3.0 AFFECTED ENVIRONMENT

This chapter describes the existing conditions of the physical, biological, cultural, and socioeconomic resources of the lands involved in the proposed exchange. The resources that have been identified on the lands that BLM[1] would acquire are summarized in Sections 3.1, 3.2, and 3.3. The resources on the PSO Tract that could be affected by mining operations are described in Section 3.4. The resources that are addressed here were identified during the scoping process or interdisciplinary team review as having the potential to be affected.

Critical elements of the human environment (BLM 1988) that could potentially be affected by the proposed action include air quality, cultural resources, Native American religious concerns, T&E species, hazardous or solid wastes, water quality, wetlands/riparian zones, invasive non-native species, environmental justice, and areas of critical environmental concern. T&E species are addressed in Appendix C. Prime or unique farmlands, floodplains, wild and scenic rivers, and wilderness are not present in the project areas and are not addressed further.

3.1 Bridger Lands

The Bridger lands, located in east-central Lincoln County, Wyoming, are comprised of nine distinct tracts (Figures 1-1 and 1-2). These nine tracts include approximately 3,086 acres within and adjacent to the southern end of the BTNF. There are seven western tracts and two eastern tracts. As shown in Figure 1-2, the western tracts and part of one of the eastern tracts are inside the BTNF. As discussed in Chapter 1, USFS would administer the lands inside the BTNF and the BLM would administer the lands outside the BTNF if an exchange is completed. Additional information about the Bridger Tract is included in Appendix D.

Topography and Physiography

The Bridger lands occupy a portion of the southern end of the Idaho/Wyoming overthrust belt physiographic province. The dominant landforms in the region are northerly trending ridges and valleys which are subparallel to major and minor thrust fault traces. The eastern tracts occupy a portion of Mahogany Ridge.

Geology and Mineral Resources

Significant oil and gas reserves are present in the overthrust belt. WOGCC records indicate there has been no oil and gas test drilling on the property. Coal deposits are also present in this area. The two eastern tracts are located along or near Mahogany Ridge, which is underlain by coal and lignite in the lower part of the Upper Cretaceous Frontier Formation. No coal mining activities have occurred on the Bridger lands. Coal production from Lincoln County

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

has been largely from a surface mine located approximately 20 miles south of the Bridger property.

Water Resources

The western Bridger lands are located along tributaries to the Hams Fork, a south-flowing tributary of the Green River. The eastern tracts are located along tributaries of Fontenelle Creek, an eastward flowing tributary of the Green River. Perennial and ephemeral streams flow through portions of many of the Bridger lands.

There are no known wetlands on the Bridger lands; however, riparian habitat is present on several of the tracts.

Soils

The western Bridger lands are characterized by soils that are high in clay and are subject to compaction and to accelerated erosion when disturbed. According to USFS information, the majority of the soils in the Bridger lands are considered to be "sensitive ground," which implies soils with a high erosion and compaction hazard and severe revegetation limitations.

Vegetation

The western Bridger lands are predominantly forested with mixed aspen-conifer species. The major vegetation types on these tracts include lodgepole pine, sagebrush, mountain mahogany, aspen, and willow. Lodgepole pine is the dominant tree species. In this area, lodgepole pine occurs in patches which may range in size from a few acres up to several thousand acres but are more typically several hundred acres in size. The lodgepole pine patches are broken up across the landscape by riparian areas dominated by willow; open sagebrush/grass areas and parks; wide bare ridgelines; aspen patches and stringers; and spruce-fir forested areas.

The two eastern tracts are generally unimproved rangeland. On these eastern tracts, vegetation includes mountain big sage, lodgepole pine, mountain mahogany, and grasses.

See Appendix C for discussion of threatened, endangered, and sensitive plant species that have been identified as potentially present by the USFWS.

Wildlife

The Bridger lands proposed for BLM acquisition (the eastern tracts) include designated elk parturition and transition range, mule deer winter and yearlong range, and moose yearlong and crucial winter range.

The Bridger lands proposed for USFS acquisition (western tracts and a portion of one eastern tract) provide habitat for many wildlife species. Species present include small animals such as hares, grouse, beavers, neo-tropical migrant birds, and coyotes. Harvested animals such as elk, deer, moose, mountain lions and black bears are present as well as a number of threatened,

endangered, and sensitive species. The USFS Bridger tracts serve as summer, winter, and parturition range for these species and also contain important migration corridors between summer and winter ranges.

The USFS Bridger tracts include spring, summer, and fall range for a portion of the West Green River elk herd and important travel corridors between summer and winter range. This elk herd does not rely on permanent feedgrounds to sustain the population during winter months, although the elk have been fed on an emergency basis during severe winters. This area is still relatively remote. The western tracts lie within a "security" range extending along Commissary Ridge. By definition, elk security habitat must be more than one half mile from roads and at least 250 or more contiguous acres.

The USFS Bridger tracts provide parturition and crucial winter range as well as spring, summer, and fall range for the Lincoln moose herd, one of the largest moose populations in the state. Moose in this herd unit utilize a variety of plant communities that are found on the USFS Bridger tracts.

The USFS Bridger tracts provide spring, summer and fall range for the Wyoming Range mule deer herd, the largest mule deer herd in the state.

Colorado River Cutthroat trout are known or suspected to occupy the streams within many of the Bridger lands.

See Appendix C for discussion of threatened, endangered, and sensitive wildlife species that have been identified as potentially present by the USFWS.

Land Use

The rugged nature of this portion of the Wyoming Range has prevented most commercial development. Five of the seven western tracts (inside the BTNF) have recently been or are currently being logged to recover marketable timber. Recent forest fires have encroached near the tracts and fire fighting crews have used available roads for access.

The eastern tracts are largely undisturbed and unimproved native rangeland, which are used for livestock grazing. The Bridger lands outside the BTNF, which BLM would acquire, include a total of 118 AUMs These lands are unfenced from the South LaBarge Common allotment, and the BLM Pinedale Field Office credits the grazing permittee for inclusion of these private AUMs into the grazing permit.

Public lands (USFS or BLM) surround all of the Bridger lands; therefore, public recreation has been a major use of the Bridger lands in recent years. All of the tracts have been used for hunting and, where appropriate, for fishing activities. Several of the tracts include many sites suitable for dispersed camping. Other recreational uses include hiking, wildlife observation, off-road vehicle use and photography.

Transportation

The Bridger lands are accessed by two principal roads. The eastern tracts, located along Mahogany Ridge and Fontenelle Creek, are reached by improved aggregate-surfaced roads leading north from U.S. Highway 189 north of Kemmerer and generally up Fontenelle Creek. An unimproved two-track jeep trail crosses the southern-most tract; however, access across Fontenelle Creek is limited. Access to the western tracts is by way of an improved county road that follows the Hams Fork upstream to the Hams Fork Campground. The Hams Fork Campground is located about one mile west of the nearest tract. Jeep trails to some of the tracts from the main road have recently been improved for the purpose of supporting logging operations currently underway on several of the tracts.

Cultural Resources

No formal cultural resources inventory is known for the Bridger lands outside the BTNF (proposed for BLM acquisition). Mahogany Ridge is a hogsback uplift containing numerous rock outcrops and ledges which might hold prehistoric rock shelters, but none are known. Burnt Bend on Fontenelle Creek may contain historic period resources, as numerous cabins, line shacks and other stock maintenance locales are found on adjacent and similar portions of Fontenelle Creek, Coal Creek and Rock Creek. Similarly, prehistoric camp sites are expected on the terraces of Fontenelle Creek, preserved in the alluvial soils found there. Overall, however, the project area is one of low to moderate cultural resource potential.

No historic or prehistoric sites are known to exist on any of the western parcels (inside the BTNF). The USFS Kemmerer District has 49 recorded Heritage resources sites. Of these, 25 are prehistoric and the remaining 24 are historic. Most of the prehistoric sites are small lithic scatters indicative of temporary campsites utilized by nomadic hunters and gatherers. Artifacts recovered from these sites suggest that most of them date to the last 3,000 years; however, one site contained material suggesting an age of over 8,000 years.

Native American Consultation

The Mahogany Site, a prehistoric pictograph site of reported Ute affinity, is located a few miles from the eastern tracts. This site is a rare and significant rock art locality and is considered an important site to modern day Native Americans (the Shoshone and Ute, specifically). While no sites of interest to or considered sensitive by modern Tribal individuals are known for any of the lands proposed for acquisition, consultation and/or site visits have not been conducted. Thus, it would be premature to rule out the presence of localities considered important to modern Tribal interests.

3.2 JO Ranch Lands

The JO Ranch property, located in southwest Carbon County, Wyoming,

includes approximately 1,236.5 acres that are primarily along the valley floor of Cow Creek (Figures 1-1 and 1-3).

Topography and Physiography

Cow Creek and its tributaries drain the west foothills of the Sierra Madre Mountains. West of Cow Creek, the area is described as gently rolling topography. To the east of Cow Creek the slopes rise gradually upward forming the deeply dissected foothills of the Sierra Madre Mountains.

Geology and Mineral Resources

The JO Ranch lands are located in the Washakie Basin, which contains oil and gas reserves. There are actively producing conventional oil and gas wells in the vicinity of the JO Ranch lands but, according to WOGCC records, there are currently no producing conventional oil and gas wells on the lands proposed for exchange. Portions of the JO Ranch lands are underlain by coal beds. The coal in this area is not economically mineable and there are no operating coal mines in this area. CBM exploration is presently occurring, however, and some of the proposed development is in the area of the lands proposed for exchange. A CBM EIS is in preparation for this area. One CBM test well was drilled in 1999 on one 40-acre lot included in the exchange proposal; however, there is no record of any production from that well.

Water Resources

Cow Creek is a southwest-flowing ephemeral drainage (Figure 1-3). Cow Creek and its tributaries drain the west foothills of the Sierra Madre Mountains. Cow Creek joins Muddy Creek, a tributary of the Little Snake River, about one mile southwest of the JO Ranch lands.

Vegetation

The bottom lands along Cow Creek are mostly a riparian-grassland habitat type, dominated by Nebraska sedge, beaked sedge, tufted hairgrass, redtop, Kentucky bluegrass and a variety of forbs. At the upper end of the creek there are willows and waterbirch. The uplands consist of Wyoming big sagebrush and mixed grass habitat types, with local areas along the west boundary containing a high percentage of bitterbrush. The northern portion of the JO Ranch lands lies at the edge of the Sand Hills (see Figure 1-3), which contain a mixture of shrubs including silver sagebrush, basin big sagebrush, Douglas and rubber rabbitbrush, bitterbrush, rose, serviceberry, snowberry, and chokecherry. Needle-and-thread grass and prairie sandreed are the dominant grasses along with other grasses and forbs. The overall condition of these plant communities is good. Thistles may be present in the meadow habitat, but no noxious plant species are known to occur in this area. Both the riparian and sand hillls plant communities are important in terms of the plant and animal life they

support and neither are very common in terms of total acreage in this area.

See Appendix C for discussion of threatened, endangered, and sensitive plant species that may be affected by the exchange.

Wildlife

The portion of Cow Creek included in the exchange proposal has live water and is considered a willow riparian/meadow grassland type of habitat. The northern portions of the JO Ranch lands fall within the area that is known as the Sand Hills which is a unique upland habitat.

The JO Ranch lands include both mule deer and elk crucial winter range. This area is part of the Baggs Elk Crucial Winter Range Management Area.

The area falls within the 2-mile buffer of ten greater sage grouse leks, but no leks have been identified on the JO Ranch lands. This area is considered good nesting and brood rearing habitat for greater sage grouse. The area may be important to Columbia sharp-tailed grouse since these birds are expanding their range into areas adjacent to these parcels. No raptors have been identified on the lands proposed for exchange, but several historical ferruginous and golden eagle nests have been identified within ¼ mile.

The portion of Cow Creek included in the exchange proposal could include habitat for non-game BLM sensitive fish species such as roundtail chubs, flannelmouth suckers, and bluehead suckers.

See Appendix C for discussion of threatened, endangered, and sensitive wildlife species that may be affected by the exchange.

Land Use

Livestock production, both cattle and sheep, and supplemental hay production for winter feed have historically been and remain the principal uses of the JO Ranch lands. Currently the property is leased for the purpose of cattle grazing. The lands immediately adjacent to and surrounding the JO Ranch property are federal or state surface and have also historically been used primarily for sheep and cattle production.

The JO Ranch lands are generally unimproved. Recreational uses of the JO Ranch lands are primarily associated with pronghorn antelope, mule deer, elk and sage grouse hunting. The extensive public lands surrounding the JO Ranch property are readily accessible and therefore important to hunters. Other than fall hunting activity, the area attracts limited numbers of recreationists engaged in back county camping and hiking, rock hounding, wildlife observation, off-road vehicle use, outdoor photography, and scenic touring.

Cultural

The JO Ranch lands include the JO Ranch or Rankin Ranch buildings, which are a collection of stone

buildings that date from the late 1800s. These buildings are eligible for National Historic Site status.

