agents, mixtures, and additives. Operators have tried adding substances like microspheres and rice hulls, using different blends of ANFO and slurries and gels, and using electronic detonation systems that can vary shot timing, different shot hole patterns, and plastic liners. No one single procedure or variation has proven consistently successful due to the numerous factors that are believed to contribute to the production of NO_2. The most successful control measure has been reducing the size of the cast blasting shots. (Rick Chancellor 2003).

Air Quality Related Values - Visibility and Acidification of Lakes

Air quality related values (AQRVs), including the potential air pollutant effects on visibility and the acidification of lakes and streams, are applied to PSD Class I and sensitive Class II areas. The land management agency responsible for the Class I area sets a level of acceptable change (LAC) for each AQRV. The AQRVs reflect the land management agency's policy and are not legally enforceable standards.

Visibility. Potential impacts to visibility were considered at 29 PSD Class I and sensitive Class II areas near the PRB. Table 3-3 shows the nearest distances from the sensitive receptor areas to the West Hay Creek LBA tract analysis area.

Visibility can be defined as the distance one can see and the ability to perceive color, contrast, and detail. Fine particulate matter ($PM_{2.5}$) is the main cause of visibility impairment. Visual range, one of several ways to express visibility, is the furthest distance a person can see a landscape feature. Maximum visual range in the western United States would be about 140 miles.

Visibility impairment is expressed in terms of deciview (dv). The dv index was developed as a linear perceived visual change (Pitchford and Malm 1994) and is the unit of measure used in the EPA's Regional Haze Rule to achieve the national visibility goal. A change in visibility of 1.0 dv represents a "just noticeable change" by an average person under most circumstances. Increasing dv values represent proportionately larger perceived visibility impairment. Figure 3-8 shows annual averages for the 20% best, worst and middle visibility days at Badlands and Bridger wilderness areas from 1988 to 1998, respectively (IMPROVE 2002)[1].

Acidification of Lakes. The acidification of lakes and streams is caused by atmospheric deposition of pollutants (acid rain). Lake acidification is expressed as the change in acid neutralizing capacity (ANC) measured in microequivalents per liter (Peq/l), the lake's capacity to resist acidification from acid rain. Table 3-7 shows the existing ANC monitored in some mountain lakes disturbed by mining activities.

TABLE 3-7

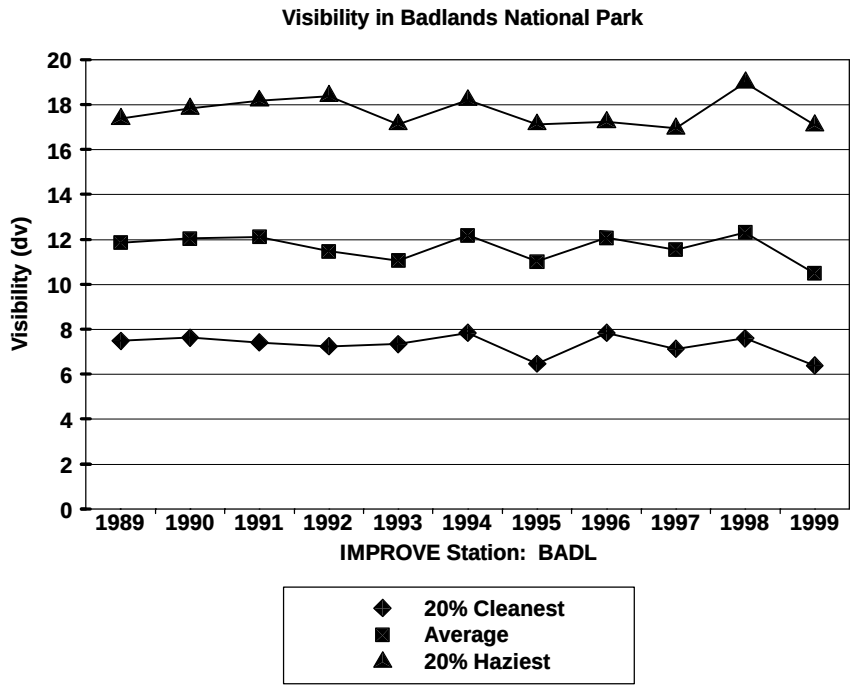
EXISTING ACID NEUTRALIZING CAPACITY IN SENSITIVE LAKES

Wilderness Area	Lake	Background ANC (Peq/L)	Distance from Analysis Area (miles)
Bridger	Black Joe	69.0	210
	Deep	61.0	210
	Hobbs	68.0	225
	Upper Frozen	5.8[1]	215
Cloud Peak	Emerald	55.3	85
	Florence	32.7	80
Fitzpatrick	Ross	61.4	215
Popo Agie	Lower Saddlebag	55.5	210

1 The background ANC is based on only 6 samples taken between 1997 and 2001

Source: Argonne 2002

1 Summaries are based on IMPROVE aerosol data using procedures from the EPA *Draft Guidance for Tracking Progress under the Regional Haze Rule*.



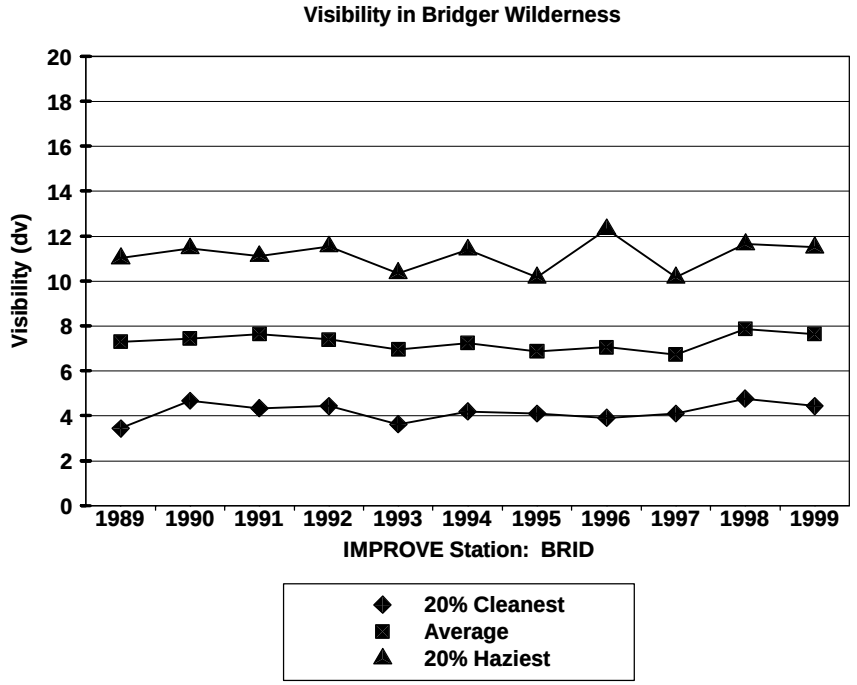


Figure 3-8. Visibility in the Badlands and Bridger Wilderness Areas.

WATER RESOURCES

Groundwater

Within the West Hay Creek LBA tract there are three water-bearing geologic units that could be disturbed by mining. In descending order, these units are the alluvium, Wasatch Formation overburden, and the Wyodak coal seam or its local equivalent, which in this case would be the Anderson and Canyon coal seams. The subcoal Fort Union Formation is used for water supply at the Buckskin Mine but will not be physically disturbed by mining activities. Figure 3-2 shows the stratigraphic units beneath the West Hay Creek LBA tract and their hydrologic properties.

Triton has completed 22 monitoring wells within the West Hay Creek tract analysis area, most in 1999. Six of these are in the alluvium of Hay Creek, six are in Anderson Coal, four are in Canyon Coal, and six are in the Wasatch Formation overburden. The location of these monitoring wells is shown on figure 3-9. Data from these wells, as well as previously collected data at the Buckskin Mine, were used to prepare the following description of baseline groundwater conditions within the LBA tract analysis area.

Recent Alluvium. Within the West Hay Creek LBA tract, the surface drainages are generally dry draws and the alluvium, colluvium, and slope wash deposits associated with these draws are generally thin. In addition, these unconsolidated deposits are typically of limited lateral extent precluding any significant storage and movement of groundwater. The texture of the alluvium becomes coarser with depth.

Wasatch Formation. Within the PRB this 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 largely used for stock watering. Because the saturated sandstone and coal units within the Wasatch Formation are not continuous, the Wasatch is not considered 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 that 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. These deposits occur along the northern boundary of the LBA tract under the Proposed Action and within the action alternative 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.

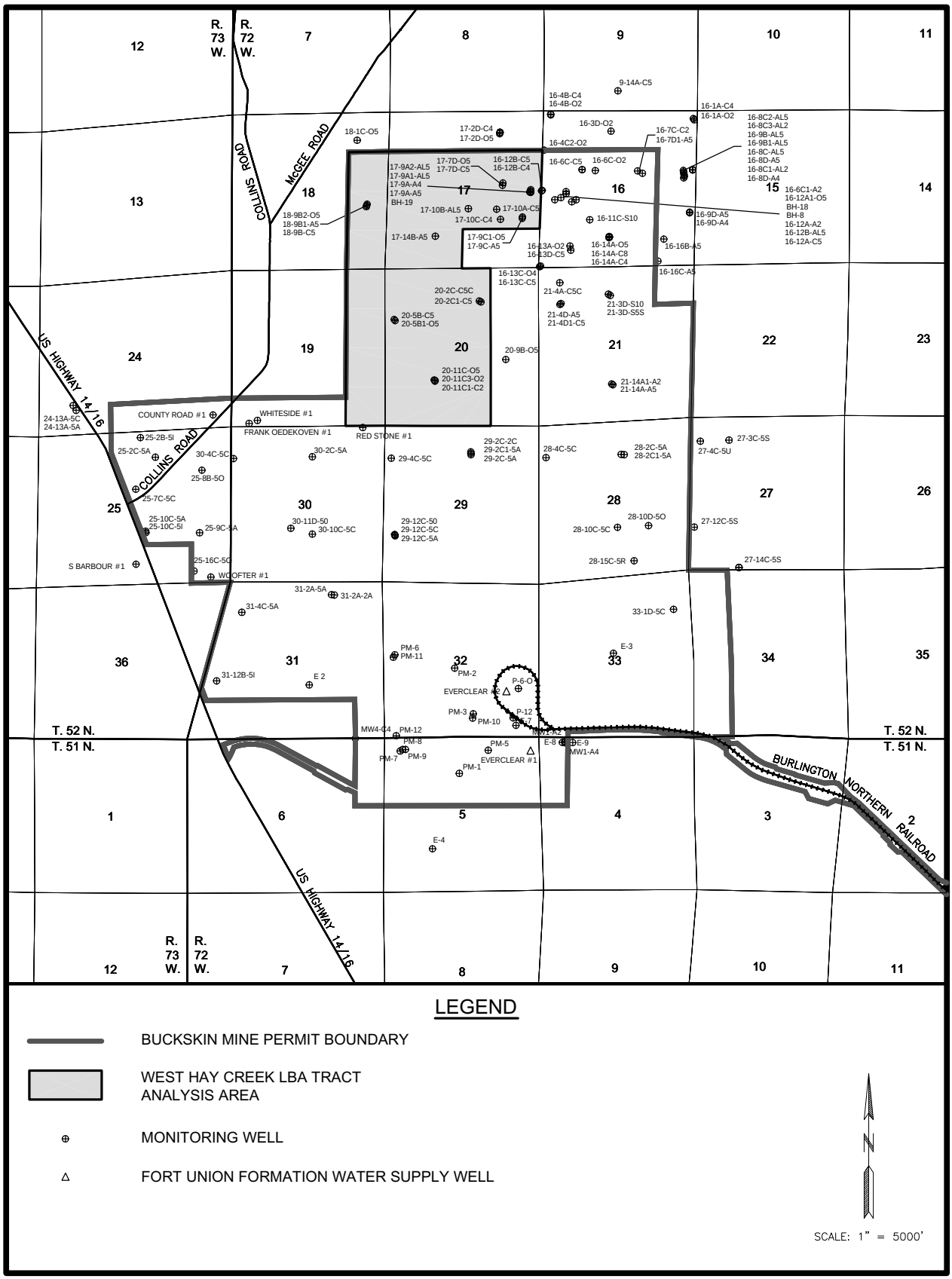


Figure 3-9. Monitoring Well Locations Within and Near the West Hay Creek LBA Tract and Fort Union Formation Water Supply Well Locations at the Buckskin Mine.

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 feet per day to 10^2 feet per day. The geometric mean hydraulic conductivity based on 203 tests was 0.2 feet per day. The geometric mean hydraulic conductivity from 70 aquifer tests using wells completed in sandstone in the Wasatch overburden was 0.35 feet per day, while that from 63 aquifer tests completed in siltstone and claystone in the Wasatch overburden was 0.007 feet per day (Rehm et al. 1980). Aquifer tests from Wasatch overburden within and adjacent to the West Hay Creek LBA tract present an aquifer hydraulic conductivity range of 0.04 to 13 feet per day, depending primarily on the presence and amounts of shallow sands within the low-permeability silts and clays that make up the majority of the overburden (Appendix D6, Buckskin Mine WDEQ/LQD permit).