Native American Consultation

No sites of interest to or considered sensitive by modern Tribal individuals are known for the lands proposed for acquisition. Consultation and/or site visits have not been conducted.

Transportation

The property is accessed by improved aggregate-surfaced roads off of Wyoming State Highway 789 approximately 20 miles north of Baggs, Wyoming. There are numerous two-track ranch roads located throughout the property.

3.3 Welch Lands

The Welch lands, located in north-central Sheridan County, Wyoming, comprise approximately 1,600 acres (Figures 1-1, 1-4). The Welch lands are located in the PRB, a part of the Northern Great Plains which includes most of northeastern Wyoming and a portion of southeastern Montana. The Big Horn Mountains are within sight of the Welch lands to the west. The Welch lands are located in the same general area as the federal coal lands that P&M proposes to acquire in Sheridan County, which are referred to as the PSO Tract in this EIS and are described below in Section 3-4 (see Figure 3-1).

Topography and Physiography

The Welch lands occupy a portion of the Tongue River valley floor and the adjacent dissected uplands between Ash Creek and Hidden Water Creek, both tributaries of the Tongue River (Figure 1-4).

Geology and Mineral Resources

The Welch lands are underlain by coal. There is a long history of coal mining activities in the Sheridan coal field. Coal was mined extensively from numerous underground mines that were located primarily along the Tongue River upstream of the Welch lands. Underground coal mining began in the late 1800s and continued into the 1940s. Many square miles of room and pillar underground mine workings extend on both sides of the confluence of Goose Creek with the Tongue River, located about three miles south-southwest of the Welch lands. The closest underground mine, the Acme Mine No. 42, extends beneath a portion of the Welch lands. Maps of this mine that were prepared in 1922 show the approximate extent of mining at that time. According to the book 'Black Diamonds of Sheridan' (Kuzara 1977), mining in the Acme Mine No. 42 continued until about 1942, which suggests the potential existence of underground mine workings on the Welch lands beyond the limits mapped in 1922. The underground mines in this area were all closed and sealed off by 1953, following the railroad's conversion from coal to petroleum fuel and the advent of surface coal mining.

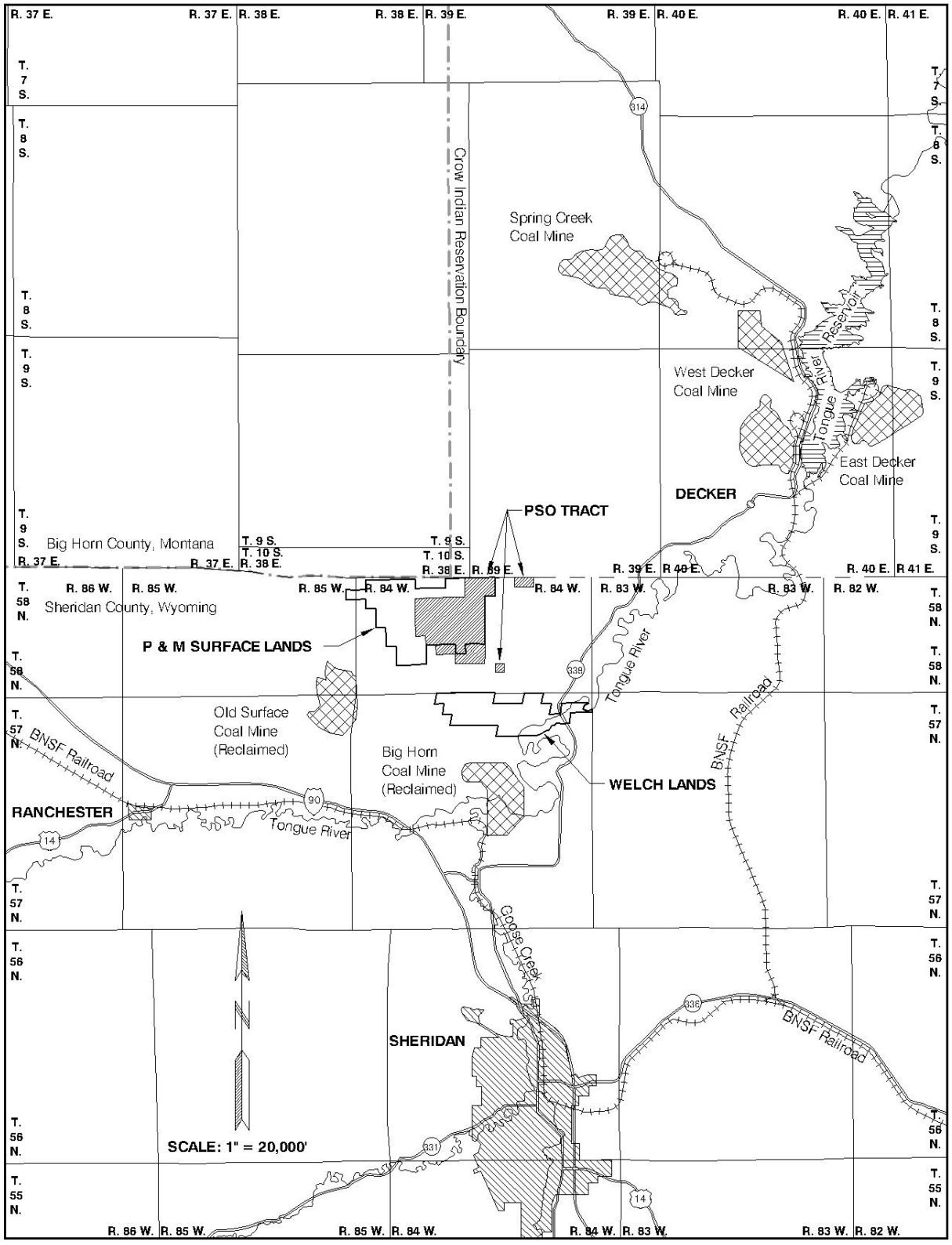

Figure 3-1. General Analysis Area.

Roof collapses over the closed Acme Mine No. 42 led to the development of underground coal fires. One such fire, which was located south of and immediately adjacent to the Welch lands, continued for many years. In 1987, under the direction of the Abandoned Mine Lands Reclamation Program, the fires were extinguished by smothering with earthen material and the disturbance area of approximately 90 acres was reclaimed. Spontaneous coal fires still occur along outcrops adjacent to the Tongue River within the Welch lands, specifically in the southwest portion of T.58N., R.84W., Section 2 (WWC 2001).

P&M acquired its ownership in the Welch lands in October 1998. The previous owners obtained a permit to mine coal in a portion of the Welch lands in 1979 and began stripping topsoil to access shallow coal reserves on the property. A short haul road was also constructed. Plans to mine the area were canceled and, because minor surface disturbance had occurred and mining was not anticipated in the foreseeable future, the disturbed area was reclaimed under the direction of WDEQ in 1999. Currently there are no active surface coal mines in Sheridan County, although large-scale surface mining is being conducted approximately eight miles northeast of the Welch lands in Montana. In the past few years CBM has been developed in this area (Refer to Section 3.4.3 for additional discussion of CBM development in this area).

Water Resources

Approximately 1.5 miles of the Tongue River runs through the eastern portion of the Welch lands. The river and riparian area lie within an alluvial valley floor.

Soils

The soils in the area are dominated by very deep soils on the flood plains, low terraces, and alluvial fans. The soil association is described as a Haverdad-Ziegweid-Nuncho.

Vegetation

The vegetation along the portion of the Tongue River that runs through the eastern portion of the Welch lands includes late seral cottonwood, green ash and chokecherry. This riparian area is in proper functioning condition. The meadows along the river are irrigated under a territorial water right for hay production. The river and riparian area lie within an alluvial valley floor which contains the highest diversity of vegetation and wildlife on the Welch lands and is in pristine condition.

The upland areas on the property contain sagebrush/grasslands intermixed with skunkbush sumac and ponderosa pine and juniper stands. Several draws contain green ash, chokecherry and hawthorne shrubs. A large portion of the upland woodlands was burned in a July 2001 wildfire.

See Appendix C for discussion of the occurrence of threatened,

endangered, and sensitive plant species potentially present on the Welch lands

Wildlife

Wildlife typically present on the Welch lands include antelope, mule deer, white-tailed deer, coyote, fox, sage grouse, sharp-tail grouse, turkey, grey partridge, pheasant, waterfowl, golden eagle, red-tailed hawk, turkey vulture, and numerous non-game birds and mammals. Other species observed or known to frequent the Welch lands include bald eagle, cormorant, blue heron, mountain lion, bobcat and elk.

The Tongue River along this stretch is a transition zone between cold-water and warm-water fish species and contains small-mouth bass, sauger, walleye, catfish, brown trout, and numerous non-game species.

See Appendix C for discussion of the occurrence of threatened, endangered, and sensitive wildlife species potentially present on the Welch lands.

Ownership and Use of Land

The surface of the Welch lands is owned by P&M, the oil and gas estate is privately owned, and the coal ownership is private (owned by P&M) and unleased federal. P&M surface and coal estate rights are included in the exchange proposal.

The property consists predominantly of unimproved rangeland, scattered pine and juniper forests in deep drainages, and hay croplands typical of a flood and subirrigated alluvial valley floor. Historically, the property has been used principally for livestock grazing, with crop production concentrated along portions of the valley floor of the Tongue River. Since the property was settled in the early 1900s, grazing practices have been relatively unchanged. The current surface leaseholder grazes a small number of cattle in the area.

Currently, development and associated disturbance on the property are limited to an irrigation ditch, a diversion dam, fences, utility easements, a reclaimed gravel pit, reclaimed surface mine operations (described in the section on Geology and Mineral Resources), and unimproved dirt roads and trails.

Recreational opportunities on the lands include big game and game bird hunting (both upland and waterfowl) and sport fishing. The Tongue River valley offers a greater diversity of game bird habitat than is found on the adjacent lands, and the Tongue River in this area is a good small-mouth bass fishery resource. White-tailed deer hunters may also experience success on the Welch lands because the denser riparian vegetation within the Tongue River valley is a habitat that is preferred by the deer. In addition, the two-track ranch roads and trails that traverse the property provide access for other outdoor activities such as hiking, biking and photography.

The federal coal included in the lands proposed for exchange is unleased. The oil and gas estate is privately owned. There has been no oil and gas exploration or development on the Welch lands; however, CBM wells have been drilled in the area and CBM could potentially be developed on the Welch lands.

Cultural Resources

The Welch lands have been inventoried at the Class III level, a number of sites have been tested, and 44 sites are recorded, including 27 lithic scatters, 2 quarries, 6 camps or occupations, 3 historic homesteads or structural remains, 1 wagon mine, 1 historic bridge, and 2 prehistoric lithic scatters associated with sheepherder's monuments or historic cairns. The Welch lands are located adjacent to Tongue River and close to the Thunderchild Rehabilitation Center.

Native American Consultation

None of the inventoried sites included in the Welch lands are known to be of interest to or considered sensitive by modern Tribal individuals. Consultation and/or site visits have not been conducted.

Transportation

The Welch lands can be accessed from Sheridan via Wyoming State Highway 338 (Figure 1-4). Several unimproved two-track ranch roads serve the property both from Highway 338 and from the Ash Creek Road located just north of the property.

3.4 PSO Tract

The following paragraphs describe the resources present on the PSO Tract. PSO would acquire the federal coal underlying the PSO Tract if the exchange is completed. The resources present on the PSO Tract are described in some detail because P&M proposes to mine the coal under these lands if the exchange is completed. Because of the proximity of the PSO Tract to the Welch lands, there are many similarities in the affected environment for both tracts (Figure 3-1).

3.4.1 General Setting

The PSO Tract, like the Welch lands, is located in the PRB, a part of the Northern Great Plains which includes most of northeastern Wyoming and a large portion of southeastern Montana. Vegetation is primarily sagebrush, mixed prairie grass, and ponderosa pine with a shrub understory. The climate is semi-arid and characterized by cold winters, warm summers and a large variation in annual and seasonal temperature and precipitation. Wind, precipitation, and temperature patterns in the study area are significantly affected by the Big Horn Mountain range, which is within sight of the project area to the west.

The average annual precipitation at Sheridan (Figure 3-1) for the period of record 1920-2000 is just over 15 inches (WRCC 2001). The annual precipitation records for the period of record 1949-1974 near the Decker Coal Mine (Figure 3-1) ranged from a

low of about 6.5 inches in 1960 to a high of about 17.6 inches in 1968, with an average of about 11.8 inches. About 45 percent of the annual precipitation falls in the 3-month period April through June. In Sheridan, June (2.79 inches) and May (2.54 inches) are the wettest months, and February (0.48 inch) is the driest. Nearly 30 percent of the annual precipitation falls as snow from October through March. Snowfall averages 44.8 inches per year, with most occurring in March (9.2 inches) and January (7.6 inches). The remainder of the annual precipitation generally occurs as summer thunderstorms, and most flooding in the area occurs in response to high-intensity thunderstorms of comparatively short duration. Potential evapotranspiration at approximately 22 inches (Martner 1986) exceeds annual precipitation.

The seasonal and daily variations between maximum and minimum temperatures are often extreme. Temperatures at Sheridan have historically ranged from 106°F to –37°F, while the temperatures in the Tongue River valley approximately 30 miles north of the project area have been recorded to range from 107° to –45°F. July is the warmest month, with a mean daily temperature of 69.6°F, and January is the coldest month with a mean daily temperature of 19°F. The frost-free period in Sheridan averages 125 days (WRCC 2001).

Winds are greatly affected by local topography. The prevailing winds recorded by the Decker Coal Mine come from the northwestern, southern and northeastern directions. Winds blowing from the western half of the compass are generally faster than winds blowing from the eastern half. The greatest percentage of fast winds come from the northwest quadrant. The average wind velocity recorded in Sheridan is about 8 miles per hour; however, velocities in excess of 25 miles per hour are common throughout the year. The fastest wind speed ever recorded at the Sheridan airport, 84 mph, was in November 1949. Hot, dry winds commonly blow during the summer and strong winds often accompany winter snow storms causing drifting.

General information describing the area's resources were gathered from draft BLM Buffalo Field Office planning documents (BLM 1996a, 1996b, 1996c, 1996d, 1996f) and a BLM coal leasing study (BLM 1996e).

3.4.2 Topography and Physiography

The PRB is an elongated, asymmetrical structural downfold. It is bounded by the Casper Arch, Laramie Mountains, and Hartville Uplift to the south; the Miles City Arch in Montana to the north, the Big Horn Mountains on the west, and the Black Hills on the east. The PSO Tract is located near the northwest limb of the structural basin, near the Tongue River valley and within sight of the Big Horn Mountains. The PRB landscape consists of broad plains, low hills, and tablelands. Generally, the topography changes from open hills with 500-1,000 ft of relief in the northern part of the PRB to plains

and tablelands with 300-500 ft of relief in the southern part. Playas are common in the basin, as are buttes and plateaus capped by clinker or sandstone.

The PSO Tract lies within the drainages of Ash Creek and Youngs Creek. These perennial streams are tributaries of the Tongue River, which lies about three miles east and four miles south of the project area. Most of the project area consists of the dissected uplands between Ash Creek and Little Youngs Creek, a perennial tributary of Youngs Creek (Figure 2-2). The tributaries of these streams have dissected numerous deep, steeply sloping ravines that are separated by relatively flat rounded uplands. The eastern portion of the proposed Ash Creek Mine area, which overlies privately-owned coal, is dominated by a broad valley occupied by Little Youngs Creek and its confluence with Youngs Creek (Figure 2-2). Slopes range from nearly flat to over 60 percent. Slopes on the uplands and valley bottoms are generally between one and ten percent, while the bedrock areas along the valley edges exhibit the steeper slopes. Slope analyses would be done for the proposed Ash Creek Mine permit application if the exchange is completed.

3.4.3 Geology

Stratigraphic units in the proposed Ash Creek Mine area that would be impacted if the exchange is completed and a mine is opened are, in descending order, recent (Quaternary age) alluvial and eolian deposits and the Paleocene age Fort Union Formation (which contains the target coal beds). Figure 3-2 shows two geologic cross-sections drawn through the proposed Ash Creek Mine area (one roughly north-south and one northeast-southwest). These cross sections are a basic representation of the geology in the vicinity of the PSO Tract. Figure 3-3 is a chart showing the stratigraphic relationships and hydrologic characteristics of the surface and subsurface geologic units in the area of the PSO Tract.

Surficial deposits in the analysis area include Quaternary alluvial, colluvial and eolian deposits, clinker, and weathered Fort Union Formation. There are alluvial deposits, consisting of floodplain, stream and terrace deposits, along the area's major drainages (Ash Creek, Youngs Creek, Little Youngs Creek, and West Branch Little Youngs Creek). In general, these alluvial sediments are composed of interbedded silts and clays overlying beds of sand and gravel. Unconsolidated materials that occupy the bottom of the Little Youngs Creek drainage have a maximum thickness of about 40 ft, including as much as 23 ft of interbedded sand and gravel, generally overlain by finer-grained materials (Hedges, et al. 1980). The gravel consists primarily of rounded to subrounded detrital clinker with a maximum particle size of approximately 2 inches in diameter (Ash Creek Mining Company 1984). Colluvium, sheetwash and residual deposits derived from the Fort Union

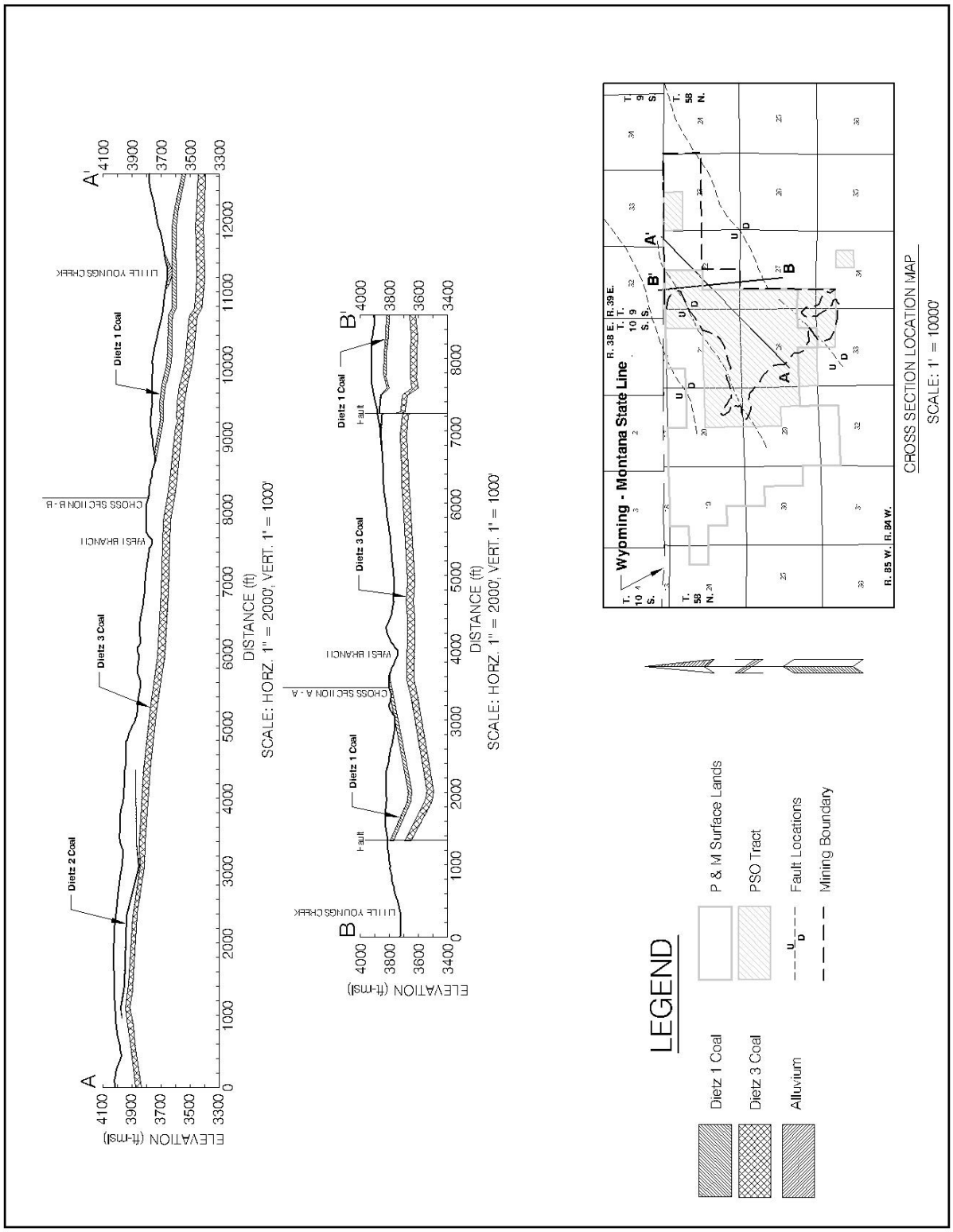

Figure 3-2. Geologic Cross Sections for the Ash Creek Mine.

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

Figure 3-3. Stratigraphic Relationships and Hydrologic Characteristics of Upper Cretaceous, Lower Tertiary, and Recent Geologic Units, Powder River Basin, Wyoming. (Compiled from Hodson et al. 1973 and Lewis and Hotchkiss 1981).

Formation bedrock occur on the uplands and slopes.

The Eocene age Wasatch Formation is not present within the PSO Tract area.

The Fort Union Formation is approximately 3,400 ft thick in this vicinity and consists primarily of interbedded shales, mudstones, siltstones, lenticular sandstones, and coal. It is divided into three members: Tongue River (which contains the target coal seams), Lebo, and Tullock, in descending order (Figure 3-3).

The Tongue River Member consists of interbedded claystone, silty shale, carbonaceous shale and coal, with lesser amounts of fine-grained sandstone and siltstone. The clastic beds of the Tongue River Member were deposited on floodplains of large rivers, in river and stream channels, or on deltas extending outward into swamps. The clastic beds tend to be lenticular in shape and of limited areal extent. As a result, the lithology of the strata often changes rapidly over short distances, making it difficult to characterize the exact lithology of the overburden or interburden for any great lateral distances.

The Fort Union coal seams of mineable depth and thickness in the PSO Tract area include, in descending order, the Anderson and Dietz coal seams. The Anderson and Dietz seams are correlatable over a broad area. At the Decker Coal Mine, they are mined as the D1 and D2 seams. At the Big Horn Coal Mine the Dietz seam is correlatable with the Dietz 2 and Dietz 3 coals. The Anderson is stratigraphically higher than the mining disturbance at the Big Horn Coal Mine and generally occurs only as isolated remnants south and west of the PSO Tract (Ash Creek Mining Company 1984). Within the general Monarch, Wyoming and Decker, Montana area the Fort Union coal seam nomenclature varies with respect to location and/or author (Law, et al. 1979). The Anderson seam in the PSO Tract area is correlatable to and is also called the Dietz 1 seam. The Dietz 1 seam in the PSO Tract area is correlatable to and is also called the Dietz 2 seam. The Dietz 2 seam in the PSO Tract area is correlatable to and is also called the Dietz 3 seam. For the sake of consistency, the two mineable coal seams within the PSO Tract will be referred to as the Dietz 1 and Dietz 3 coal seams throughout the remainder of this EIS.

Thickness of the coal seams varies across the PSO Tract area. The Dietz 1 coal seam is present only in the northern half of the site because of erosion and burning, and its thickness increases from approximately five ft to an average of approximately 20 ft in Sections 22 and 23 of T.58N., R.84W. The Dietz 3 seam is present across the proposed mining area and ranges in thickness from approximately 10 to 50 ft, averaging about 41 ft. Overburden above the Dietz 1 seam ranges from approximately 25 to 275 ft in thickness. The overburden above the Dietz 3 where Dietz 1 is not present is

from 20 to 120 ft thick. The interburden thickness between the Dietz 1 and Dietz 3 seams ranges from 20 to 140 ft, with a thickening trend from east to west.

The stratigraphy in the PSO Tract area is similar to that found at the other surface coal mining sites in the general area (Figure 3-1). Overburden and interburden consists of "burn" or scoria, siltstone, shale and minor sandstone units. Burn is present at several locations in the PSO Tract area, particularly to the south where the Dietz seams crop out at the surface.

Two northeast-trending structural faults approximate the northwest and southeast boundaries of the proposed mining area (Figure 3-2). Though not accurately defined by drilling yet, the displacements across each of these two major faults are estimated to be 60 to 180 ft. Generally, the stratigraphic dip is to the northeast at approximately 4 percent between the faults. There are local areas where the shallow strata dip at higher angles, generally due to local folding or faulting.

The Lebo Shale and Tullock members of the Fort Union Formation, which underlie the Tongue River member (Figure 3-3), would not be disturbed if mining occurs. 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 1996f).

Coal. Some of the largest accumulations of subbituminous coal reserves in the world are contained within the PRB. Surface coal mining occurs where the coal is at its shallowest depth, i.e., nearest the outcrops along the eastern and western edges of this structural basin. Active surface coal mining in the PRB is centered in two general zones: the eastern side of the basin and the western side of the basin. The eastern zone is in Campbell and Converse Counties, starting about 20 miles north of Gillette, Wyoming and extending south for about 75 miles. The major producing seams in that area are the Fort Union's Anderson and Canyon seams (combined they form the Wyodak seam). The western zone is an area between Sheridan, Wyoming (the Sheridan Coal Field) and Colstrip, Montana. At the present time there are six active surface mines in the western zone, all of which are located in Montana. Numerous old, abandoned underground coal mines exist immediately north of Sheridan, as does the recently reclaimed Big Horn Coal Mine and an older unnamed strip mine, known locally as the Hidden Water pits (Figure 3-1). Near the Montana State line the major

producing seams are the Fort Union's Monarch and Dietz seams.