Water quality in the Wasatch Formation is generally poor, with total dissolved solids (TDS) concentrations ranging from approximately 1,800 mg/L to 3,400 mg/L near the LBA tract. Groundwater from the Wasatch Formation is predominantly a calcium and magnesium sulfate type within the Buckskin Mine area and the West Hay Creek LBA tract.

Wyodak Coal. Due to its continuity, the Wyodak coal seam is considered a regional aquifer within the PRB. Within the West Hay Creek LBA tract, the Wyodak coal contains a parting, which divides the seam into two separate mineable seams (the Anderson and Canyon). Despite the occurrence of separate seams, the Wyodak coal is considered a single aquifer in the general analysis area.

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, are created by the expansion of the coal as the weight of overlying sediments is 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 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.

Aquifer tests conducted in the monitoring wells completed in the Anderson and Canyon seams within and adjacent to the West Hay Creek LBA tract. Coal aquifer hydraulic conductivity measured within and adjacent to the LBA tract at the Buckskin Mine ranges from 0.13 to 950 feet per day (Appendix D6, Buckskin Mine WDEQ/LQD permit). The USGS reports an average coal aquifer hydraulic conductivity of 0.8 feet per day for the general area (Martin et al. 1988).

The chemistry of groundwater in the coal within the adjacent Buckskin Mine and the West Hay Creek LBA tract is variable. Quality is similar between the Anderson and Canyon seams. In general, it is a calcium sulfate type with relatively high TDS concentrations (1,000 to 3,900 mg/L) although sodium bicarbonate type samples have also been identified. Calcium, magnesium and sulfate-rich Anderson coal groundwater found within the LBA tract and adjacent areas is uncharacteristic of the sodium bicarbonate dominated groundwater from the same unit within Buckskin Mine's historic permit area. Some groundwater influence to both coal units by overlying overburden aquifers occurs east of the proposed LBA tract near overburden and scoria contacts where both seams are shallow. In two wells in the Canyon seam within the LBA tract, TDS concentrations are less than 1,500 mg/L; low relative to typical overburden units.

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 Triton near the LBA tract and presented in the GAGMO 20-year report (Hydro Engineering 2001) indicate that the groundwater flow directions have been influenced by mining and CBM activities. Groundwater flow within the coal aquifer near the LBA tract is now to the west and southwest.

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 the thickness of the aquifer. It 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 square feet per day.

Triton has completed two wells in the subcoal Fort Union Formation to supply water to the Buckskin Mine. The wells range in depth from 1,362 to 1,510 feet. Figure 3-9 shows the Buckskin Mine supply wells, designated as Everclear-1 and Everclear-2. A search of groundwater rights was conducted using Wyoming State Engineer's Office (SEO) records for the West Hay Creek LBA tract analysis area. This search identified a total of 656 permitted groundwater rights within 3 miles of the tract, of which 231 wells are owned by coal mining companies. The remaining 425 wells are presented in appendix F. The SEO data does not record the water-producing formation but typically does record the well depth. Of the 656 wells identified, only 12 wells had completion depths in excess of 1,000 feet. Wells of this completion depth could conceivably be producing from the Tullock Member of the Fort Union Formation.

The water quality of the Fort Union Formation is generally good. Water from this aquifer is typically 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 to supply water for the Buckskin Mine.

Surface Water

Overall, the West Hay Creek LBA tract is similar in topography to the Buckskin Mine permit area. Slopes range from flat to about 22%. The area surrounding the West Hay Creek 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, both rain and snow storms increase soil moisture, hence decreasing infiltration capacity. 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 West Hay Creek LBA tract are displayed in figure 3-10.

The only named stream within the LBA tract is Hay Creek, which flows from west to east through the LBA tract and joins the Little Powder River about 3 miles east of the LBA tract. Hay Creek is a minor headwater stream in the regional drainage network of the Little Powder River. Hay Creek exhibits both intermittent and ephemeral flow characteristics. It is not identified on the USGS hydrologic map of the state of Wyoming nor is it specifically listed in the Surface Water Classification List described in chapter I of the WDEQ/WQD Rules and Regulations. Under the WDEQ/WQD regulations, Hay

Creek is classified as a Class 3B stream that is protected for aquatic life (other than fish), recreation, agriculture, industrial uses, and scenic value.

Class 3B waters are tributary waters including adjacent wetlands that are not known to support fish populations or drinking water supplies and where those uses are not attainable. Class 3B waters are intermittent and ephemeral streams with sufficient hydrology to normally support and sustain communities of aquatic life including invertebrates, amphibians, or other flora and fauna that inhabit waters of the state at some stage of their life cycles.

Hay Creek is a third order stream where it leaves the Buckskin Mine's downstream permit boundary but a first order stream where it enters the permit boundary. Hay Creek's watershed at the upstream LBA tract boundary is 2.34 square miles, excluding a closed basin occupying 0.14 square miles primarily in the W½ of section 18. At its confluence with the Little Powder River, Hay Creek drains 14.96 square miles, again excluding closed basin watersheds.

Within the Buckskin Mine permit boundary, the Hay Creek channel has a horizontal length of approximately 16,580 feet based on measurements made on a 10-foot contour interval map prepared from aerial photography and extrapolating the original channel alignment through several channel impoundments. The valley length over the same reach is about 13,290 feet; hence, the ratio of the channel length to valley length (sinuosity ratio) is 1.25. This is a relatively small sinuosity characteristic of immature streams of low order. The channel elevation declines 99.5 feet over the channel length between the permit boundary crossings. This is equivalent to an average channel slope of 0.0060 feet per feet.

Within the LBA tract analysis area, there are three small impoundments on the main channel of Hay Creek: Impoundment 3, Impoundment 4, and McGee Reservoir (figure 3-10). Immediately to the south of McGee Reservoir, another small impoundment known as Mader Reservoir is located just outside of the LBA tract analysis area on a side channel of Hay Creek. All of these have estimated storage capacities of less than 2 acre-feet, with the exception of McGee Reservoir which has an estimated capacity of about 21 acre-feet.

McGee Reservoir typically fills each summer because of runoff and groundwater overflow from Impoundment 4. Pool elevations in McGee Reservoir fluctuate some five to six feet each year but storage is sufficient to support small fish (fat-head minnows and green sunfish). Mader Reservoir intercepts the water table in sandy slope wash/sheetwash sediments derived from weathering of local, surficial sandstone units. The pool elevation in Mader Reservoir fluctuates little, and it is only about one to two feet deep.

Upstream from McGee Reservoir, the Hay Creek channel is little more than a grassed swale except for a few bedrock cutbanks. Downstream from the reservoir, the channel becomes progressively more incised in slope wash deposits and is typically rectangular

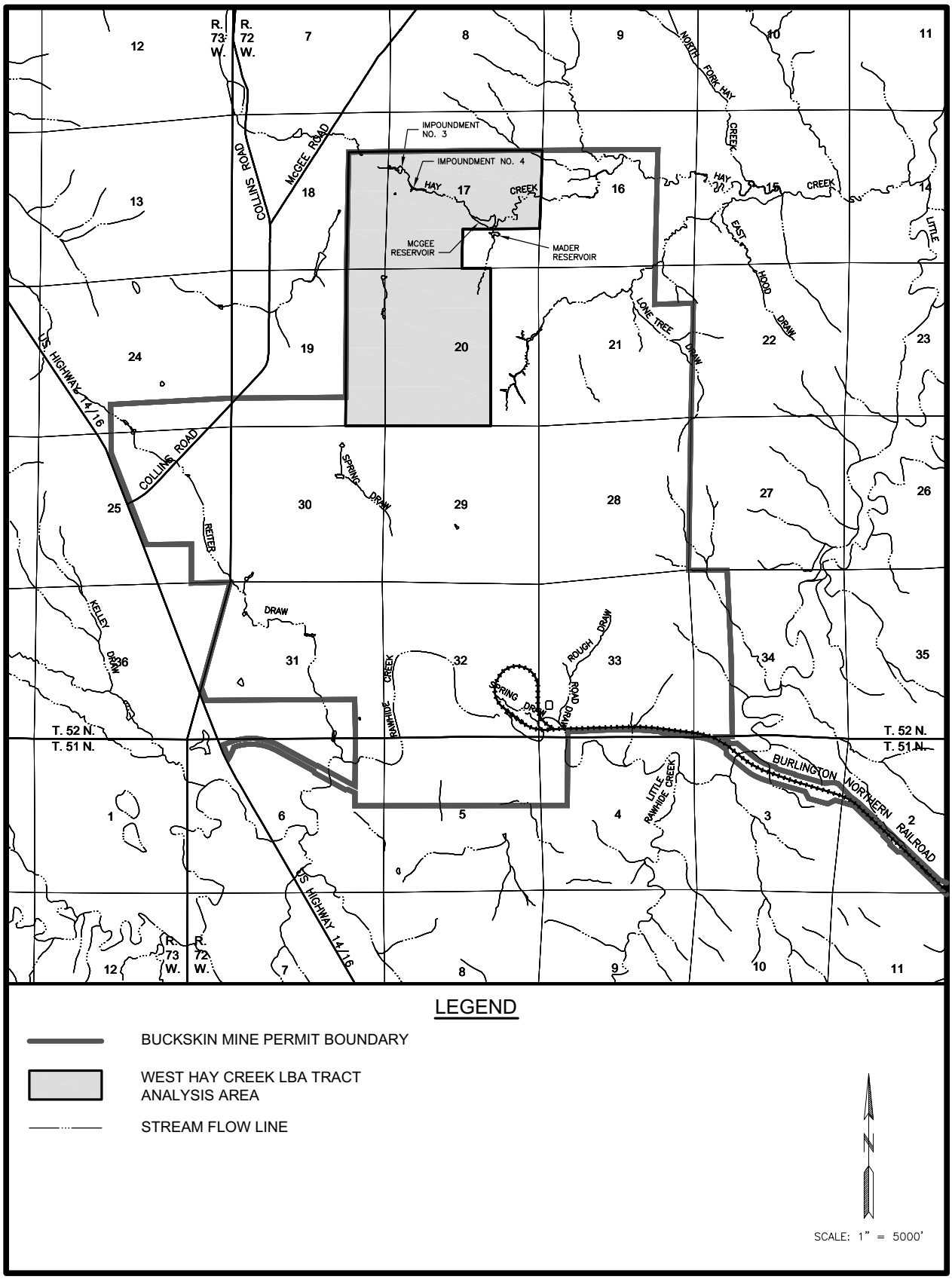


Figure 3-10. Surface Water Features Within and Adjacent to the West Hay Creek LBA Tract.

to parabolic in shape.

The Buckskin Mine monitored flows and water quality in Hay Creek during 1999 and 2000. Several seeps and springs associated with the Hay Creek drainage within the Buckskin Mine permit area were also monitored. Most local surface waters are a calcium sulfate-type that exceeds WDEQ domestic use standards for sulfate and TDS depending on flow rate and sample location. Several of the upstream samples are sodium bicarbonate type and are believed to be influenced by CBM pumping activities. Surface water quality is usually unsuitable for domestic use, marginal for irrigation, and suitable for stock and wildlife.

Water Rights

Records at the Wyoming State Engineer's Office were searched for groundwater rights within a 3-mile radius of the West Hay Creek LBA tract analysis area. This information is required for WDEQ permitting. SEO data from a records search conducted March 2004 indicate there are 656 permitted water wells within 3 miles of the tract, of which 36 permitted wells are within the LBA tract Preferred Alternative. Water rights, which have been abandoned or cancelled, have been excluded from the search.

Of the total number of wells within the search area, coal mining companies own 231 wells (35%). Of the remaining 425 wells within the search area, approximately 68% are permitted for stock watering, 17% are permitted for miscellaneous use, 81% are permitted for CBM development, and 9% are permitted for domestic use. Other uses amounted to less than 1%. Most of these wells have been permitted for multiple uses. Appendix F contains a listing of the 425 non-coal mine wells and associated water rights information.

SEO records were searched for surface water rights using the SEO's computer database. The search was conducted for surface-water rights within ½ mile of the LBA tract and 3 miles downstream from the permit boundary, as required for WDEQ permitting. This search area covers all of the LBA as applied for and all alternatives.

SEO records indicate 21 permitted surface water rights within the search area. Eleven of the surface water rights are held by a coal mining company, and two are held by oil and gas companies. The remaining eight other surface water rights are for irrigation, stock watering, and domestic use. Appendix F shows a listing of the 10 non-coal mine surface water rights.

Alluvial Valley Floors (AVFs)

WDEQ regulations define AVFs as unconsolidated stream laid deposits where water availability is sufficient for subirrigation or flood irrigation agricultural activities. Prior to leasing and mining, AVFs must be identified because SMCRA restricts mining activities that affect AVFs that are determined to be significant to agriculture. Impacts to designated AVFs 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 conducted by Triton to determine the presence of AVFs within and surrounding the Buckskin Mine and analysis area determined there were no AFVs within that area. The WDEQ has concurred with that finding. The nearest declared AVF is south of the analysis area along Rawhide Creek. Portions of that AVF area have been disturbed by mining and re-established by Triton.