A surface coal mine north of Sheridan was permitted with the WDEQ in 1976 as the PSO No. 1 Mine, which is now called the Ash Creek Mine (WDEQ Permit No. 407). This mine is located in the northeast quarter of Section 22, T.58N., R.84W., adjacent to the federal coal being considered for exchange. An initial box cut, overlying privately owned coal, was opened in the late 1970s. The mine plan was contingent upon approval and construction of a proposed railroad spur for an adjacent proposed mine in Montana. No method of coal transportation was built and all operations ceased in 1980. Operations remained suspended through 1995 when reclamation activities began. Reclamation was completed and a full area bond release request by the Ash Creek Mining Company was granted by WDEQ/LQD in 1996. Mine Permit 407 was transferred from Central and Southwest Services, parent company of the Ash Creek Mining Company, to P&M in 1997.

The Fort Union coal seams are subbituminous and are generally low-sulfur, low-ash coals. The quality of the recoverable coal reserves within the area of the federal coal being considered for exchange is represented by the analyses (done on an as-received basis) of recent exploration drilling samples collected by P&M. The Dietz 1 seam has a weighted average heating value of approximately 9,279 Btu/lb and contains 5.8 percent ash and 0.44 percent sulfur. The Dietz 3 seam has a weighted average heating value of approximately 9,352 Btu/lb and contains 5.4 percent ash and 0.53 percent sulfur. The volatile matter, fixed carbon and moisture percentages were not available from the analyses of these recently obtained samples, although those values for the Dietz 1 and Dietz 3 seams, respectively, as determined for the PSO No. 1 Mine area were as follows: 31.68 percent and 32.98 percent for volatile matter, 35.82 percent and 36.43 percent for fixed carbon, and 26.05 percent and 26.05 percent for moisture (Ash Creek Mining Company 1984).

Oil and Gas. Oil and gas have been produced in the PRB for more than 100 years from reservoir beds that range in age from Pennsylvanian to Oligocene (DeBruin 1996). There are approximately 500 fields that produce oil and/or natural gas. The estimated mean amounts of undiscovered hydrocarbons in the basin are 1.94 billion barrels of recoverable oil and 1.60 trillion ft^3 of gas (USGS 1995). Depth to gas and oil-bearing strata is generally between 4,000 ft and 13,500 ft, but some wells are as shallow as 250 ft.

The western portion of the PSO Tract is located near geologic structures that contain producible quantities of oil. The Ash Creek and Ash Creek South Fields, both discovered in the early 1950s, are located in T.10S., R.38E., Section 3, Big Horn County Montana, and in T.58N., R.84W., Sections 29, 30, 31, and 32, Sheridan County, Wyoming, respectively.

Production is from the Upper Cretaceous Ash Creek sandstone, which lies approximately 4,600 ft below the surface in this area (Morgando 1958). See Section 3.4.11 for further discussion of wells that are currently producing and associated facilities.

Coal Bed Methane. The generation of methane gas from coal beds occurs as a natural process. Methane produced by coal may be trapped in the coal by overburden pressure, by the pressure of water in the coal, or by impermeable layers immediately above the coal. Deeper coal beds have higher pressures and generally trap more gas. Under favorable geologic conditions, methane can be trapped at shallow depths in and above coal beds, and this seems to be the case in the PRB. Without the existence of conditions which act to trap the gas in shallow coals or in adjacent sandstones, the gas escapes to the atmosphere. It is likely that much of the methane generated by the coal beds in the PRB has gradually escaped into the atmosphere because of the relatively shallow coal burial depths. A recent study estimates that there are approximately 38.2 trillion cubic ft of CBM gas in place in PRB coal beds and that an estimated 25.6 trillion cubic ft of that gas is recoverable (Finley and Goolsby 2000). The authors of this study indicated that these numbers reflect only coal beds that are thicker than 20 ft and deeper than 200 ft because it is generally accepted by industry that coal beds 20 ft or more are necessary for economic production of CBM and that coal beds less than 200 ft deep have already been de-pressured and much of the gas has escaped to the atmosphere.

Historically, methane has been reported flowing from shallow water wells and coal exploration holes in parts of the PRB. According to DeBruin and Jones (1989), most of the documented historical occurrences have been in the northern PRB. Olive (1957) references a water well in T.54N., R.74W. which began producing gas for domestic use in 1916.

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

Since the early 1990s, the BLM has completed numerous EAs and two EISs analyzing CBM projects. The Wyodak CBM Project EIS was completed in 1999. It studied 3,600 mi^2 of mixed federal, state, and private lands. The EIS analyzed the impacts of drilling and producing up to 5,000 new federal, state, and private CBM wells in addition to the 890 wells that had been evaluated in previous NEPA documents. BLM subsequently completed an EA to analyze the impacts of drilling as many as 2,500 additional federal drainage protection wells within the Wyodak EIS project area (BLM 2000).

These wells are being drilled and produced to prevent the loss of federal CBM resources and corresponding royalties from undrilled federal oil and gas leases that are adjacent to and potentially being drained by wells drilled on private or state lands. BLM is currently preparing a new EIS to analyze the cumulative impacts of reasonably foreseeable CBM and conventional oil and gas development within the Wyoming portion of the PRB. The PRB Oil and Gas Project Draft EIS was mailed to the public in January 2002.

Approved spacing for CBM wells in the PRB is one well per coal seam per 80 acres, or eight well cluster locations per section. Since there are three potential coal seams (i.e., Dietz 3, Monarch, and Carney) that would be to produce CBM in the Ash Creek area, a total of 78 CBM wells could be drilled within the boundary of the federal coal being considered for exchange. As of June 2001 CBM was not being produced on the PSO Tract, although five wells had been drilled on privately-owned oil and gas leases in the PSO Tract. Four additional CBM wells have been permitted on the tract.

The ownership of oil and gas resources, including CBM, in the PSO Tract is discussed in Section 3.4.11 of this EIS.

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 PSO Tract.

Uranium. Uranium exploration and mining were very active in the 1950s, when numerous claims were filed in the PRB. A decreased demand combined with increased foreign supply reduced uranium mining activities in the early 1980s. There are currently two in-situ leach operations in central Converse County in the southern PRB. Production at another ended in 2000. No known uranium reserves exist on the PSO 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 in the PSO Tract area.

No mining claims, mineral material sales contracts, free use permits, or solid mineral leases exist within the PSO Tract.

3.4.4 Soils

The soils on the PSO Tract are typical of the soils that occur on the adjacent lands. The area covered in this study was covered by a soil survey completed and published by the NRCS.

Based on the NRCS soils studies, there is enough suitable topsoil for salvaging within the PSO Tract area to redistribute suitable soils to a depth of about two to three ft over all disturbed areas.

All soil surveys were completed to an order 2-3 resolution by the NRCS. 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 affected area associated with the Proposed Action.

Soils developing predominantly in alluvial or colluvial fan deposits

- Bidman - Ulm, dry, complex, 0 to 6 percent slopes
- Cambria - Forkwood complex, 0 to 15 percent slopes
- Cushman - Forkwood association, 3 to 15 percent slopes
- Harlan loams, dry, 0 to 15 percent slopes
- Haverdad - Worthenton complex, 0 to 3 percent slopes
- Kishona - Cambria complex, 3 to 6 percent slopes
- Parmleed - Bidman association, 3 to 15 percent slopes
- Zigweid - Cambria loams, 0 to 15 percent slopes
- Zigweid - Kishona - Cambria complex, 6 to 15 percent slopes

Soils developing predominantly in residuum on uplands

- Baux - Bauxson association, dry, 0 to 65 percent slopes
- Cushman - Worf association, 3 to 25 percent slopes
- Parmleed - Worfka association, 0 to 15 percent slopes
- Shingle, moist - Baux - Rock outcrop complex, 30 to 60 percent slopes
- Shingle - Haverdad association, 0 to 80 percent slopes
- Shingle - Rock outcrop complex, 30 to 50 percent slopes
- Shingle - Samday clay loams, 6 to 60 percent slopes
- Shingle - Theedle - Kishona association, 6 to 25 percent slopes
- Shingle - Wibaux complex, 0 to 60 percent slopes
- Shingle - Wibaux complex, cool, 15 to 80 percent slopes
- Shingle - Worf complex, 6 to 15 percent slopes
- Spearman - Wibaux association, 6 to 25 percent slopes
- Theedle - Kishona association, 6 to 15 percent slopes

Soils developing predominantly in eolian sand deposits

- Hiland - Decolney complex, 3 to 15 percent slopes
- Taluce - Tullock - Vonalee association, 6 to 15 percent slopes

Table 3-1 provides the extent of five depth classes of suitable topsoil within the PSO Tract.

An average of about two ft of topsoil would be redistributed on all disturbed acres. Soils sites with high alkalinity, salinity or clay content are unsuitable for use in reclamation.

The soil depths and types on the PSO Tract are similar to soils currently being salvaged and utilized for reclamation at the other surface mines in the Sheridan area. The tract is expected to have an adequate quantity and quality of soil for reclamation. The site-specific soil surveys have located hydric soils and/or inclusions of hydric soils. The presence of hydrophytic vegetation and wetland hydrology would be determined during jurisdictional wetland determinations included in the mine permit application package (see Section 3.4.8).

3.4.5 Air Quality

3.4.5.1 Air Quality Regulations

Air quality and pollutant emissions to the air are regulated under both federal laws and regulations (CAA) and Wyoming state laws and regulations implemented by the WDEQ. 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 AAQS. These standards have been established by the U.S. EPA and the WDEQ at levels deemed necessary to preclude adverse impacts on human

Table 3-1. Acres of Topsoil Available for Reclamation Within the Boundary of the Federal Coal Being Considered for Exchange Under the Proposed Action.

Thickness of Suitable Topsoil (inches)	Acres	Percent
0	0.0	0.0
0 - 12	83.1	4.1
12 - 30	1585.9	77.6
30 - 48	168.1	8.2
48 - 60	207.9	10.1
Total	2045.0	100.0

health and welfare. The applicable federal and Wyoming AAQS are shown in Table 3-2.

States designate areas within their borders as being in "attainment" or "non-attainment" with the AAQS. Since the PSO Tract is near the border of Wyoming and Montana, the attainment status of nearby areas in both states is considered. The PSO Tract is in an area is designated an attainment area for all pollutants. However, the town of Sheridan, Wyoming, located about 12 miles south of the project area, is a non-attainment area for PM_{10}. The town of Lame Deer, Montana, located about 50 miles northeast, is also a non-attainment area for PM_{10}. The towns of Laurel and Billings, Montana, non-attainment areas for SO_2, are located about 90 miles northwest of the project area.

Under requirements of the CAA, EPA has established PSD rules, the purpose of which is to prevent further deterioration of air quality in areas that are in attainment with the Absaroka Wilderness Area, located about 130 miles to the west of the site. The next closest Class I area is Wind Cave National park in South national AAQS. The increment allowable under PSD depends on the area's designation as Class I, II, or III. Increases in ambient concentrations of NO_2, SO_2 and PM_{10} are limited to modest increments in Class II areas (most of the country), and to very small increments in Class I areas (national parks and other designated pristine areas). The closest Class I area to the PSO Tract is the North

Table 3-2. Federal and Wyoming Ambient Air Quality Standards.

Emissions	Averaging Period	Wyoming Standard ($\mu g/m^3$)	Federal Standards	
			Primary ($\mu g/m^3$)	Secondary ($\mu g/m^3$)
PM_{10}	24-hour[1]	150	150	Same
	annual[2]	50	50	Same
Sulfur Dioxide (SO_2)	3-hour[1]	1,300	----	1,300
	24-hour[1]	365	365	----
	annual[2]	80	80	----
Nitrogen Oxide (NO_x)	annual[2]	100	100	Same
Carbon Monoxide (CO)	1-hour[1]	40,000	40,000	----
	8-hour[1]	10,000	10,000	----
Ozone (O_3)	1-hour[1]	235	235	Same
Lead (Pb)	Calendar Quarter	1.5	1.5	Same

[1] Standards not to be exceeded more than once per year.
[2] Annual arithmetic mean not to be exceeded.
Source: Wyoming DEQ and US EPA air quality regulations.

Dakota, located about 195 miles east southeast of the site. The closest sensitive Class II areas to the PSO Tract include the Northern Cheyenne Indian Reservation, Cloud Peak Wilderness Area and Devil's Tower National Monument, which are approximately 25, 36 and 93 miles distant, respectively. Wyoming's PSD standards for particles are identical to federal standards, except that Wyoming has not adopted Class III standards (Table 3-3).

For a new major source, PSD regulations require specific permitting reviews to demonstrate that increments will not be exceeded and to ensure best available emission controls would be applied. A new mine is classified as a major source 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)]. For the proposed Ash Creek Mine, the only fugitive emissions that would be counted toward the potential-to-emit for PSD applicability purposes are those directly associated with the coal preparation plant. Mining related fugitive emissions are exempt from the applicability determination.