Wetlands

"Waters of the US" is a collective term for all areas subject to regulation by the Corps of Engineers (COE) (section 404 of the Clean Water Act). "Waters of the US" include special aquatic sites, wetlands, and jurisdictional wetlands. Special aquatic sites are large or small geographic areas that possess special ecological characteristics of productivity, habitat, wildlife protection, or other important and easily disrupted ecological values (40 CFR 230.3). Wetlands are a type of *special aquatic site*, which 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. As the result of a recent Supreme Court ruling *(Solid Waste Agency of Northern Cook County v. United States Army Corps of Engineers, January 9, 2001)* non-navigable, isolated intrastate wetlands (playas) and other waters of the US are not considered jurisdictional. Navigable, non-isolated wetlands and other waters of the US are still considered jurisdictional by the COE.

Many wetland scientists consider areas that contain only one of the three criteria listed above as functional wetlands. The FWS used this categorization in producing the National Wetland Inventory (NWI) 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 becomes a part of the mine permit document. The reclamation plan is revised to incorporate at least an equal type and number of jurisdictional wetlands.

Jurisdictional wetland inventories were conducted within the analysis area in 1999 and 2000. The 2000 survey also redelineated the jurisdictional wetlands on land in the S½S½ of sections 19 and 20, T. 52 N., R. 72 W. These lands were first surveyed in 1993. The wetlands delineation was completed in accordance with the procedures and criteria contained in the *Wetland Delineation Manual.* The consolidated delineation was subsequently approved by the COE in April 2001. Buckskin Mine then obtained authorization under the COE Programmatic General Permit 99-03 in July 2001. A total of 23.86 acres of waters of the US have been identified within the LBA analysis area, of which 17.52 acres are jurisdictional wetlands (figure 3-11). Identified jurisdictional wetlands include Riverine - emergent marsh (9.82 acres) and Riverine - wet meadow (7.7 acres). The additional 6.34 acres of waters of the US, which did not qualify as jurisdictional wetlands, include impoundment - stockponds, intermittent/perennial pool (4.20 acres), and riverine - natural ponds (2.14 acres). In addition, approximately 1,811 linear feet of nonwetland waters of the US have been inventoried within the LBA analysis area.

VEGETATION

A vegetation baseline study was completed by Triton on the lands contained within the West Hay Creek LBA tract as applied for under the Proposed Action and the action alternatives in 1999. The baseline study area is located within the northwest portion of the current Buckskin Mine permit area. The vegetation communities in this area were delineated, mapped, and sampled in accordance with the current WDEQ/LQD requirements. The results of the baseline studies, including the Proposed Action lands, were reviewed and approved by WDEQ/LQD as part of an earlier permit amendment. Sampling was conducted on a large enough area to include sufficient room for overburden layback and other mining needs to recover the coal under the Proposed Action, the Preferred Alternative, and Alternative 3 tracts.

A total of eight vegetation types have been identified and mapped within the analyses area. Table 3-8 presents the acreage and percent of the area encompassed by each vegetation type. Figure 3-12 shows the eight vegetation communities, previously disturbed areas, and areas covered by surface water. The vegetation types include lowland prairie, mixed grass prairie, sand prairie, big sagebrush, silver sagebrush, riparian bottomland, agricultural pasture, and agricultural cropland. In addition to the eight vegetation communities, there is also a plains cottonwood tree shelterbelt containing 37 trees located within the analysis area.

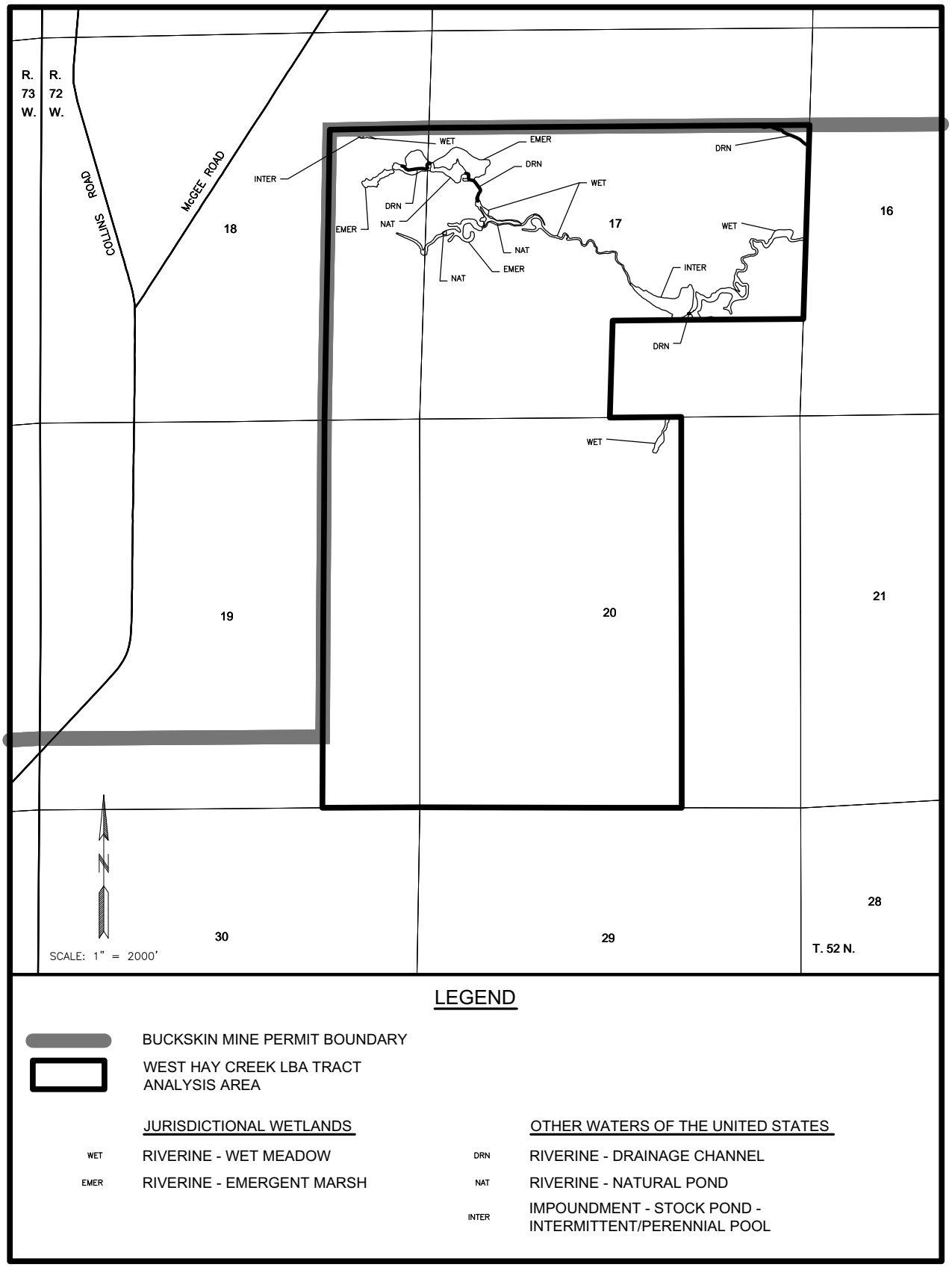


Figure 3-11. Wetlands Within the West Hay Creek LBA Tract Analysis Area.

TABLE 3-8

VEGETATION TYPES WITHIN THE ANALYSIS AREA

Vegetation Type	Acres	Percent of Area
Sandy Prairie Grassland	461.4	40%
Big Sagebrush Shrubland	238.9	21%
Agricultural B Pastureland, High Management	129.7	11%
Agricultural B Cropland	117.3	10%
Lowland Prairie Grassland	55.0	5%
Silver Sagebrush Shrubland	50.7	4%
Agricultural B Pastureland, Moderate Management	47.8	4%
Riparian Bottomland	19.4	2%
Mixed Grass Prairie	7.3	1%
Disturbed by previous Nonmining activities	25.5	2%
Surface Water	6.9	1%
Cottonwood Shelterbelt	0.9	< 0.1%
Total	1,160.8	100.00%

Vegetation Types

The *Lowland Prairie Type* occurs on gently sloping plains and benches adjoining subirrigated bottoms and in closed basins. This type tended to occur on saline soils.

Vegetative cover in the lowland prairie type averages 76%; total ground cover averaged 97%. In order of relative cover, perennial graminoids were dominant with 61% cover followed by perennial forbs (12%) and subshrubs (2%). Dominant grass/grasslike species include Kentucky bluegrass (*Poa pratensis*), alkali bluegrass (*Poa juncifolia*), inland saltgras (*Distichlis stricta*), crested wheatgrass (*Agropyron cristatum*), slender wheatgrass (*Elymus trachycaulus*), Douglas sedge (*Carex douglasii*), and alkali sacaton (*Sporobolus airoides*). The common forbs are yellow sweetclover (*Melilotus officinalis*), western ragweed (*Ambrosia psilostachya*), wild licorice (*Glycyrrhiza lepidota*), prostrate verbena (*Verbena bracteata*), wavyleaf thistle (*Cirsium undulatum*), western yarrow *Achillea lanlulosa*), and blue lettuce (*Lactuca oblongifolia*). Shrubs and subshrubs are not dominant components. Common shrubs and subshrubs include rubber rabbitbrush (*Chrysothamnus nauseosus*), cudweed sagewort (*Artemisia ludoviciana*), fringed sagewort (*Artemisia frigida*), and broom snakeweed (*Guiterrezia sarothrae*).

Total perennial/biennial herbaceous production averages 1,849 pounds per acre. Perennial grasses (77% relative production) and perennial forbs (12% relative production) provided most production.

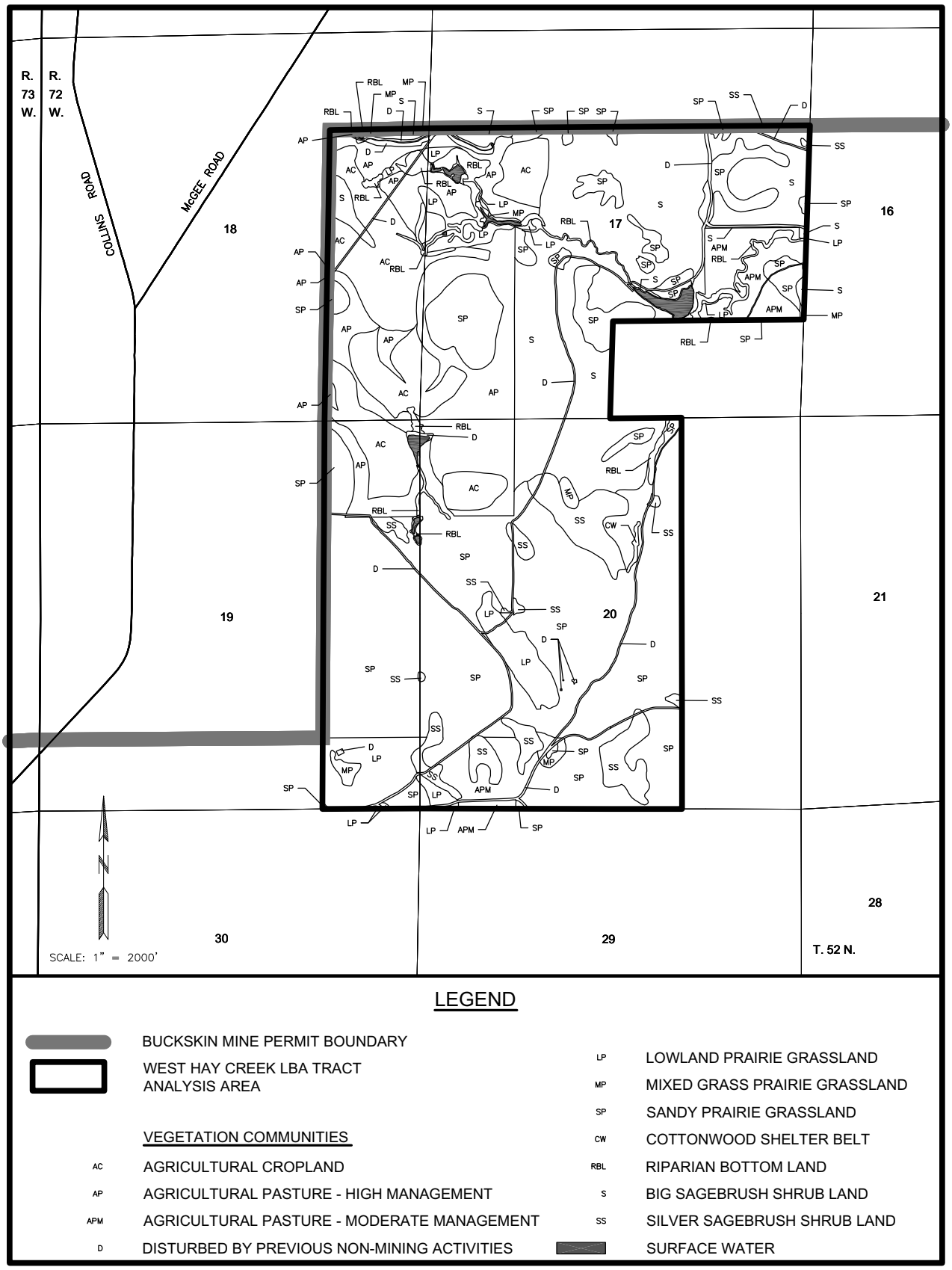


Figure 3-12. Vegetation Communities Within the West Hay Creek LBA Tract Analysis Area.

Shrub density averaged 53 plants per acre. Silver sagebrush was the predominant shrub (85% of all shrubs). Subshrub density averages 16 plants per acre (50% broom snakeweed and 50% fringed sagewort).

The *Mixed Grass Prairie Type* occupies rolling hills and ridges where soils are moderately deep to deep. This type occurs most frequently on loams, sandy clay loams, fine sandy loams, and sandy loams and is likely to occur on the Bidman, Cambria, Kishona, Lawver, Teckla, Wibaux, and Hiland soil series.

Vegetative cover averages 60%; total ground cover averages 88%. In order of relative cover, perennial graminoids are dominant with 62% followed by perennial forbs (10%), shrubs (1.3%) and subshrubs (1%). Dominant grass/grasslike species in the mixed grass prairie include needle-and-thread (*Stipa comata*), prairie junegrass (*Koeleria macrantha*), and western wheatgrass (*Agropyron smithii*). Dominant forbs include western ragweed (*Ambrosia psilostachya*), Sawatch knotweed (*Polygonum sawatchense*), scarlet globemallow (*Sphaeralcea coccinea*), Hood's phlox (*Phlox hoodii*), prairie coneflower (*Ratibida columnifera*), and prairie evening primrose (*Oenothera albicaulus*). Common shrubs and subshrubs are big sagebrush, silver sagebrush, four-wing saltbush (*Atriplex canescens*), broom snakeweed (*Guiterrezia sarothrae*), and fringed sagewort (*Artemisia frigida*).

Total perennial/biennial herbaceous production average 934 pounds per acre. Perennial grasses (78% relative production), perennial forbs (10% relative production), forbs (10%), provided the most production, with shrubs (1.3%), and subshrubs (1%) providing a minor component of production.

Shrub density averages 700 plants per acre, 63% of which are Wyoming big sagebrush, 35% of which are silver sagebrush, and 2% of which are four-wing saltbush. Subshrub density averages 571 plants per acre (26% broom snakeweed, 64% fringed sagewort, and 3% four-wing saltbush).

The *Sandy Prairie Type* occurs on rolling hills and plains and is associated with windblown areas. This type commonly occupies areas with deep to moderately deep fine sandy loams and sandy loams. Thus, it is likely to occur in Terro, Vonalee, and Vonalf soils.

Vegetative cover averages 57%; total ground cover averages 84%. In terms of relative cover, perennial graminoids are dominant at 65% followed by perennial forbs (11%) and shrubs (3%). Dominant grass/grasslike species include needle-and-thread (*Stipa comata*), prairie sandreed (*Calamovilfa longifolia*), prairie junegrass *(Koeleria macrantha)*, threadleaf sedge (*Carex filifolia*), sand bluestem (*Andropogon hallii*) and crested wheatgrass (*Agropyron cristatum*). The common forbs are western ragweed (*Ambrosia psilostachya*), hairy golden aster (*Heterotheca villosa*), scarlet guara (*Gaura coccinea*), wild licorice (*Glycyrrhiza lepidota*), and low pussytoes (*Antennaria dimorpha*). Common subshrubs and shrubs are prickly phlox (*Leptodactylon pungens*), silver sagebrush (*Artemisia cana*), and Wyoming big sagebrush (*Artemisia tridentata wyo.*).

Total perennial/biennial herbaceous production averages 1,224 pounds per acre and is mainly perennial grasses (78% relative production) and perennial forbs (11% relative production).

Shrub density averages 789 plants per acre--silver sagebrush (48%), Wyoming big sagebrush (20%) and four-wing saltbush (12%) are predominant. Subshrub density averages 1,085 plants per acre with fringed sagewort (90%) and yucca (7%).

The *Big Sagebrush Type* occurs on a variety of topographic locations including gentle slopes, and rolling hills within the analysis area. It commonly occurs on shallow clay loams (such as Theedle and Shingle series) and deep loams (such as Forkwood and Cushman series) and occasionally occurs on sandy loams. Thus, it could occur throughout the analysis area although it was unlikely to occur on sandy windblown deposits.

Vegetative cover in the big sagebrush type averages 63%; total ground cover averages 90%. In order of relative cover, perennial graminoids contribute 42% followed by shrubs (19%), subshrubs (6%), and perennial forbs with 4%. Dominant grass/grasslike species include needle-and-thread (*Stipa comata*), prairie junegrass (*Koeleria macrantha*), Kentucky bluegrass (*Poa pratensis*), western wheatgrass (*Agropyron smithii*), native bluegrass (*Poa secunda secunda*), and green needlegrass (*Stipa viridula*). Common forbs include Hood's phlox (*Phlox hoodii*), silverleaf scurfpea (*Psoralea argophylla*) scarlet gaura (*Gaura coccinea*), and western yarrow (*Achillea lanulosa*). Common shrubs and subshrubs are Wyoming big sagebrush (*Artemisia tridentata wyo.*), broom snakeweed (*Guiterrezia sarothrae*), and fringed sagewort (*Artemisia frigida*).

Total perennial/biennial herbaceous production averages 1,041 pounds per acre, most of which was provided by perennial grasses (75% relative production), annual grasses (19% relative production), and perennial forbs (4% relative production).

Shrub density averages 5,186 plants per acre (88% big sagebrush and 11% silver sagebrush). Subshrub density averages 3,000 plants per acre (64% broom snakeweed, 34% fringed sagewort, and 2% winterfat).

The *Silver Sagebrush Type* occurs on gentle to moderately sloping plains and rolling hills as well as ephemeral drainage bottoms and adjacent terraces. This type is found on a variety of soil textures in the Lawver, Teckla, Wibaux and Vonalee series.

Vegetative cover averages 70%; total ground cover averages 95%. Dominant species are needle-and-thread (*Stipa comata*), native bluegrass (*Poa secunda secunda*), Kentucky bluegrass (*Poa pratensis*), threadleaf sedge (*Carex filifolia*), western wheatgrass (*Agropyron smithii*), and prairie sandreed (*Calamovilfa longifolia*). Western ragweed (*Ambrosia psilostachya*), Silverleaf scurfpea (*Psoralea argophylla*), scarlet globemallow (*Sphaeralcea coccinea*) are common forbs. The most common shrubs and subshrub are silver sagebrush (*Artemisia cana*), four-wing saltbush (*Atriplex*

canescens), Wyoming big sagebrush, and cudweed sagewort (*Artemisia ludoviciana*).

Total perennial/biennial herbaceous production averages 1,086 pounds per acre as follows: perennial grasses (56% relative production), annual grasses (33% relative production) and perennial forbs (9% relative production).

Shrub density averages 3,988 plants per acre. Silver sagebrush is the dominant shrub at 90%, followed by four-wing saltbush (6%) and Wyoming Big sagebrush (4%). Subshrub density averages 248 plants per acre dominated by fringed sagewort (89%) and broom snakeweed (11%).

The *Riparian Bottomland Type* is limited in distribution and occurs primarily along Hay Creek. Atypical instances are also located on hillsides associated with groundwater seeps and reservoirs. The riparian bottomland type can be subdivided into two sub-communities: riparian bottomland-meadow and riparian bottomland-marsh. Riparian bottomland-meadow is the predominant subcommunity. The riparian bottomland-marsh type is limited to the perimeters of stock ponds and creek pools. Substrates are characteristically deep and poorly drained and include Boruff series and mollic fluvaquents.

Vegetative cover averages 96%; total ground cover averages 99%. In order of relative cover, perennial/grasslike species provide 85% followed by perennial forbs with 9%. Dominant species are cordgrass (*Spartina pectinata*), common spikesedge (*Eleocharis palustris*), American bullrush (*Scirpus pungens poly.*), thickspike wheatgrass (*Elymus lanceolatus lan.*), Canada bluegrass (*Poa compressa*), clustered field sedge (*Carex praegracilus*), and softstem bulrush (*Scirpus validus*). Common forbs include tufted white prairie aster (*Aster ericoides pansus*), maximilian sunflower (*Helianthus maximiliani*), wild licorice (*Glycyrrhiza lepidota*), and showy milkweed (*Asclepias speciosus*). Wood's rose (*rosa woodsii*) is the most common shrub.

Total perennial/biennial herbaceous production averages 3,103 pounds per acre, most of which was provided by perennial grasses and grasslike species (95% relative production) followed by perennial forbs (3% relative production). Annual grass production was insignificant at less than 1%.

Agricultural - Pastureland Type. All agricultural pastures within the analysis area are under either moderate or high management levels. Based on the level of management, total vegetation cover ranges from 50% to 78%. Total ground cover ranges from 84% to 95%. Perennial grasses and grasslike species provide 91% relative cover.

Dominant grasses and grasslike species include crested wheatgrass (*Agropyron cristatum*), Kentucky bluegrass (*Poa pratensis*), Canada bluegrass (*Poa compressa*), Russian wildrye (*Elymus junceus*), bulbous bluegrass (*Poa bulbosa*) and thickspike wheatgrass (*Elymus lanceolatus lanceolatus*). Yellow sweetclover (*Melilotus officinalis*) is the most common forb. Shrubs and subshrubs were not present in the transect samples.

Herbaceous productivity for the pasture community is based on countywide hay production values for various soil series present in the analysis area as provided by the Natural Resources Conservation Service. Under average annual rainfall conditions, estimated forage production may range from 1,200 to 3,000 pounds per acre.

Agricultural - Cropland Type. The western portion of the analysis area contains a large amount of croplands. Various small grains were on these lands for quite some time. No vegetation studies were conducted for these croplands.

Threatened, Endangered, and Candidate Plant Species

No federally listed threatened, endangered, or candidate plant species are known to occur within the analysis area. The analysis area was surveyed in 1999 for threatened, endangered and candidate species using the *Wyoming Rare Plant Field Guide* (Thorne 1994) as their reference. Ute ladies'-tresses surveys were conducted by Habitat Management, Inc., who met with FWS personnel on August, 30, 1999 to review currently acceptable Ute ladies'-tresses survey methods and practices. The FWS memorandum published November 23, 1992 entitled "Interim Survey Requirements for *Spiranthes diluvialis*" was also used as a guide in conducting the survey. All individuals who conducted the survey have received written recognition from the FWS Colorado Field Office as being qualified to conduct Ute ladies'-tresses surveys and are on the FWS's list of qualified consultants (appendix G).

WILDLIFE RESOURCES

Background information on wildlife near the West Hay Creek tract was gathered from several sources including: Buckskin Mine WDEQ/LQD permit and annual reports, Wyoming Game and Fish Department (WGFD) and FWS records and personnel contacts with WGFD and FWS biologists.

Site-specific data for the entire proposed lease area were obtained from sources including the WDEQ/LQD permit and annual reports for the Buckskin Mine. Baseline and monitoring surveys cover large perimeters around the permit area. Consequently, the LBA tract has been surveyed during annual wildlife monitoring for the Buckskin Mine. Thunderbird Wildlife Consulting, Inc. (TWC), formerly Powder River Eagle Studies (PRES) have conducted annual wildlife monitoring surveys at Buckskin Mine from 1984 through 2003. Their current monitoring plan complies with Appendix B of the WDEQ/LQD Coal Rules and Regulations. The study area has included most of the LBA analysis area throughout TWC's monitoring timeframe. Baseline wildlife monitoring was conducted on the analysis area concurrent with the Belco Exchange lands (February 1999 through February 2000). Thus, extensive wildlife data are available for the analysis area. The data presented herein is from TWC's baseline and annual monitoring data.

The LBA tract and adjacent area consists primarily of uplands. The topography is level

to rolling, with some areas sloping to steeply sloping. Sagebrush-grassland and grassland are the principal native habitat types in the south and eastern portions of the analysis area. Agricultural pasturelands and croplands dominate the northwest quarter of the analysis area. Bottomland habitat is along Hay Creek (ephemeral stream) in the northern portion of the analysis area. No designated critical, crucial, or unique habitats are present. Several stockponds and natural pools exist on the analysis area. The only trees in the analysis area are 37 cottonwoods in a shelterbelt located near the center of section 20, T. 52 N., R. 72 W. Hay Creek and other unnamed channels on the LBA tract are ephemeral.

Big Game

Pronghorn *(Antilocapra Americana*) and mule deer *(Odocoileus hemionus)* are the only big game species that regularly occur on or near the analysis area. Rare sightings of white-tailed deer *(Odocoileus virginianus)* have been recorded.

The WGFD has classified the entire area as yearlong pronghorn range. The Buckskin Mine is at the north end of a larger multi-mine survey area (including Buckskin Mine, Eagle Butte Mine, and Rawhide Mine) that has been surveyed each winter since 1993. Pronghorn densities in the Buckskin area have consistently been lower than those of the multi-mine area.

It is likely that the analysis area is a fringe area of pronghorn use (Triton 2000). Long-term (1987-1998) winter pronghorn density in the Buckskin area has ranged from 2 to 14 animals per square mile (/mi^2) but has generally been greater than 8 animals/mi^2. August 1999 pronghorn density on a 36-mi^2 survey area, which included the analysis area, was a minimum of 5.6 animals/mi^2. Records show that the pronghorn reproductive ratio in the Buckskin area often reaches 90 or more fawns per 100 does. This exceeds the WGFD data for northern Campbell County, which indicated a ratio of 57 fawns per 100 does (BLM 2001a).