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

Blasting is also responsible for another type of emission from surface coal mining. Overburden blasting sometimes produces low-lying gaseous orange clouds which contain NO_x. Increasing public concern over this issue prompted a WMA-sponsored symposium, which was held in Gillette, Wyoming on January 12 and 13, 2000. The symposium brought together experts from the industry and regulatory agencies to discuss possible causes and solutions to excessive NO_x emissions from

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

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

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

blasting. Since that time, mine operators in the eastern PRB and blasting agent manufacturers have been working together to reduce NO_x emissions through experimentation with different blasting agent mixtures and additives used with regard to the relative competency of the overburden and its moisture content. The use of sophisticated electronic detonation systems is another method currently being experimented with in an effort to reduce NO_x emissions (Doug Emme, August 2001).

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

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

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

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

Although fugitive emissions from mining activities during the most active mining year at the Ash Creek Mine are estimated to be 259 tpy, potential emissions that count towards the PSD applicability threshold would be much less than 250 tpy. Thus, the project would not be classified as a major source and would not be subject to PSD review. Because final engineering for the coal preparation plant is not complete, it is not possible to determine the exact level of emissions that would count towards the PSD threshold at this time.

NSPS Subpart Y, "Standards of Performance for Coal Preparation Plants" (40 CFR 60.250), applies to coal preparation plants that process more than 200 tpd of coal and which are constructed or modified after October 24, 1974. The standard applies to affected facilities at the plant, including (but not limited to) coal crushers, conveyors, storage systems, transfer and loading systems. The standard specifies opacity limits for affected units.

The proposed Ash Creek Mine satisfies the applicability requirements for this NSPS. Thus, affected equipment constructed at the coal preparation plant would be required to meet the requirements of this NSPS.

NSPS Subpart Kb, "Standards of Performance for Volatile Organic Liquid Storage Vessels" (40 CFR 60.1106), applies to certain storage vessels constructed or modified after July 23, 1984. This NSPS could apply to the facility depending upon final engineering. However, final engineering is not complete and details necessary to determine applicability of this NSPS standard are not yet available.

3.4.5.2 Affected Environment

The PSO Tract area is located in the Tongue River airshed, which comprises approximately 4,500 mi^2 in a rectangular area extending along the Tongue River from the Big Horn National Forest to the confluence with the Yellowstone River about 145 miles to the north northeast. Information on the climate and meteorology of the area, as presented in this section, is based on available data from the town of Sheridan as well as nearby stations.

Wyoming can be characterized as having a combination of both highland and mid-latitude semiarid climates. The dominant factors which affect the climate of the area are elevation, local relief and the mountain barrier effect. This barrier effect can produce marked temperature and precipitation differences between windward and leeward slopes. Generally, temperatures decrease and precipitation increases with increasing elevation. The climatic description of the project area itself is high plains semi-arid, characterized by large diurnal and seasonal variations in temperature and seasonal variations in precipitation.

The general climate of the area is typical of a semi-arid high plains environment with relatively large seasonal and diurnal variations in temperature and seasonal variation in precipitation. Long-term average monthly maximum, minimum and mean temperatures for Sheridan are presented in Table 3-4. These data show the large seasonal variation in temperature with the warmest month being July, with a mean at 69.6°F, while the coldest month is January, with a monthly mean at 19.0°F. July is the month with the warmest average maximum (86.7°F) while January is the month with the coolest average minimum (5.9°F). The annual mean temperature for the area is 43.9°F.

Precipitation data descriptive of the general region was obtained from a station east of Clearmont, Wyoming and presented in Table 3-5. The average annual precipitation received is 12.0 inches with the majority falling between April and September.

The month with the highest precipitation total is June 2.9 inches while the months with the lowest totals are December, January and

Table 3-4. Average Maximum, Minimum and Monthly Mean Temperatures for Sheridan, Wyoming.

Month	Average Maximum (°F)	Average Minimum (°F)	Monthly Mean (°F)
January	31.9	5.9	18.9
February	36.6	10.7	23.7
March	44.5	19.5	32.0
April	57.0	30.0	43.5
May	67.4	39.7	53.6
June	76.5	47.9	62.2
July	87.3	53.5	70.4
August	86.6	51.1	68.9
September	74.6	40.8	57.7
October	61.9	30.6	46.3
November	44.9	18.6	31.8
December	35.5	9.7	22.6
Year	58.7	29.8	44.3

[1] Sheridan Field Station; located 44.43°N and 106.83°W at 3,750 ft above sea level. Data period from 1920-2000; WRCC 2001.

Table 3-5. Climatic Monthly Precipitation For Arvada 3 N Located in Sheridan County, Wyoming.

Month	Precipitation (inches)
January	0.4
February	0.4
March	0.6
April	1.1
May	2.0
June	2.9
July	1.0
August	0.9
September	1.1
October	0.7
November	0.5
December	0.4
Annual	12.0

[1] Climatic precipitation data from NCDC cooperative station, 1936 through 1977. Arvada 3N in Sheridan County, located at 44.7°N and 106°W, at 3,681 ft above mean sea level; NCDC 2001.

February at 0.4 inch each. As is typical with a semi-arid area, year-to-year and month-to-month temperature and precipitation values can and will vary widely from the climatic averages.

Winds are greatly affected by local topographic features. Wind data have not been collected from the specific project area, but such data are available for a 5-year period from Sheridan. These data (1984 and 1987 through 1990) were processed into a joint frequency distribution of wind direction by wind speed and the results are presented as a wind rose diagram in Figure 3-4. The predominant wind directions for Sheridan are from the northwest and west-northwest at 12.7 percent and 11.5 percent of the time, respectively. The annual average wind speed for the period was 8.7 mph with the strongest winds coming out of the west-northwest (12.3 mph) and northwest (12.1 mph).

Wind data are also available for the last five years (1996 through 2000) from the Decker Coal Mine. These data were also processed into a frequency distribution of wind direction and are depicted as a wind rose diagram in Figure 3-4. The prevailing wind directions recorded at the Decker Mine are from the northwest and south, both at 12.5 percent of the time. Wind directions at the Decker meteorological station are strongly influenced by the local terrain and close proximity to the Tongue River Reservoir (Figure 3-4). The PSO Tract area is characterized by the Ash Creek and Youngs Creek drainages which both flow generally from the west-northwest toward the Tongue River to the east. The area has some complex terrain, especially in the western half of the property. As such, it is anticipated that the wind flow patterns will follow relatively closely the patterns observed at Decker, but with a greater frequency of return flows from the southeast sectors, up the drainage valleys, as a result of afternoon heating.

According to current regulatory standards by which air quality is defined, surface mining development in the Tongue River Basin has not resulted in impacts to air quality that have exceeded federal or state standards. The maximum 24-hour PM_{10} concentration observed in the last six years (from nearby mine data) was 118 $\mu g/m^3$ recorded in 1995. Annual PM_{10} concentrations average about 11 $\mu g/m^3$. These values are well below the AAQS of 150 and 50 $\mu g/m^3$ for the 24-hour and annual averaging times, respectively.

It is important to note that the non-attainment areas discussed in the air quality regulations section are not due to surface mining. Rather, they are the result of pollution generated in the immediate vicinity of those population centers.

The air quality of the PRB area is generally good. WDEQ/AQD assumes a background PM_{10} concentration of 15 $\mu g/m^3$ for regulatory purposes (Judy Shamley, April 2000). Figure 3-5 is a depiction of visibility impairment measured in

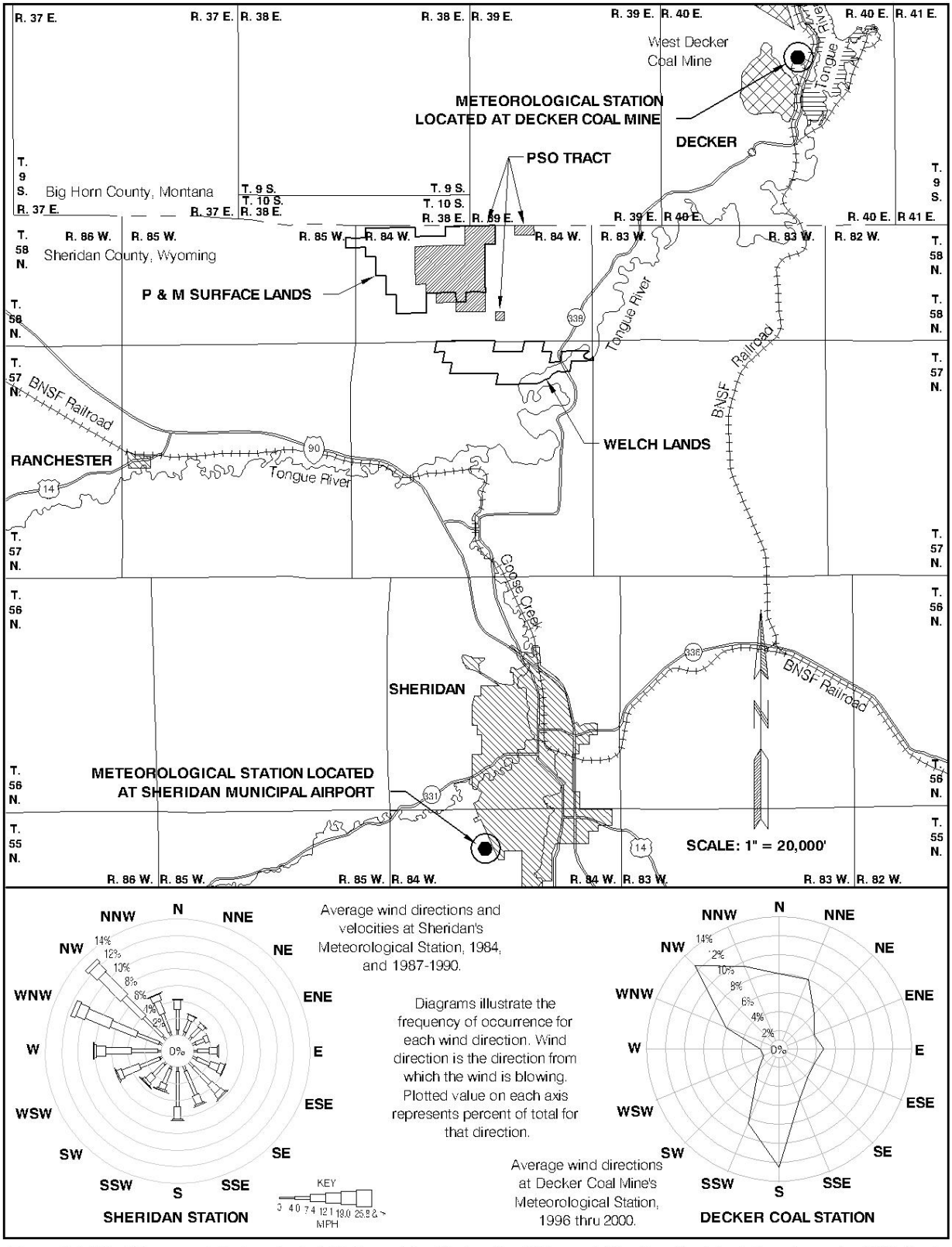

Figure 3-4. Wind Roses and Meteorological Stations at the Decker Coal Mine and Sheridan Municipal Airport near the PSO Tract.

deciviews (dv). A dv is a general measure of view impairment caused by pollution. A dv of 13 translates to a view of approximately 60 miles, which in the PRB is common viewing distance. As can be seen from Figure 3-5, the only areas of the U.S. with less view impairment than the PRB are the Colorado Plateau (dv = 11) and the Great Divide Basin (dv = 10).

3.4.6 Water Resources

3.4.6.1 Groundwater

Within the PSO Tract there are two water-bearing geologic units that could be disturbed by mining. These units are the alluvium of West Branch, Little Youngs Creek and Youngs Creek, and the Dietz 1 and Dietz 3 coal seams. The sub-Dietz coal Fort Union Formation would not be disturbed by mining activities. The stratigraphic units beneath the PSO Tract and the hydrologic properties are displayed in Figure 3-3.

The PSO No. 1 Mine completed 17 monitoring wells near the PSO Tract in 1980; two in the Dietz 1 seam, five in the Dietz 3 seam, and ten in the alluvium (Figure 3-6). As discussed previously, the Ash Creek Mine, as it is currently called, was initially permitted as the PSO No. 1 Mine in 1976. This was prior to most of the current regulations and guidelines governing surface coal mining in Wyoming. Most of the monitoring wells for the PSO No. 1 Mine were installed after pit development; therefore, groundwater level drawdowns had already occurred at many of the well locations when the first measurements were recorded.

The future of the PSO No. 1 Mine was contingent upon approval and construction of a proposed railroad spur for an adjacent mine in Montana that was being contemplated by Shell Oil Company. The pit remained open until late 1995 when reclamation of the PSO No. 1 Mine site began. By mid-1996 reclamation was complete and a single backfill monitoring well was then installed. Data from the PSO No. 1 Mine's 18 monitoring wells, as well as data collected by MBMG to identify the hydrogeology of the adjacent proposed surface coal mine area in Montana (Hedges, et al. 1980), were used to prepare the following description of the baseline groundwater conditions in the PSO Tract area. Figure 3-6 shows the locations of the PSO No. 1 Mine pit and the MBMG monitoring wells as well as the 18 PSO No. 1 Mine monitoring wells.