The analysis area is located within the WGFD's Gillette antelope herd located north of Interstate 90 and is in hunt area 17. The 2001 postseason population estimate is about 12,000 antelope, slightly above the herd objective of 11,000. This is the first time since 1996 that the herd has been at or slightly above objective levels. Drought conditions the past two years has tended to slow herd growth through lower than average fawn survival four of the past five years. The long term average for preseason fawn ratios is approximately 75 fawns to 100 does. However, this herd has not produced an average fawn ratio for 8 years. Historically, the major management problem with this herd has been the ability to achieve an adequate harvest. Most of the antelope are on private land. This is also the case in the LBA tract area. There are no public lands within the analysis area, and public hunting access is limited. It is unlikely that enough licenses can be sold in the future to achieve the harvest needed to keep this population at its objective (Oedekoven 2002).

The analysis area is located within the Powder River mule deer herd and deer hunt area

18. The herd is currently estimated at 44,000 (postseason 2001), which is approximately 16% below its objective of 52,000 deer. As with antelope, access to private land is limited.

WGFD has classified the majority of the analysis area as yearlong mule deer habitat with a portion of the southeast classified as winter/yearlong. The area is not considered whitetail deer habitat (Oedekoven 2002).

Deer were not numerous in the analysis area during the 1999-2000 baseline study. Only five mule deer were identified in the analysis area during the winter aerial survey. Ground and aerial survey data indicate that deer use was negligible in 1999. Annual monitoring results for the entire Buckskin Mine survey area has shown that the area supports low to moderate numbers of mule deer with the highest numbers generally observed in winter and spring (Triton 2000). Ground counts suggest that mule deer numbers have declined somewhat from the mid-1990s (Triton 2001). Mule deer were recorded in a wide variety of habitat types from 1995 through 2001 but more were generally observed in either mine reclaimed grassland or sagebrush grassland (Triton 2001). Crucial or critical mule deer habitat does not occur on or adjacent to the analysis area (Triton 2000).

Other Mammals

A variety of small and medium-sized mammal species occur near the analyses area. These include predators and furbearers, such as coyote (*Canis latrans),* red fox (*Vulpes vulpes*), striped skunk (*Mephitis mephitis*), raccoon (*Procyon lotor*), and feral cats. Prey species include rodents such as mice, pocket gophers, voles, chipmunks, and lagomorphs (jackrabbits and cottontails). Surveys for prairie dog towns were conducted on the analysis area and adjacent lands. No prairie dog towns were identified within the analysis area. The closest prairie dog town to the LBA tract is located in the SE¼ of section 9 and the SW¼ of section 10, T. 52 N., R. 72 W. There is also another prairie dog town located in section 4, T. 52 N., R. 72 W. approximately 1.75 miles north of the analysis area. Both of these towns are shown on figure 3-13. These mammal species are cyclically common and widespread throughout the region. These prey species are important for raptors and other predators.

Raptors

Numerous raptor species have been observed on or adjacent to the West Hay Creek 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, none have nested on the site due to limited suitable habitat (cliffs and tall trees). Figure 3-13 shows the

locations of raptor nest sites identified since monitoring began for Buckskin Mine in an area that includes the West Hay Creek LBA tract. The figure shows 13 intact nest sites. As of June 2002, all of the nest sites were still intact; there were three active nests, all of which were used by red-tailed hawk pairs. Two nests previously used by great horned owls in 1999 through 2001 were not used in 2001. The golden eagle nest site was not used from 1999 through 2002.

Game Birds

Three species of upland game birds were observed during the 1999 baseline study: the sage grouse (*Centrocercus urophasianus*), sharp-tailed grouse (*Pedioecetes phasianellus*), and gray partridge (*Perdix perdix*).

The FWS has received several petitions to list the greater sage grouse under the Endangered Species Act because of range-wide population declines and, in a press release issued on April 15, 2004, the agency announced that is has determined that enough biological information exists to warrant a more in-depth examination of the status of the greater sage grouse. According the press release, this decision, known as a "90-day Finding," triggers a more thorough review of the available biological information. The causes for the sage grouse range-wide decline are not completely understood and may be influenced by local conditions. However, habitat loss and degradation, as well as loss of population connectivity are important factors (Braun 1998, Wisdom et al. 2002).

The greater sage grouse is found at elevations ranging from 4,000 to 9,000 feet. Greater sage grouse are dependent on sagebrush for food and protection from predators. In the summer, the grouse depend on the grass and plants that grow under the sagebrush to provide nesting material and high protein insects that are critical to sage grouse chicks in their first month of life. In winter, more than 99% of the species' diet is sagebrush leaves and buds. Population and habitat analyses suggest that wintering habitat can be as limiting as mating and breeding habitats. Anecdotal information from several sources in Wyoming suggests that sage grouse populations are negatively affected by construction (energy development) activities, especially those that degrade important sagebrush habitat, even when mitigative measures are implemented (Braun 1998, Lyon 2000). There is some evidence that grouse populations do repopulate areas developed for resource extraction after reclamation for the species (Braun 1987). However, there is no evidence that populations attain their previous levels. Reestablishment of sage grouse in a reclaimed area may take 20 to 30 years, or longer (Braun 1998).

The sage grouse is the most commonly encountered upland game bird species in the analysis area. No sage grouse leks were identified within the analysis area. One abandoned lek is present in the NE¼4SW¼ of section 16, T. 52 N, .R. 72 W. (a state section). The abandoned lek is located approximately 1/2-mile east of the analysis area, within the existing Buckskin Mine permit area (figure 3-13). This lek was active

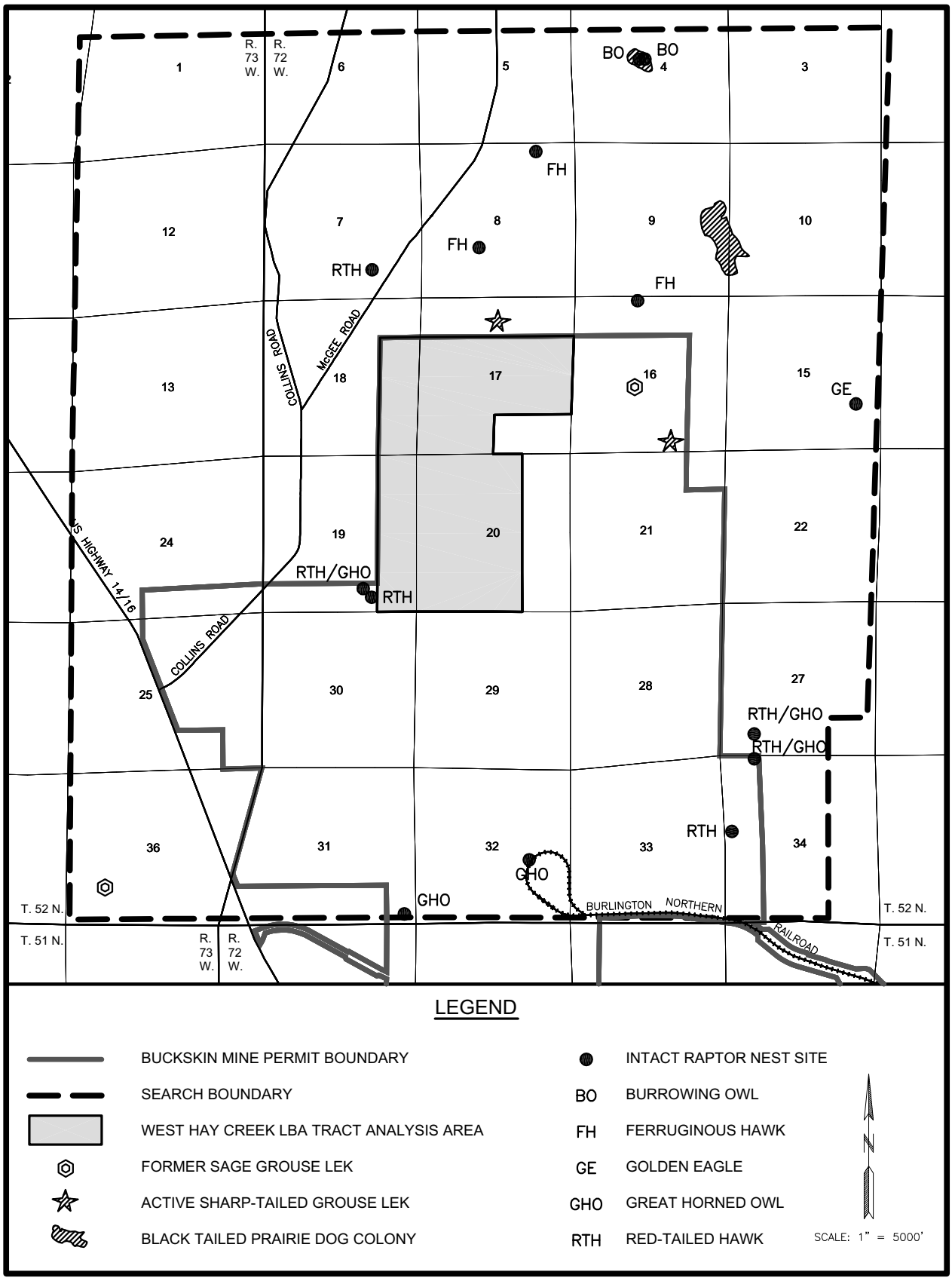


Figure 3-13. Raptor Nest Sites, Grouse Leks, and Prairie Dog Colonies Within and Adjacent to the West Hay Creek Analysis Area (Status as of 06-05-02).

from 1989 through 1992. The lek was active again in 2001, but no activity was observed from 1993 through 2000, or in 2002 and 2003. No broods were recorded during formal brood surveys, but two broods were observed in July on adjacent lands east of the LBA tract. Wintering habitat is limited in the analysis area, and no sage grouse or sage grouse sign was found during the winter baseline surveys.

Two active sharp-tailed grouse leks were identified in 2002 on lands adjacent to the LBA tract. As shown on figure 3-13, one lek is within ¼ mile of the analyses area (Triton 2002).

Gray partridge, an introduced species, is most commonly observed in the vicinity of seeded grass/haylands and small grain croplands. Three observations, all outside of the analysis area, were recorded during the 1999 baseline study (Triton 2000).

Mourning doves (*Zenaida macroura*) were on or near the analysis area during spring and summer surveys. This species is a relatively common breeding bird in Campbell County. Occasional turkey (*Meleagris gallopavo*) and pheasant (*Phasianus colchicus*) observations have been recorded during wildlife monitoring activities at the Buckskin Mine. Therefore, both species could possibly be recorded within the 2-mile perimeter of the analysis area (Triton 2000).

Migratory Birds of Management Concern

Table 3-9 provides a list of the 40 migratory bird species of management concern in Wyoming that the FWS uses for reviews concerning existing and proposed coal mine leased land (FWS 2002). This listing was taken directly from the Wyoming Bird Conservation Plan (Cerovski et al. 2000). The regional status and expected occurrence, historical observations, and breeding records on and near the West Hay Creek LBA tract for each listed species are included in table 3-9.

The following listed species were observed during the 1999 through 2002 surveys or are expected to occur in or adjacent to the analysis area. The ferruginous hawk (*Buteo regalis*) is classified as common and an historical breeder. Only one observation of a ferruginous hawk was recorded during the entire baseline study. However, they are assumed to have nested in the analyses area because nests characteristic of the ferruginous hawk were found within 1 mile north of the analyses area. Such ground nests can persist for many years. No nesting activity was observed during the 1999 baseline study or 2000 through 2002 annual surveys. Suitable nesting habitat for the short-eared owl (*Asio flammeus*) such as hayfields and tall weeds is present though no nests were located during the baseline survey. It was classified as uncommon and infrequently observed. The Swainson's hawk (*Buteo swainsoni*) was classified as common but a rare breeder to the area. The bald eagle (*Haliaeetus leucocephalus*) is seasonally common and most frequently observed in the winter (Triton 2000, 2002).

Sage grouse (*Centrocercus urophasianus*), recently added to the Level 1 list, is common to the area and is classified as an occasional breeder. See additional discussion above.

Sage grouse (*Centrocercus urophasianus*), recently added to the Level 1 list, is common to the area and is classified as an occasional breeder. See additional discussion above.

The grasshopper sparrow (*Ammodramus savannarum*) and lark bunting (*Calamospiza melanochorys*) were observed several times within the grassland habitat. Based on 1999 through 2002 data, lark buntings are common breeders and the grasshopper sparrow is an occasional breeder within the area. The vesper sparrow (P*ooecetes gramineus*) and the lark sparrow (Chondestes *grammacus*) were classified as common to the area. The McCowan's longspur (*Calcarius mccownii*) and the less common chestnut-collared longspur (*Calcarius ornatus*) were also infrequently or rarely observed and classified as potential breeders within the grassland habitat type. Lark buntings were also common to the sagebrush-grasslands and bottomlands. Though not found in the grasslands, the Brewer's sparrow (*Spizella brewerii*) is a very common species and breeder in the sagebrush-grasslands within the analysis area.