Recent Alluvium. Within the boundary of the federal coal being considered for exchange, alluvium is present along West Branch. Little Youngs Creek is located just north of the tract proposed for exchange and could be affected if privately owned coal adjacent to the tract is mined (Figure 2-2). The alluvium along Little Youngs Creek ranges from roughly 50 to 100 ft wide and consists of 10 to 20 ft of fine-grained clays, silts and sands underlain by up to 35 ft of coarse sand and scoria gravel (Ash Creek Mining Company 1984). Hedges, et al. (1980) reported that slightly thicker deposits of

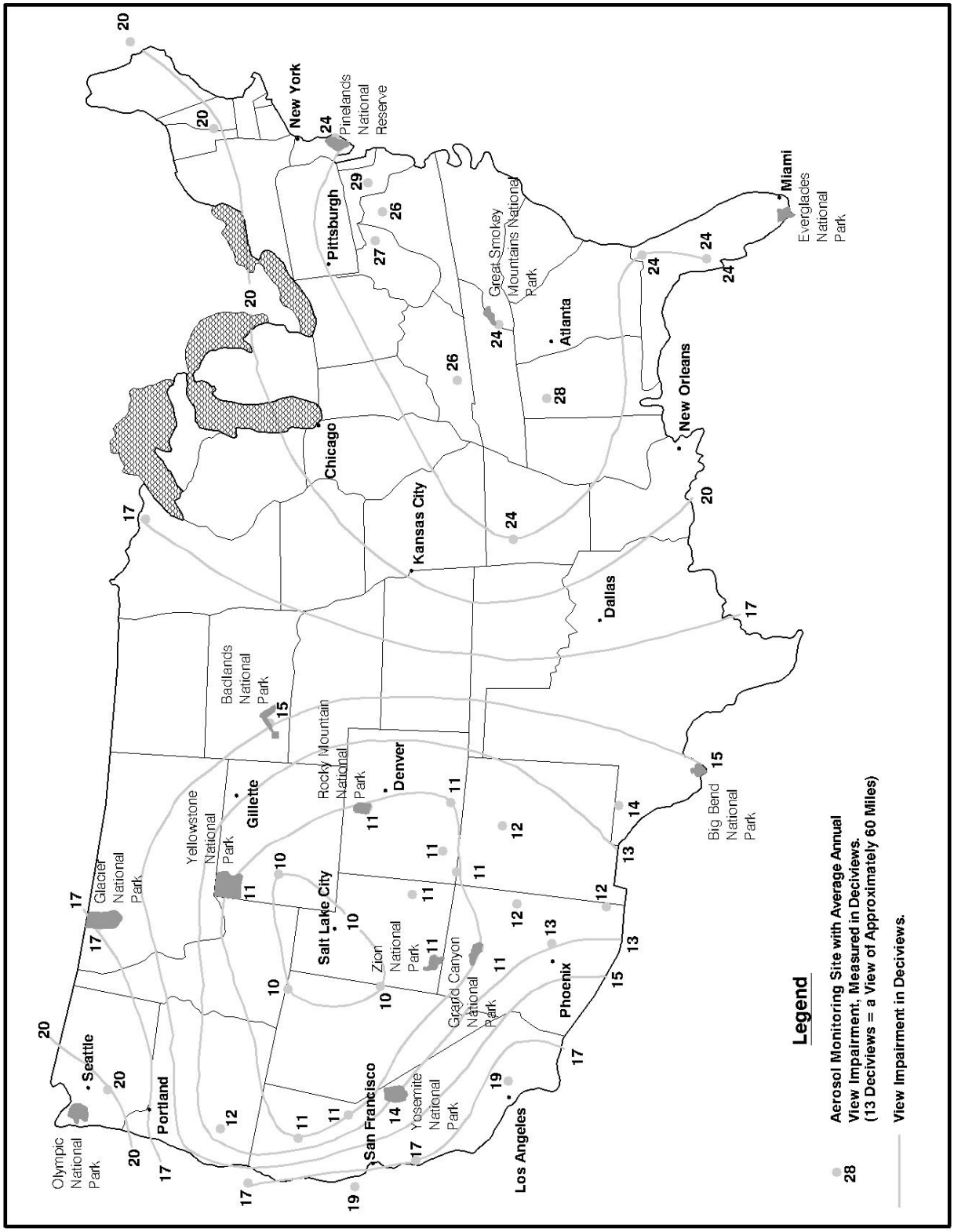

Figure 3-5. Average Annual View Impairment as a Function of Light Extinction. (From IMPROVE, 1995)

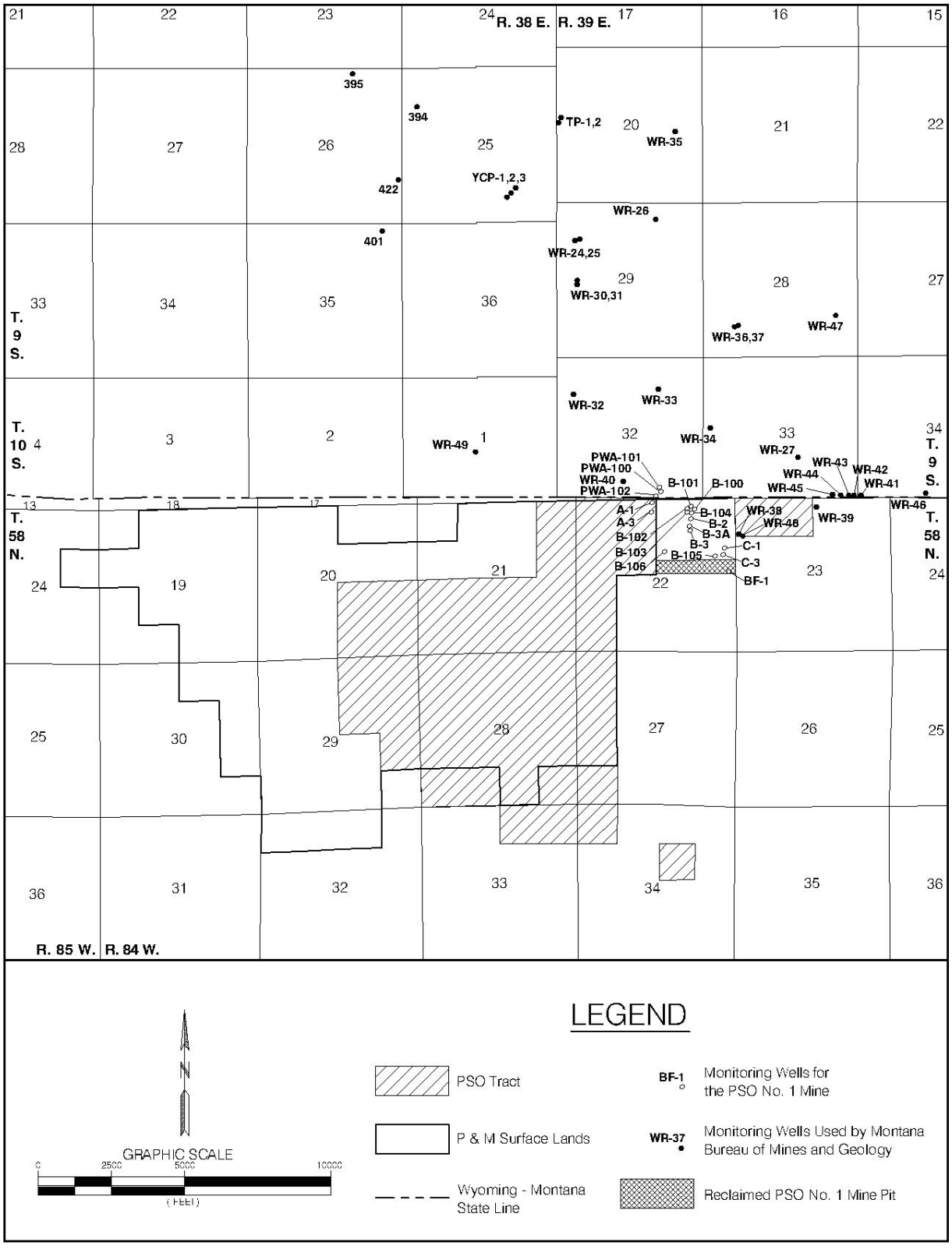

Figure 3-6. Monitoring Well Locations Within and Adjacent to the PSO Tract.

alluvium occupy the bottom of the Youngs Creek drainage where the maximum thickness of unconsolidated materials is approximately 65 ft. Alluvial deposits along West Branch are not extensive and were not intensively investigated for the baseline hydrology section of the PSO No. 1 Mine permit application.

The hydraulic properties of the alluvium are variable, although the coarse material in the basal Little Youngs Creek alluvium forms a moderate to high yield aquifer. The hydraulic conductivity of the Little Youngs Creek alluvium ranges from 86 to 134 ft/day, the average computed for the entire saturated thickness is about 120 ft/day (Ash Creek Mining Company 1984). Aquifer testing of both the Little Youngs Creek and Youngs Creek alluvium also indicated that the groundwater is confined in the coarse-grained basal materials beneath the overlying clay and silt deposits at some well locations, whereas at other locations the basal gravels may not behave as a confined aquifer.

Water levels in the Little Youngs Creek alluvium were affected by the construction of the initial pit of the PSO No. 1 Mine. The pit did not disturb the majority of the valley fill of Little Youngs Creek, although some alluvium was removed. As a result, the natural groundwater flow pattern was altered and gradients were toward the pit until backfilling occurred in 1996. Since reclamation, alluvial groundwater levels have apparently fully recovered and underflow through the alluvium has been reestablished.

Alluvium along the area's watercourses transmits large volumes of groundwater southeastward. It is recharged vertically from streamflow and precipitation, and laterally from subcrops of discharging bedrock aquifers. It provides temporary storage of water during periods of high streamflow and returns it to the streams during periods of low streamflow. Most flow in the alluvium occurs within the basal gravels that consist of locally derived burn/clinker materials.

Groundwater sampled from the Little Youngs Creek alluvial aquifer is generally a magnesium, calcium-bicarbonate type. The TDS concentrations are usually about 500 to 600 mg/l, and it is classified as permissible to good for irrigation and livestock uses.

Clinker. Another geologic unit consisting of sediments that overlaid a coal seam at one time in the past before the coal burned naturally is clinker, also called scoria or burn. 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 PRB. Scoria deposits occur within the PSO Tract area. The hydrologic function of scoria in the general area is to provide infiltration of precipitation and recharge to laterally contiguous Dietz 1 and Dietz 3 coal seams.

Dietz 1 and Dietz 3 Coal Seams. Due to their lateral continuity, the Dietz 1 and Dietz 3 coal seams are considered regional aquifers within this area of the PRB, although both are somewhat low yielding. Within the PSO Tract area the Dietz 1 coal seam is present over a wide range of depths below the surface (approximately 25 to 275 ft), and due to erosion and burning it occurs as a 20-ft thick seam only in the northern half of Sections 22 and 23, T.58N., R.84W. The Dietz 2 and Dietz 3 seams have an interburden thickness ranging from approximately 20 to 40 ft. The Dietz 2 seam is present only in the southern part of the PSO Tract area and is less than 5 ft thick. Therefore, the Dietz 2 is not considered mineable, nor is it considered an aquifer in this area. The Dietz 3 seam is present across the entire general area and ranges from approximately 10 to 50 ft thick.

The value of the Fort Union coal seams as sources of groundwater is largely dependent upon their depths and occurrence with respect to recharge areas. In addition, the hydraulic conductivity of a coal seam is typically highly variable and is reflective of the amount of fracturing the coal has undergone, as unfractured coal is virtually impermeable. The yield of groundwater to wells and mine pits is smallest where the permeability of the coal is derived primarily from localized unloading fractures. These fractures, which are the most common, were created by the expansion of the coal as the weight of overlying sediments was slowly removed by erosion. The highest permeability is imparted to the coal by tectonic fractures. These are through-going fractures of areal importance created during deformation of the 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 coal fractured by unloading only.

The hydraulic properties of the coal seams within and adjacent to the PSO Tract are expected to be very similar to those that were determined by aquifer pump testing some of the monitoring wells shown in Figure 3-6. The hydraulic conductivity of the Dietz 1 and Dietz 3 coal seams ranges from 0.13 to 3.6 ft/day. The average hydraulic conductivity for the coal bed aquifers is estimated to be 1.0 ft/day (Hedges, et al. 1980). The average storage coefficient value was determined to be roughly 0.0003, indicative of a confined aquifer and typical for Fort Union coal seams that are usually overlain and underlain by relatively impermeable siltstone and shale strata. These values agree well with those measured at other surface mining operations in this general area of the PRB.

Prior to mining, the direction of groundwater flow within a coal aquifer is generally from the recharge

areas near the outcrop and burn zones downgradient following the dip of the coal. Variations in the degree and extent of fracturing (thus transmissivity), outcrop geometry, and structural faulting also control flow patterns.

The Dietz 1 seam receives recharge via clinker along the coal's burned outcrop areas and in places where subcrops of the coal lie beneath the water table in alluvium along watercourses. Discharge from the system ultimately occurs along the Tongue River east-northeast of the PSO Tract area. The northeast-trending faults act to control the groundwater flow patterns, as stratigraphic displacements across the faults act as barriers to groundwater flow. The subcrop line, or leading edge of the Dietz 1 coal seam, is located in Sections 20, 21, and 22, T.58N., R.84W., and the structural gradient is downward to the northeast. The Dietz 1 coal therefore does not occur contiguously to the west or south and essentially no recharge west or south of the PSO Tract area can occur. The subcrop zone lies beneath the alluvium of the West Branch and Little Youngs Creek and the seam is saturated downdip to the northeast indicating the alluvial subcrop is a source of recharge. Discharge from the Dietz 1 coal aquifer occurs mostly at the seam's subcrops beneath the Tongue River valley to the east-northeast of the PSO Tract area.

The Dietz 3 seam is burned over broad areas of the Little Youngs Creek and Ash Creek drainages west and north of the PSO Tract area. The structurally and topographically high outcrops of scoria there are the primary recharge areas. Discharge from the Dietz 3 coal aquifer occurs mostly at the seam's subcrops beneath the Tongue River valley to the east-northeast of the PSO Tract area.

The baseline potentiometric surfaces of the Dietz 1 and Dietz 3 beds are very similar and are in fact identical where the two beds converge downdip of the PSO Tract area. Groundwater flow direction in both the Dietz 1 and Dietz 3 seams is to the northeast parallel to the structural gradient and bounded by the northeast-trending fault planes.

Site-specific water level data collected at monitoring wells shown in Figure 3-6 indicate that opening the PSO No. 1 Mine box cut pit in 1976 caused groundwater level drawdowns to occur locally in both the Dietz 1 and Dietz 3 coal seams due to pit dewatering, although the general flow direction remained toward the northeast, down the structural gradient. The pit penetrated through the Dietz 1 coal in 1976. This coal seam is dry near the pit, but monitoring wells located north of the pit which do have water in them recorded drawdowns. Currently, groundwater flow in the Dietz 1 seam is still toward the pit and this should continue until the backfill fully saturates and equilibrium is reestablished. Recovery has proceeded rapidly since reclamation occurred. The PSO No. 1 Mine pit partially removed the interburden

between the Dietz 1 and Dietz 3 seams. As a result, groundwater from the Dietz 3 seam migrated through the confining layer upward into the excavation, lowering the hydrostatic pressure. Reclamation has apparently stopped the upward leakage, as groundwater levels have been quickly increasing (P&M 2001), although recent nearby CBM activity may now influence the rate at which premining equilibrium will be reached.

The chemistry of groundwater in the coal seams is variable with respect to location from the recharge areas. In waters near recharge areas, magnesium, calcium, sodium, sulfate and bicarbonate are all present in significant concentrations. At a short distance downgradient (northeastward), magnesium and calcium concentrations are reduced and sodium becomes the principal cation. Similarly, the percentage of sulfate concentration is reduced leaving bicarbonate the predominant anion. Further downgradient sulfate is nearly absent, leaving sodium and bicarbonate overwhelmingly the predominant ions. TDS concentrations range from 1,000 to 3,000 mg/l. The SAR is typically very high and the water is poor to unsuitable for most uses except livestock watering (Hedges et al. 1980, and Ash Creek Mining Company 1984).

Sub-Dietz Coal Fort Union Formation. No hydrologic units below the Dietz 3 coal seam would be directly disturbed by the proposed Ash Creek Mine. The thickness of interburden between the Dietz 3 seam and the next water-bearing unit, which is the Monarch (also called the Lower Monarch or Canyon) coal seam, is approximately 100 ft. Roughly another 100 ft of interburden separate the Monarch seam from the next aquifer - the Carney coal seam. Below the Carney seam the Tongue River Member is interbedded with the Lebo Shale Member of the Fort Union Formation. 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). Beneath the Lebo Member is the Tullock Member, consisting of discontinuous lenses of sandstone separated by interbedded shale and siltstone. The transmissivities of the Tullock Member sandstones are generally high and many of the surface mines in the PRB have water supply wells completed in this interval (Martin, et al. 1988). However, due to its excessive depth, the Tullock Member is not utilized as a source of water in this area of the PRB.

In the vicinity of the PSO Tract area the hydrologic units stratigraphically beneath the Dietz 3 coal seam that have been or are presently being dewatered are the Monarch and Carney coal seams. The Monarch seam was mined at the Big Horn Coal Mine and actively dewatered until final reclamation was completed in 2000. Currently, CBM development is occurring to the north, south, and east of the PSO Tract area and is reducing water levels in the Dietz 3,

Monarch and Carney coal seam aquifers.

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. Neither the Lance or Fox Hills Formations are to be affected by the proposed Ash Creek Mine, nor are these formations being affected or utilized as a source of groundwater in the general Ash Creek area.

3.4.6.2 Surface Water

The area surrounding the PSO Tract consists of relatively flat, rounded uplands dissected by numerous deep, steeply sloping ravines. In general, the streams within this area are typical for the region, and their flow events are closely reflective of precipitation patterns. Flows would be expected to vary widely on a seasonal and annual basis. 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. Perhaps as much as 60 to 80 percent of the annual streamflow volume would be expected to result from spring snowmelt runoff. During the spring, general storms (both rain and snow) increase soil moisture, hence decreasing infiltration capacity, and subsequent rainstorms can result in both large runoff volumes and high peak discharges. The surface water quality varies with streamflow rate; the higher the flow rate, the lower the TDS concentration but the higher the suspended solids concentration. Surface water features within and adjacent to the PSO Tract are displayed in Figure 3-7.

Surface water drainages within and adjacent to the PSO Tract area include Youngs Creek, Little Youngs Creek, West Branch and Ash Creek. The streams of primary interest are the main stems of Little Youngs Creek and its tributary, West Branch. Little Youngs Creek is a tributary to Youngs Creek, which is a tributary to Tongue River. The PSO Tract area lies within the drainages of Youngs Creek and Ash Creek, although the main stems of these two streams do not fall within the boundary of the federal coal being considered for exchange. West Branch lies within the PSO Tract. The relationship between the area of the federal coal being considered for exchange and the area of the proposed Ash Creek Mine, which includes privately-owned coal adjacent to the PSO Tract, is shown on Figure 2-2. Little Youngs Creek flows in an east-southeast direction towards its confluence with Youngs Creek, and West Branch flows eastward toward its confluence with Little Youngs Creek (Figure 3-7).

Little Youngs Creek originates in the Wolf Mountains in Montana. Only about 22 percent of its drainage area is situated within the State of Wyoming. The drainage area of Little Youngs Creek above the state line is approximately 13.8 mi^2. Little Youngs Creek streamflow varies with

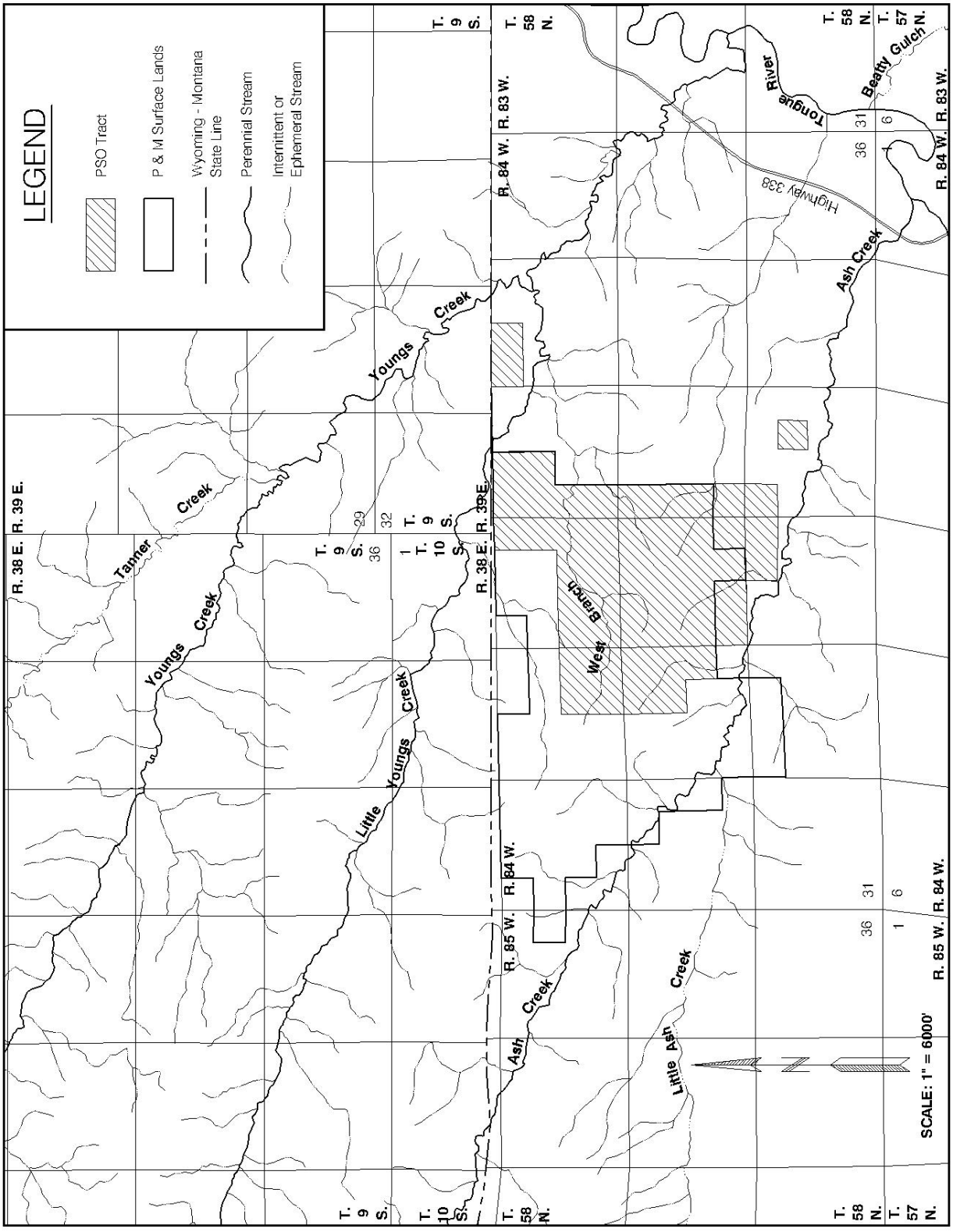

Figure 3-7. Surface Water Features Within and Adjacent to the PSO Tract.

the seasons and is further affected by stream diversions for stock reservoirs and irrigation withdrawals, as well as irrigation return flows. During the low-flow season, streamflow is maintained largely by groundwater seepage from the alluvial system (Hedges, et al. 1980). Based primarily upon long-term observations by local residents, Little Youngs Creek would be classified as a perennial stream, particularly throughout its lower reaches. These observations also indicate that the natural base flow is very small, probably only a fraction of one ft^3 per second during the low-flow season. During the driest years there may be periods of time when there is no streamflow. A streamflow monitoring station located about one-half mile upstream of the state line was maintained by Shell Oil Company for portions of the 1980 through 1982 water years, and records from that station indicate that the stream was dry for prolonged periods of time during the low-flow season (Ash Creek Mining Company 1984).

West Branch is classified as an ephemeral stream, meaning it flows only in direct response to snowmelt or precipitation runoff events. The West Branch alluvial system is not extensive enough to maintain streamflow by seepage of groundwater. The upper reach of this stream lies entirely within the PSO Tract area and its confluence with Little Youngs Creek is approximately 1 mile downstream (east) of the PSO Tract area.

The drainage area of Little Youngs Creek is approximately 17 mi^2 and the mean annual runoff is roughly 1,300 ac-ft. The entire drainage area of West Branch is situated in Wyoming and it is approximately two mi^2 in area. The mean annual runoff from the West Branch is roughly 150 ac-ft. Because no long-term streamflow data are available for Little Youngs Creek or West Branch, an indirect hydrologic correlation method was used to estimate the mean annual flows. Measured regional streamflows, precipitation records, and drainage basin characteristics were used to estimate the unit annual discharge for the Little Youngs Creek drainage basin.

In 1975, prior to any mining activities at the PSO No. 1 Mine, water samples were collected from Little Youngs Creek and West Branch to document baseline surface water quality in the general vicinity of the mine site (Ash Creek Mining Company 1984). Local surface waters were characterized as moderately alkaline, very hard and slightly turbid. Calcium and magnesium were the predominant cations while bicarbonate and sulfate were the major anions. The SAR was less than 1, indicating that the water is suitable for irrigation on all types of soils. Concentrations of nutrients were low indicating that upstream input of organic materials does not occur; however, relatively high fecal coliform bacteria values indicated that either domestic or animal wastes were entering the streams upstream from the mine. Surface water quality is usually unsuitable for domestic uses without treatment, but suitable for most agricultural uses, livestock and wildlife.