The upland sandpiper (*Bartramia longicauda*) was classified as infrequently observed and as a potential breeder within the analysis area.

The burrowing owl (*Athene cunicularia*) is uncommon and classified as an infrequent breeder within the analyses area. The loggerhead shrike (*Lanius ludovicianus*) and long-billed curlew (*Numenius americanus*) were classified as uncommon and infrequently observed (Triton 2002).

TABLE 3-9

REGIONAL STATUS OF 40 MIGRATORY BIRDS OF MANAGEMENT CONCERN IN WYOMING FOR COAL MINES AND EXPECTED AND ACTUAL OCCURRENCE ON AND WITHIN ½ MILE OF THE WEST HAY CREEK LBA TRACT

Species	Seasonal Status/ Breeding Records in Northeastern WY[1]	Expected Occurrence in Vicinity of West Hay Creek [2]	Occurrence and Historical Breeding Status at West Hay Creek
LEVEL I			
Mountain plover *Charadrius montanus*	summer/observed	rare	never recorded
Sage grouse* *Centrocercus urophasianus*	resident/breeder	common	occasional breeder
Baird's sparrow *Ammodramus bairdii*	never recorded	rare	never recorded
Ferruginous hawk* *Buteo regalis*	resident/breeder	common	historical breeder
Brewer's sparrow* *Spizella breweri*	summer/breeder	common	regular breeder
Sage sparrow *Amphispiza belli*	summer/observed	uncommon	never recorded

TABLE 3-9 (cont)			
Species	**Seasonal Status/ Breeding Records in Northeastern WY[1]**	**Expected Occurrence in Vicinity of West Hay Creek [2]**	**Occurrence and Historical Breeding Status at West Hay Creek**
LEVEL I (continued)			
McCown's longspur* *Calcarius mccownii*	summer/breeder	uncommon	infrequently observed
Swainson's hawk* *Buteo swainsoni*	summer/breeder	common	rare breeder
Long-billed curlew* *Numenius americanus*	summer/breeder	uncommon	infrequent spring migrant
Short-eared owl* *Asio flammeus*	resident/breeder	uncommon	infrequently observed
Peregrine falcon *Falco peregrinus*	resident/observed	rare	never recorded
Burrowing owl* *Athene cunicularia*	summer/breeder	uncommon	Infrequent breeder
Bald eagle* *Haliaeetus leucocephalus*	resident/observed	seasonally common	frequent in winter
Upland sandpiper* *Bartramia longicauda*	summer/breeder	uncommon	infrequently observed
LEVEL II			
Cassins's Kingbird *Tyrannus vociferans*	summer/breeder	uncommon	never recorded
Lark bunting* *Calamospiza melanocorys*	summer/breeder	common	common breeder
Dickcissel *Spiza americana*	summer/observed	rare	never recorded
Chestnut-collared longspur* *Calcarius ornatus*	summer/breeder	uncommon	rarely recorded
Black-chinned Hummingbird *Archilochus alexandri*	never recorded	not expected	never recorded
Pygmy nuthatch *Sitta pygmaea*	resident/observed	not expected	never recorded
Marsh wren *Cistothorus palustris*	summer/observed	uncommon	never recorded
Western bluebird *Sialia mexicana*	summer/observed	uncommon	never recorded
Sage thrasher* *Oreoscoptes montanus*	summer/breeder	common	rarely observed
Grasshopper sparrow* *Ammodramus savannarum*	summer/breeder	common	occasional breeder
Bobolink *Dolichonyx oryzivorus*	summer/observed	uncommon	never recorded
Common loon *Gavia immer*	summer/observed	not expected	never recorded
Black-billed cuckoo *Coccyzus erythropthalmus*	summer/breeder	uncommon	never recorded

TABLE 3-9 (cont)			
Species	**Seasonal Status/ Breeding Records in Northeastern WY[1]**	**Expected Occurrence in Vicinity of West Hay Creek [2]**	**Occurrence and Historical Breeding Status at West Hay Creek**
LEVEL II (continued)			
Red-headed woodpecker *Melanerpes erythrocephalus*	summer/observed	uncommon	never recorded
Yellow-billed cuckoo *Coccyzus americanus*	never recorded	uncommon	never recorded
Eastern screech-owl *Otus asio*	never recorded	uncommon	never recorded
Western screech-owl Otus kennicottii	never recorded	uncommon	never recorded
Western scrub-jay *Apheloma californica*	never recorded	uncommon	never recorded
Loggerhead shrike* *Lanius ludovicianus*	summer/breeder	uncommon	infrequently observed
Vesper sparrow* *Pooecetes gramineus*	summer/breeder	common	common breeder
Lark sparrow* *Chondestes grammacus*	summer/breeder	common	occasional breeder
Ash-throated flycatcher *Myiarchus cinerascens*	never recorded	abundance unknown	never recorded
Bushtit *Psaltriparus minimus*	never recorded	uncommon	never recorded
Merlin* *Falco columbarius*	resident/breeder	uncommon	rarely observed
Sprague's pipit *Anthus spragueii*	migrant/observed	uncommon	never recorded
Barn owl *Tyto alba*	summer/breeder	abundance unknown	never recorded

[1]Compiled from Luce et al. (1999), for lat-long block that encompasses northern Campbell County.
[2]Expected occurrence on or within ½ mile of Buckskin Mine was based on range, history of occurrence, and habitat availability.
*Species highlighted with asterisks were recorded on or within ½ mile of Buckskin Mine during baseline or monitoring studies at least once before or during May 2002.
Source: Luce, B., A. Cerovski, B. Oakleaf, J. Priday, and L. Van Fleet. 1999. Atlas of Birds, Mammals, Reptiles, and Amphibians in Wyoming. Wyoming Game and Fish Department, Cheyenne, Wyoming.

Suitable habitat for the mountain plover occurs in the analysis area, particularly in the sandy prairie grassland areas; however, mountain plovers have not been recorded in the area.

Additional migratory bird species of management concern in Wyoming are not expected to occur on the analysis area, although marginal potential habitat for some species was identified within the 1999 survey area. These include the barn owl *(Tyto alba*), Sprague's pipit (*Anthus spragueii*), dickcissel (*Spiza americana*), and Baird's sparrow (*Ammodramus baridii*). Of these species, PRES only observed one dickcissel during their years of monitoring the mines in northern Campbell County. Other species listed on table 3-9 have been rarely or never recorded in the analyses area.

Other Species

Wildlife surveys completed specifically in the analyses area 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. Lists of species recorded at the Buckskin Mine and within the analyses area are in the mine's permit document available at WDEQ/LQD.

Under current natural conditions, the LBA tract provides limited waterfowl and shorebird habitat. This habitat is mainly available during spring migration as ponds and ephemeral streams. Many of these water features generally get quite low or dry up during the summer. However, persistent ponds do remain on the upper reaches of Hay Creek within the analyses area. Broods from the American wigeon (*Anas Americana*), blue-winged teal (*Anas discors*), mallard (*Anas platyrhynchos*), northern pintail (*Anas acuta*), and northern shoveler (*Anas clypeata*) were observed during the 1999 baseline study. CBM activity also provides additional water to some small stock ponds adjacent to the analyses area

Fish species are not normally found on the LBA tract. Pool elevations in McGee Reservoir fluctuate some five to six feet each year but storage is sufficient to support small fish (fat-head minnows and green sunfish). Due to the ephemeral drainages within the analyses area, fish surveys were not required during the baseline study by the WGFD or WDEQ/LQD. All wildlife baseline study procedures were reviewed with Mr. Vern Stelter of the WGFD. PRES submitted the final study plan to Mr. Stelter in a letter dated May 14, 1999. Tom Collins, Coordinator with the WGFD, accepted the scope of work as "both complete and appropriate" in his letter dated May 18, 1999 to PRES. In addition, Buckskin Mine received a letter from WGFD Deputy Directory Gregg Arthur dated December 23, 2003 recommending approval of the temporary diversion of Hay Creek. His letter of recommendation also addressed the adequacy of the biological information available for Hay Creek and the fact that the post-mining reclamation plan was already in place.

Appendix G contains a discussion of threatened, endangered and proposed animal species.

OWNERSHIP AND USE OF LAND

Triton Coal Company, LLC owns the surface on the West Hay Creek LBA tract analysis area, including the LBA area as applied for and areas added under the action alternatives (figure 3-14). The principal land use within the tract is domestic grazing and wildlife habitat (Triton 2002). Secondary land uses are agricultural cropland and hayland. Areas of disturbance within the West Hay Creek LBA tract include plugged and abandoned oil and gas well sites, CBM wells and associated utilities/easement corridors, ranch access roads, and mine monitoring access roads.

All of the coal estate included in the LBA tract is federally owned. Figure 3-15 shows that the oil and gas estate within the analyses area is both federally and privately

owned. All of the federally owned oil and gas estate is leased. Table 3-10 provides a list of the lessees of record for the federally owned oil and gas estate.

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.

There are no conventional oil or gas wells in the analyses area. According to the WOGCC database, there were nine CBM wells located on the LBA tract that were producing or capable of producing and three additional locations had been permitted to drill or had started drilling as of April 9, 2004. Extensive CBM development has occurred west of the tract.

CBM wells were initially drilled on 40-acre spacing patterns in the Wyoming PRB, but the WOGCC has established 80-acre spacing patterns as the default spacing for CBM wells in the Powder River Basin. Most CBM drilling near the West Hay Creek LBA tract has occurred on a 40-acre pattern, either because the wells were drilled before the spacing was changed to 80 acres or under the authorization of spacing exceptions granted by WOGCC. There are 16 remaining undrilled complete or partial 40-acre lots within the study area.

Certain ancillary facilities are needed to support oil and gas production. These support facilities may include well access roads, well pads, production equipment at the wellhead (which may be located on the surface and/or underground), well production casing (which extends from the surface to the zone of production), underground pipelines (which gather the oil, gas and/or water produced by the individual wells and carry it to a larger transmission pipeline or collection facility), facilities for treating, discharging, disposing of, containing, or injecting produced water, central metering facilities, electrical power utilities, gas compressor stations, and high-pressure transmission pipelines for delivering the gas to market.

Coal mining is a dominant land use in the area surrounding the LBA tract. The Buckskin Mine is within a group of five operating surface coal mines located in northern Campbell County (figure 1-1 in chapter 1). Coal production at these five mines increased by about 17% between 1993 (about 44 million tons) and 2001 (about 51 million tons). Since 1992, one maintenance coal lease was issued and one lease exchange was completed within this mine group. Applications have been submitted for two maintenance tracts in this same group, including the LBA being evaluated in this EIS (tables 1-1 and 1-2).

Campbell County has no applicable countywide 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.

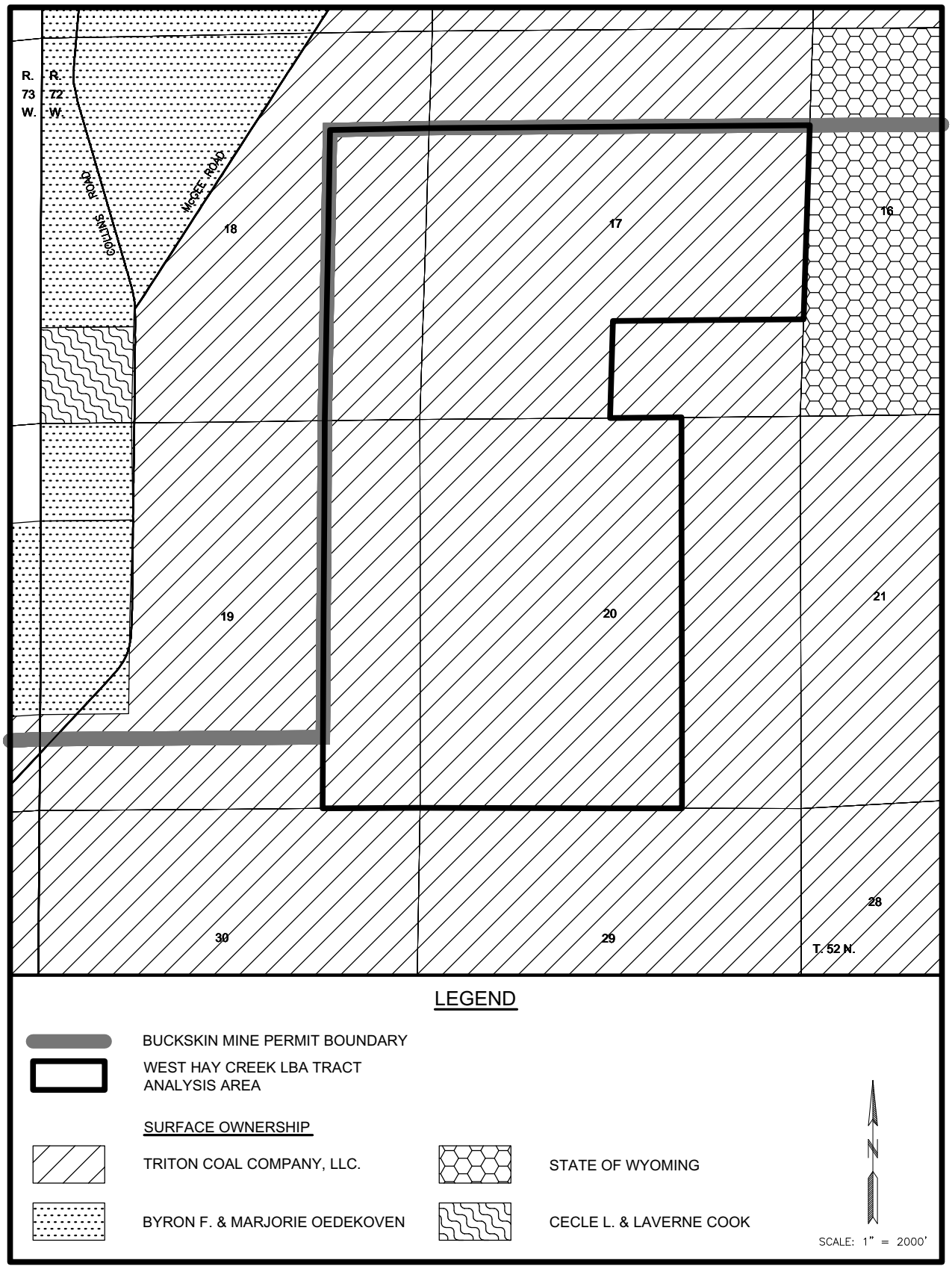


Figure 3-14. Surface Ownership on the West Hay Creek LBA Tract.

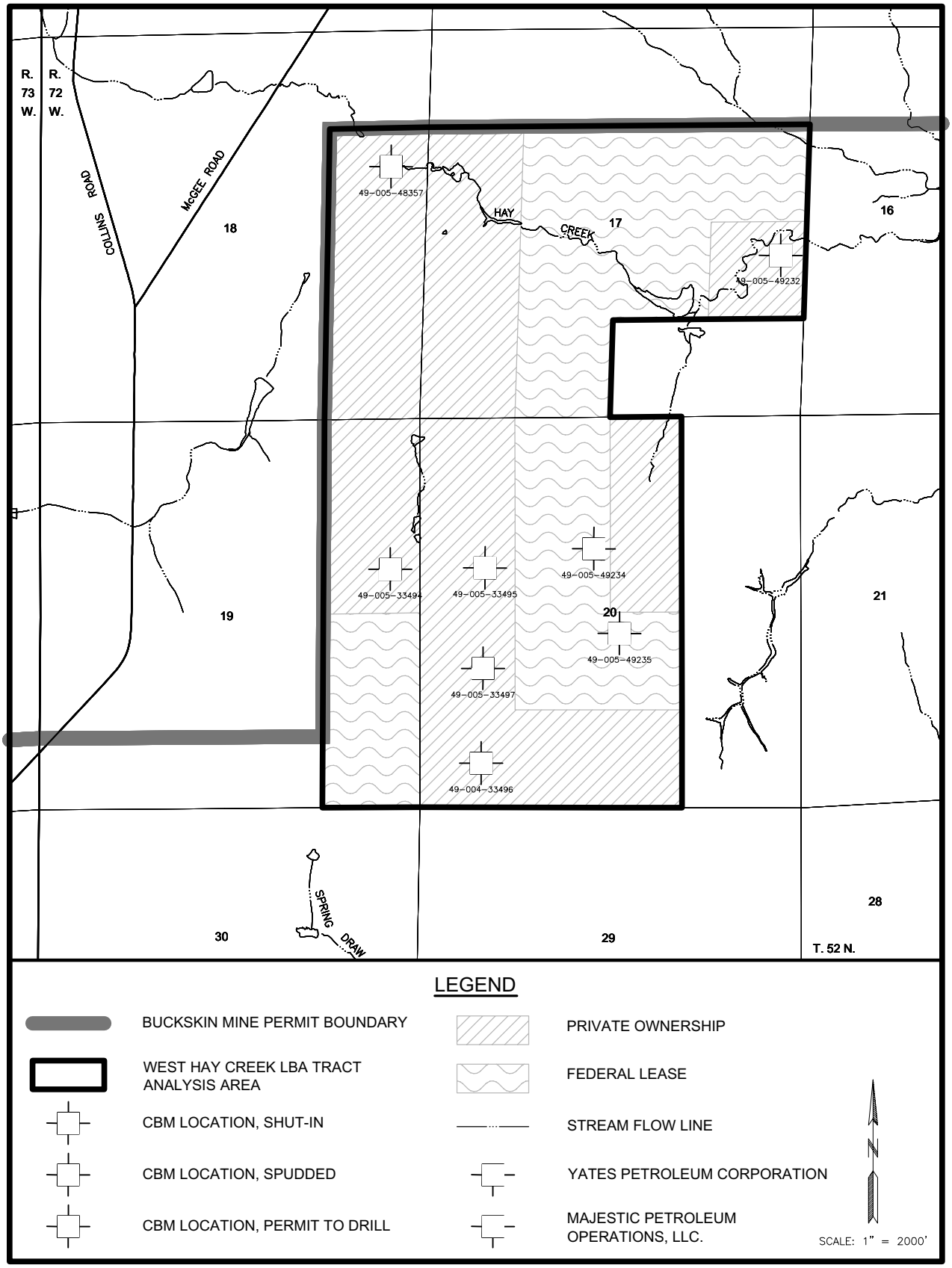


Figure 3-15. Oil and Gas Ownership on the West Hay Creek LBA Analysis Area.

TABLE 3-10

OIL AND GAS OWNERSHIP ON THE WEST HAY CREEK LBA TRACT

(T. 52 N., R. 72 W)

Location	Lease Number	Lessee of Record
Section 17		
Lot 8	WYW 134209	Majestic Petro Operations, LLC; Preston Reynolds & Co., Inc.; Redstone Resources, Inc.; Woodward Enterprises, LLC, CH4 Energy, LLC
Lots 6, 7, 10, 11, 14	WYW 138419	Maurice W. Brown
Section 19		
Lots 13, 20	WYW 138419	Maurice W. Brown
Section 20		
Lots 3, 6, 10, 11	WYW 138419	Maurice W. Brown

Note: Oil and gas rights (including coal bed methane) for the remainder of the LBA tract are privately owned.

Big game hunting is the principal recreational use in the analysis area. Landownership within the PRB is 80% private, but some private landowners permit 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 Thunder Basin National Grasslands, BLM-administered public lands, and state school sections (normally sections 16 and 36) are generally open to hunting if legal access is available. As shown in figure 3-14, there are no public surface lands included in the West Hay Creek LBA tract.

The surface estate of all of the lands within the LBA tract under the Proposed Action and the alternative configurations is privately owned, and recreational use is allowed only with landowner permission. Sport hunting in varying degrees occurs on the LBA tract. Pronghorn and mule deer occur on and adjacent to the LBA tract. Sage grouse, mourning dove, waterfowl, rabbit, and coyote are hunted in the vicinity, and some coyote and red fox trapping may occur.

CULTURAL RESOURCES

Cultural resources, 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, highly mobile hunters and gatherers who exploited a wide variety of resources used the area.

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 gathering plants. 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 largely by seasonal and environmental changes that 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 dating to the 1880s. A few small coal mining sites also exist.

A Class III cultural resources survey is a professionally conducted, intensive inventory of a target area, designed to locate all cultural properties that have surface and exposed profile indications. Cultural properties are recorded and sufficient information collected on them to allow evaluation for possible inclusion in the National Register of Historic Places (NRHP). That determination is made by the managing federal agency in consultation with State Historic Preservation Office (SHPO). Consultation with SHPO must be completed before the MLA mining plan is approved. Until consultation with SHPO has occurred and agreement regarding NRHP eligibility has been reached, all sites should be protected from disturbance.

Once a Class III survey is completed, site-specific testing or limited excavation is used, 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 developed for those sites that are eligible for the NRHP and are within the area of potential effect. Treatment plans are implemented before mining and can include such mitigating 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.

TRC Mariah Associates of Laramie, Wyoming subjected the West Hay Creek LBA analysis area to a Class III cultural resource inventory and assessment in 1999. The analysis area covered all lands proposed for coal lease and a buffer zone that would include all disturbances for the Proposed Action, the Preferred Alternative, and Alternative 3 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. WDEQ, OSM, and the Wyoming SHPO reviewed and approved the survey results. Previous cultural resource inventories were conducted in and adjacent to the analysis area in association with oil and gas development and previous mine permitting activities. Table 3-11 summarizes the distribution of cultural sites identified during the inventory by type.

TABLE 3-11

RESULTS OF THE CLASS III CULTURAL RESOURCE INVENTORY OF THE WEST HAY CREEK LBA TRACT ANALYSIS AREA

Prehistoric Sites	
Lithic scatter or possible open camp	48CA857, 858, 859, 1615, 3377, 3379, 3380, 3385, and 3387
Isolated finds	13 lithic items
Historic Sites	
Homestead	48CA1836
Earthen dams/ structures	48CA3376
Stone alignment	48CA3386

Three historical sites were identified within the analysis area. Site 48CA1836 is a homestead that was originally recorded in 1982. The site consists of the remains of the main house, three bunkhouses, four sheds, one corral and one dugout depression. Site 48CA3376 consists of three earthen dams and their reservoirs, one three-sided rock foundation, and a detached separate roof. The third site, 48CA3386, is a linear rock alignment. No other artifacts were found in association with the site. None of the sites met the criteria for eligibility to the NRHP.

Nine prehistoric sites were identified in the analysis area. All of the nine sites potentially located within the Proposed Action and alternative areas are lithic scatters. Two of four previously recorded sites could not be located again in 1999. One site met the eligibility

criteria for the NRHP. The survey results have been reviewed and approved by WDEQ, OSM, and the Wyoming SHPO. A data recovery plan has been developed and will be implemented.

Native American Concerns

Native American heritage sites are classified as prehistoric or historic. Some may be being used as offering sites and 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 that are sacred or part of the oral history and heritage that have no man-made features. To date, no Native American sacred sites in the general analysis area have been documented. 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, and Devils Tower to the east) 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 the BLM Buffalo RMP. Tribes that have been potentially identified as having concerns about actions in the PRB 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. OSM completed the Native American consultation in 2000 on lands within the analysis area. No comments were received. OSM then notified the SHPO that the one site of concern, 48CA860, was not a traditional cultural property.

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 include mammals such as early horses, tapiroids, condylarths, primates, insectivores, marsupials, creodonts, carnivores and multituberculates; reptiles such as crocodilians, alligators, lizards, and turtles; birds, eggs, amphibians, fish, plants, and nonmarine invertebrates such as mollusks and ostrocods. The Fort Union also contains fossils of plants, reptiles, fish, amphibians, and mammals.

A paleontological survey was conducted within and adjacent to the West Hay Creek LBA tract in 1999 to determine the potential for recovery of significant fossils prior to disturbance. Fragmentary crocodile scutes and invertebrate gastropod and bivalve shell fragments were located in section 21, T. 52 N., R. 72 W. Petrified wood was also abundant on the hill slopes in that area. No vertebrate or invertebrate fossils or plant material was collected, as all of it was fragmentary and considered to be of limited scientific significance.

VISUAL RESOURCES

Visual sensitivity levels are determined by people's concern for what they see and the frequency of travel through an area. Common throughout the analysis area are landscapes that include rolling sagebrush and short-grass prairie. Existing surface mines form a somewhat continuous band on the east side of US Highway 14-16 north of Gillette. Other man-made intrusions include ranching activities (fences, homesteads, and livestock), oil and gas development (pumpjacks, pipeline right of ways, CBM well shelters, and CBM compressor stations), transportation facilities (roads and railroads) and electric power transmission lines. The natural scenic quality in the immediate lease area is relatively low because of this development and the existing surface coal mining operations.

The Buckskin and Rawhide Mine facilities and some mining activities are visible from US 14-16 and Collins and McGee county roads. This is also true for portions of the LBA tract.

For management purposes, BLM evaluated the visual resources on lands under its jurisdiction in the 1985 Buffalo RMP. The inventoried lands were classified into visual resource management (VRM) classes 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 West Hay Creek LBA tract are generally classified as VRM Class IV. The existing mining activity is visible from several sites on the LBA tract.

NOISE

Existing noise sources in the area include adjacent coal mining activities, traffic on Wyoming 59, US 14-16, and the Collins and McGee county roads, rail traffic, ranching activities, and wind. No site-specific noise level data are available for the area. Because the Buckskin Mine is adjacent to the proposed LBA, a median noise level is

estimated to be 40 to 60 dBA for day, evening, and nighttime, with the noise level increasing with proximity to active mining at the Buckskin Mine. Mining activities are characterized by noise levels of 85 to 95 dBA at 50 feet from actual mining operations and activities (BLM 1992b). Figure 3-16 presents noise levels associated with some commonly heard sounds.

The nearest occupied dwelling to the LBA tract is located approximately ½ mile north of the northwestern corner of the LBA tract analysis area, in the SW¼SE¼ of section 7, T. 52 N., R. 72 W. Occupied dwellings and publicly accessible roads near the West Hay Creek LBA Tract are shown in Figure 3-17.

TRANSPORTATION FACILITIES

Transportation resources near the West Hay Creek LBA tract include US 14-16, Wyoming 59, and the Collins and McGee county roads. US 14-16 is about 2 miles west of the LBA tract area, and Wyoming 59 lies approximately 3 miles east. Both highways are paved two-lane roads that run generally north-south. The county roads are improved two-lane roads that also run roughly north-south. The Collins County Road is about 1 mile west of the LBA tract area; and the McGee County Road branches east of Collins Road about 3,000 feet from the northeast corner of the analysis area. Several unnamed two-track roads either cross the area or are adjacent to it. Access to the LBA tract is on unnamed two-track roads off McGee Road via Collins Road and US 14-16.

The nearest railroad facilities are the Burlington Northern/Santa Fe Railroad spurs accessing the Buckskin Mine 1.5 miles south of the proposed LBA tract area, and the Rawhide Mine approximately 5 miles southeast of the proposed LBA tract area. The Buckskin Mine railroad loop is the northern terminus of a series of spur lines that serve the surface coal mines north of Gillette. Oil and gas pipelines, power lines, and associated rights of way (ROWs) are found in the analysis area. However, no telephone lines are located within the proposed tracts.

Figure 3-17 shows the location of transportation facilities within and adjacent to the West Hay Creek LBA tract. Since the West Hay Creek LBA tract as applied for would be an extension of the existing Buckskin Mine operations, the existing coal transportation facilities and infrastructure would be used during mining of the LBA tract.

SOCIOECONOMICS

The social and economic study area for the proposed project involves primarily Campbell County and the cities of Gillette and Wright. The community of Gillette would most likely attract the majority of any new residents due to its current population level and the availability of services and shopping amenities.

A comprehensive socioeconomic profile of the Buffalo 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

HOW IT FEELS	EQUIVALENT SOUNDS	DECIBELS	EQUIVALENT SOUNDS	HOW IT SOUNDS
Danger to hearing	50 hp siren (100 ft)		Jackhammer	
Near permanent damage level from short exposures	Jet engine (75 ft)	130	Chainsaw	135 dB(A) Approx. 64 times as loud as 75dB(A)
Pain to ears	Turbo-fan jet at takeoff power (100ft)	120	Fire cracker (15 ft.)	125 dB(A) Approx. 32 times as loud as 75dB(A)
Uncomfortably loud	Scraper-loader	110	Rock and roll band	115 dB(A) Approx. 16 times as loud as 75dB(A)
	Jet fly over (1000 ft)		Unmuffled motor bike (2-3 ft.)	
Discomfort threshold	Noisy newspaper press	100	Car horn	105 dB(A) Approx. 8 times as loud as 75dB(A)
Very loud	Air compressor (20 ft)		Unmuffled cycle (25 ft.)	
Conversation stops	Power lawnmower	90	Garbage trucks and city buses	95 dB(A) Approx. 4 times as loud as 75dB(A)
	Steady flow of freeway trafic		Diesel truck (25 ft.)	
Intolerable for phone use	10-HP outboard motor	80	Garbage disposal	85 dB(A) Approx. 2 times as loud as 75dB(A)
	Automatic dishwasher		Food blender	
Extra auditory physiological effects	Vacuum cleaner	70	Muffled jet ski (50 ft.)	75dB(A)
	Window air conditioner outside at 2 ft.		Passenger car 65 mph (25 ft)	
		60	Busy downtown area	
Quiet	Window air conditioner in room			55 dB(A) Approx. 1/4 as loud as 75dB(A)
		50	Normal conversation	
Sleep interference	Occasional private auto at 100 ft.			
Very quiet	Quiet home during evening	40		45 dB(A) Approx. 1/8 as loud as 75dB(A)
	Bird calls			
	Library	30		35 dB(A) Approx. 1/16 as loud as 75dB(A)
	Soft whisper 5 ft.			
		20	In a quiet house at midnight	
	Leaves rustling	10		

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

Figure 3-16. Relationsip Between A-Scale Decibel Readings and Sounds of Daily Life.

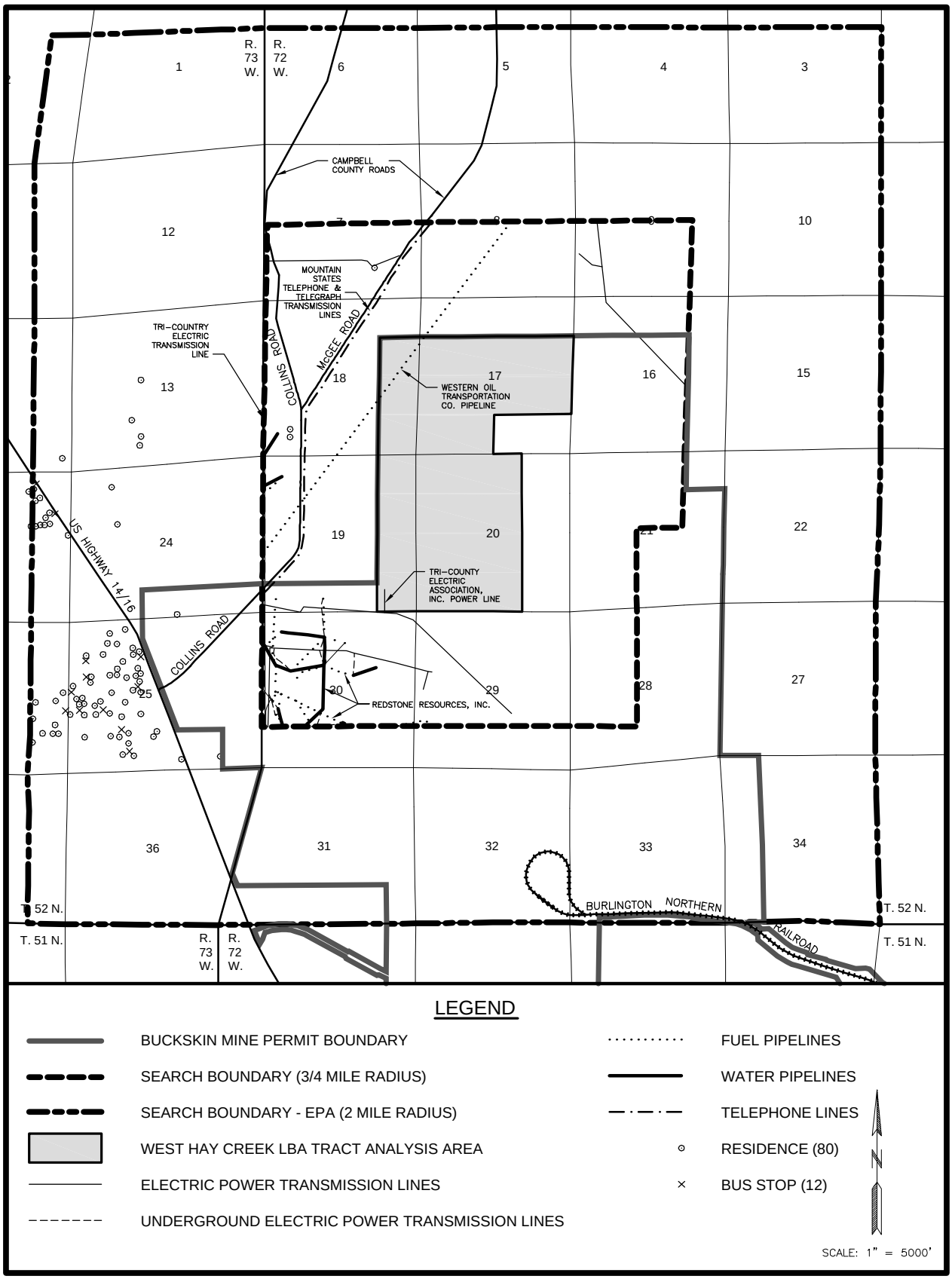


Figure 3-17. Transportation Facilities Within and Adjacent to the West Hay Creek LBA Tract Analysis Area.

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 from this report. Additional data came 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.

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 estimated July 2002 Campbell County population was 36,110, which represents a greater than 3% percent annual growth rate in recent years and makes Campbell County the fastest growing county in the state (Wyoming Department of Administration and Information 2003a).

The estimated December 2003 population of Gillette was 24,235. Between 1990 and 2003, it is estimated that Gillette grew by 4,950 persons. This represents a 25.7% increase in estimated population over a 13 years period, and an average annual growth rate of 1.97% per year (Gillette Department of Community Development 2004). Wright had an average growth rate of 0.9% during the time period from 1990 to 2000 (US Department of Commerce 1990 and 2000).

Local Economy

Coal production, as reported by the Wyoming State Inspector of Mines, showed the Wyoming's coal producers set a new yearly production record of 373.2 million tons in 2002. This was an increase of 1.2% over the 368.9 million tons produced in 2001. Coal production in Campbell County increased by 1.0% (329.5 million tons to 332.8 million tons) from 2001 to 2002. The 2002 Campbell County coal production was 89% of the state total.

In the second quarter of 2002, 29% of the total employment and 43% of the total payroll in Campbell County were attributed to mining, which also includes oil and gas employment. During the same time period in Converse County, 8% of the employment and 12% of the payroll were attributed to mining (Wyoming Department of Employment 2003).

Table 3-12 shows approximate tax revenues from coal production in Campbell County. Sales and use taxes are distributed to cities and towns within the 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% of the severance tax, and the remainder is returned to the cities, towns, and counties. Ad valorem taxes, which include property taxes, are collected by the county and disbursed to schools, cities, towns, the state foundation, and various other subdivisions within the county. Mineral royalties are collected on the

amount of production and the value of that production. The current royalty rate for federal coal leases is 12.5%, with half of this revenue returned to the state. Additional sources of revenue include lease bonus bids (also split with 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 per ton of coal mined in a 1994 study conducted for BLM by the University of Wyoming (University of Wyoming 1994).

TABLE 3-12

CAMPBELL COUNTY ESTIMATED 2003 FISCAL REVENUES[1] FROM 2002 COAL PRODUCTION
(in millions)

County	Sales and Use Collections	Severence Tax Collections	Ad Valorem Tax Collections	Royalty Collections	Total Collections
Campbell	$6.3	$81.3	$72.0	$230.9	$390.50

[1]Estimated tax receipts are based on information from the Wyoming Department of Revenue and from results of a survey conducted by the Wyoming Mining Association (WMA).

Nationally, the minerals industry was 1.3% of the gross national product (GNP) in 2001. In Wyoming, the minerals industry (including oil and gas) is 23% of the gross state product (GSP) in 2001, which makes it the largest sector of the Wyoming economy. Coal mining alone accounted for 5.4% of the Wyoming GSP (Wyoming Department of Administration and Information 2003).

Employment

Coal mining has changed a great deal since the 1970s, and new technologies have been a major contributor to these changes. The local coal mining labor force grew during the 1970s but declined during the 1980s. 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.

The coal mining labor force in Campbell County remained relatively constant for several years but has recently increased. Coal mining employment in Campbell County increased from 3,011 to 3,580 from 1998 to 2002 (Wyoming Department of Employment, Office of the State Inspector of Mines 1998-2002).

In 2001, Campbell County had an average total labor force of 22,360 with an unemployment rate of 2.9%, compared to 3.4% in 2000. Coal mining employment

represented 16% of the total labor force in Campbell County in 2000 (Wyoming Department of Employment, Research and Planning 2001).

Housing

The US Census Bureau (DOC 2003a) estimated 13,608 housing units in Campbell County in July 2002. This represents a 2.4% increase above the 13,288 housing units reported in the 2000 census and an 18% increase above the 11,538 housing units reported in the 1990 census. Campbell County residential building permits rose from 15 in 1990 to 144 in 2002 (Wyoming Housing Database Partnership 2003). According to the Wyoming Housing Database Partnership (2003), the average valuation of a single family housing unit in Campbell County in 2002 was $139,200, which was 6.1% higher than the average 2001 valuation.

The housing vacancy rate in Gillette has been low in the past few years due to population growth associated with CBM development; however, that growth has slowed. According to the Gillette Department of Community Development (2004), the total number of dwelling units in Gillette increased by 340 units, to 9,035 in 2003, a 3.9% increase. The estimated overall residential vacancy rate for December 2003 was estimated to be 1.9%. This is an increase as compared to an overall vacancy rate of 1% in 2002, but is still a very low vacancy rate (Gillette Department of Community Development 2004).

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 in 1999 has helped to alleviate overcrowding at the North Campus. The combined enrollment in both campuses for the 2003-2004 school year is approximately 1,500 students with 124 teachers (Campbell County School District 2003).

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. 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 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% per year. Nonagricultural employment is projected to increase by 22% by 2008, increasing 1.4% in 2000 and then slowing to 1.1% per year by 2006. Mining employment is projected to decline by 8.2% 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 nonmetallic minerals and 100 in coal mining (Wyoming Department of Administration and Information 2000).

Environmental Justice

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

Communities within Campbell County, entities with interests in the area, and individuals with ties to the area all may have concerns about the presence of a coal mine within the general analysis area. Communities potentially impacted by the presence or absence of a coal mine are 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 treaty right has granted access to a specific location.

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 chapter 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.

HAZARDOUS AND SOLID WASTE

Potential sources of hazardous or solid waste on the West Hay Creek LBA tract would include spilling, leaking, or dumping 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 Buckskin Mine are handled according to the procedures described in chapter 2.