Flows and water quality are currently monitored on Little Youngs Creek by P&M both upstream and downstream of the reclaimed PSO No. 1/Ash Creek Mine site. These monitoring results are reported to the WDEQ/LQD annually (P&M 2001). In general, the TDS concentrations show no appreciable increase from upstream to downstream indicating that the reclaimed area has no apparent effect on surface water quality.

3.4.6.3 Water Rights

Records of the Wyoming SEO and the Montana DNRC were searched for groundwater rights within a three-mile radius of the federal coal lands being considered for exchange. This information would be required for a WDEQ mine permit application. SEO and DNRC data indicate there are 358 permitted water wells within three miles of the federal coal being considered for exchange, of which 345 are within Wyoming and 13 are within Montana. Of the 345 permitted wells in Wyoming, 83 are monitoring wells related to surface coal mining. There are 37 mine-related monitoring wells in Montana, although the DNRC does not require a Certificate of Water Right for scientific monitoring wells, as there is no beneficial use of water. Of the 275 other wells, 32 are permitted for stock watering, 16 are permitted for domestic use, 16 are permitted for stock watering and domestic use, 207 are permitted for both CBM development and stock watering, three are permitted for CBM development only, and one is permitted for miscellaneous use. In addition, a total of 76 CBM wells currently exist in Montana that are within a three mile radius of the federal coal being considered for exchange. Similar to monitoring wells, the State of Montana has ruled that a Certificate of Water Right is not required for a CBM well unless the discharge water is put to a beneficial use (i.e., stock watering). A listing of the 275 permitted wells that are not mining-related monitoring wells is presented in Appendix E.

Wyoming SEO and Montana DNRC records were searched for surface water rights within one-half mile upstream and three miles downstream of the federal coal lands being considered for exchange. Again, this information would be required for a WDEQ mine permit application. SEO and DNRC records indicate 98 permitted surface water rights within the search area, of which 89 are within Wyoming and nine are within Montana. Five of the 89 surface water rights in Wyoming are held by the PSO No. 1 Mine/Ash Creek Mining Company for industrial and miscellaneous uses. The 93 non-coal mine surface water rights are primarily for stock watering and irrigation uses, with a small number of domestic, industrial, miscellaneous, temporary and wildlife uses. A listing of the 93 non-coal mine surface water rights is included in Appendix E.

3.4.7 Alluvial Valley Floors

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 which 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.

The portion of Little Youngs Creek that was within the PSO No. 1/Ash Creek Mine permit area was investigated for the presence of an AVF (Ash Creek Mining Company 1984). This area is not on the PSO Tract proposed for exchange, but it could be affected by mining operations on private coal if the exchange is completed. The investigation concluded that portions of Little Youngs Creek constitute an AVF within the northeastern portion of the PSO No. 1 Mine permit area, specifically where Little Youngs Creek crosses the NE¼ of Section 22, T.58N., R.84W. The two AVF components that led to this conclusion are the presence of unconsolidated stream-laid deposits and the existence of irrigation agricultural activities.

Three essential hydrologic functions were identified for restoration during the reclamation of the Ash Creek Mine: channel stability, alluvial underflow and flood irrigation. These three essential hydrologic functions were reestablished upon the mine's final reclamation. Because the PSO No. 1 Mine's pit did not disturb the majority of alluvial valley fill on Little Youngs Creek, groundwater underflow through the alluvium was not significantly changed. Irrigation ditches that were disturbed but had been neglected several years prior to disturbance were renovated, thus reestablishing the potential for flood irrigation. Reclaimed channels were constructed to safely convey the probable discharges at non-erosive velocities, thus reestablishing channel stability.

If P&M acquires the federal coal in the PSO Tract as proposed and applies for a permit to mine, the mine permit application submitted to WDEQ must include an investigation determining the presence of AVFs within the proposed permit area. As depicted by the schematic mine plan for P&M's proposed Ash Creek Mine (Figure 2-2), portions of West Branch, Little Youngs Creek, and Youngs Creek would be within the permit area. West Branch is within the PSO Tract. Little Youngs Creek and Youngs Creek are outside of the PSO Tract but would be disturbed if the privately-owned coal adjacent to the PSO Tract is mined as shown in

Figure 2-2. Ash Creek and its alluvial valley would be outside of the mined areas; therefore, it is unlikely that AVF investigations of the Ash Creek valley would be necessary. Specific declarations of the presence of AVFs and their significance to agriculture within the proposed Ash Creek Mine permit area would be made by WDEQ.

3.4.8 Wetlands

Wetlands are defined as areas inundated or saturated with surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions (40 CFR 230.3 and 33 CFR 328.3). Wetlands generally include swamps, marshes, bogs and similar areas. Jurisdictional wetlands are those wetlands that are under regulatory authority of the EPA and the COE pursuant to Section 404 of the Clean Water Act. Such wetlands must exhibit all three diagnostic characteristics including hydrophytic vegetation, hydric soils and wetland hydrology under normal circumstances.

The presence of jurisdictional wetlands on a mine property does not preclude mining but does entail special permitting procedures to assure that after mining is completed there would be no net loss of wetlands. A wetland delineation must be done according to approved procedures (COE 1987) and submitted to the COE for verification as to the amounts and types of jurisdictional wetlands present. In Wyoming, once the delineation has been verified it is made a part of the mine permit document. The reclamation plan is then revised to incorporate at least an equal number and type of wetlands.

General jurisdictional wetland inventories were completed in 2001 on the federal coal lands considered for exchange. Formal inventories would be completed and submitted to the COE as a required part of the mine permit application. The wetland delineations are completed in accordance with the procedures and criteria contained in the COE 1987 Wetland Delineation Manual. A total of 15.32 acres of waters of the U.S. have been identified, of which 6.20 acres are estimated to be jurisdictional wetlands. The remaining 9.12 acres are classified as other waters of the U.S. The 6.20 acres of wetlands are associated primarily with man-made stock ponds while the 9.12 acres of other waters are associated with stockponds (6.3 acres) and ephemeral stream channels (2.82 acres).

3.4.9 Vegetation

A preliminary vegetation baseline study on the federal coal lands being considered for exchange was completed in 2001. The study area includes part or all of Sections 15, 20, 21, 22, 23, 27, 28, 29, 33 and 34, T.58N., R.84W. The vegetation communities in this area were delineated and mapped.

A total of three (3) vegetation types have been identified and mapped within the PSO Tract. Table 3-6 presents the acreage and percent of the area encompassed by each vegetation type within the PSO Tract. The vegetation types include Mixed Shrub Grass, Ponderosa Pine and Rough Breaks. These vegetation types are described as follows:

Mixed Shrub Grass. This vegetation type is the largest mapping unit identified within the PSO Tract, occupying approximately 1,592.1 acres, or 77.85 percent of the study area. This vegetation type typically occurs in upland positions throughout the study area. Major perennial species include big sagebrush (Artemisia tridentata), western wheatgrass (Agropyron smithii), bluebunch wheatgrass (Agropyron spicatum), needle-and-thread (Stipa comata), broom snakeweed (Gutierrezia sarothrae) and fringed sagewort (Artemisia frigida). Japanese chess (Bromus japonicus) is an annual species that is common on this vegetation type.

Ponderosa Pine. This vegetation type is the second largest mapping unit comprising approximately 330.8 acres, or 16.18 percent of the area. This vegetation type occurs throughout the study area on north facing rocky slopes, outcrops and smaller foothills. Along with ponderosa pine (Pinus ponderosa) several other plant species dominate this vegetation type. These species include skunkbush sumac (Rhus trilobata) and Rocky Mountain juniper (Juniperus scopulorum). The understory vegetation is dominated by bluebunch wheatgrass, broom snakeweed, fringed sagewort, green needlegrass (Stipa viridula) and hairy goldenaster (Heterotheca villosa).

Rough Breaks. This vegetation type occurs throughout the study area and makes up approximately 122.1 acres, or 5.97 percent of the study area. This vegetation type occurs on steep sideslopes and rocky outcrops. Common species for this vegetation type include big sagebrush, rubber rabbitbrush (Chrysothamnus nauseosus) broom snakeweed, winterfat (Ceratoides lanata) and fringed sagewort. Perennial grasses include bluebunch wheatgrass,western wheatgrass and needle-and-thread.

Table 3-6. Vegetation Types Identified and Mapped Within the PSO Tract.

Vegetation Type	Acres	Percent of Area
Mixed Shrub Grass	1592.1	77.85
Ponderosa Pine	330.8	16.18
Rough Breaks	122.1	5.97
Total	2045.0	100.00

Threatened, Endangered, and Candidate Plant Species

See Appendix C for a discussion of the threatened, endangered, and candidate plant species potentially present on the PSO Tract.

3.4.10 Wildlife

3.4.10.1 Wildlife Resources

Background information on wildlife in the vicinity of the PSO Tract area was drawn from several sources including: Ash Creek Mine Annual Reports, WGFD and USFWS records and personnel contacts with WGFD and USFWS biologists.

Site-specific data for the proposed exchange area was obtained from sources including WDEQ/LQD permit applications and annual reports for nearby mines. Baseline and monitoring surveys cover large perimeters around each mine's permit area. Consequently, a majority of the PSO Tract area has been surveyed during annual wildlife monitoring for the Ash Creek Mine. The entire PSO Tract area has undergone a wildlife survey, which was completed in July of 2000 through July of 2001.

The PSO Tract area and adjacent lands consist primarily of uplands. The topography is level to rolling, with some areas sloping to steeply sloping. Mixed shrub grass habitat dominates the area. This habitat is characterized by level ground to rolling hills that are well vegetated. Ponderosa pine and rough breaks habitats also occur within the general area. All streams on the study area are ephemeral or perennial. Several ponds exist on the PSO Tract, with all of them being stockponds. Ponderosa pine trees exist on the foothills and steep rocky slopes of the proposed exchange area.

3.4.10.2 Big Game

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

Pronghorn are, by far, the most common big game species in the area. The study area is within the Clearmont Herd Unit with approximately 1000 acres within yearlong range and the remaining 1045 acres within winter-yearlong range. None of the study area or other areas within two miles have been classified as crucial or critical pronghorn habitat. The yearly big game monitoring surveys completed for the adjacent PSO No. 1/Ash Creek Mine also covered a majority of the proposed exchange area. The PSO No. 1/Ash Creek Mine surveys indicated that pronghorn were not abundant on the area during the

spring, summer or fall but frequented the site in normal winters and moved out of the area in harsh winters when deep snows accumulated on the site.

The PSO Tract area is located within the northeastern portion of the WGFD North Bighorn Mule Deer Herd Unit. The WGFD maps show the PSO Tract area is totally within winter yearlong mule deer range. Crucial or critical mule deer ranges do not occur on or within several miles of the PSO Tract area. The PSO No. 1/Ash Creek Mine surveys indicated the area is a yearlong use area and mule deer are scattered throughout the site and do not concentrate on the area during any particular season.

White-tailed deer are uncommonly observed on the PSO Tract area which is within the WGFD Powder River White-tailed Deer Herd Unit. The site is generally considered out of normal white-tailed deer range but the WGFD classified the adjacent areas associated with Ash Creek and Little Youngs Creek as yearlong habitat. No crucial white-tailed deer range exists within several miles of the PSO Tract area.

3.4.10.3 Other Mammals

A variety of small and medium-sized mammal species occur in the vicinity of the PSO Tract area. These include predators and furbearers, such as coyote (Canis latrans), red fox (Vulpes vulpes), striped skunk (Mephitis mephitis) and raccoon (Procyon lotor). Prey species include rodents such as mice, voles, chipmunks and black-tailed prairie dogs (Cynomys ludovicianus) and lagomorphs (jackrabbits and cottontails). These species are cyclically common and widespread throughout the region. They are important prey items for raptors and other predators. Surveys for prairie dog towns were conducted on the PSO Tract area and adjacent lands. Several small prairie dog towns were observed on the PSO Tract area. These prairie dog towns are located in the NE¼ of Section 21, the NW¼ of Section 22, the SE¼ of Section 20, the NE¼ of Section 29 and the NW¼ of Section 27, T.58N., R.84N. (Figure 3-8). Several other prairie dog towns are known to exist within several miles of the PSO Tract area.

The black bear (Ursus americanus) and mountain lion (Felis concolor) have been recorded in the area but are not common.

3.4.10.4 Raptors

Numerous raptor species have been observed on or adjacent to the PSO Tract area. 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 mexicanus), Cooper's hawk (Accipiter cooperii), American kestrel (Falco sparverius), turkey vulture (Carthartes aura), great horned owl (Bubo virginianus), short-eared owl (Asio flammeus) and burrowing owl (Athene cunicularia). Figure 3-8

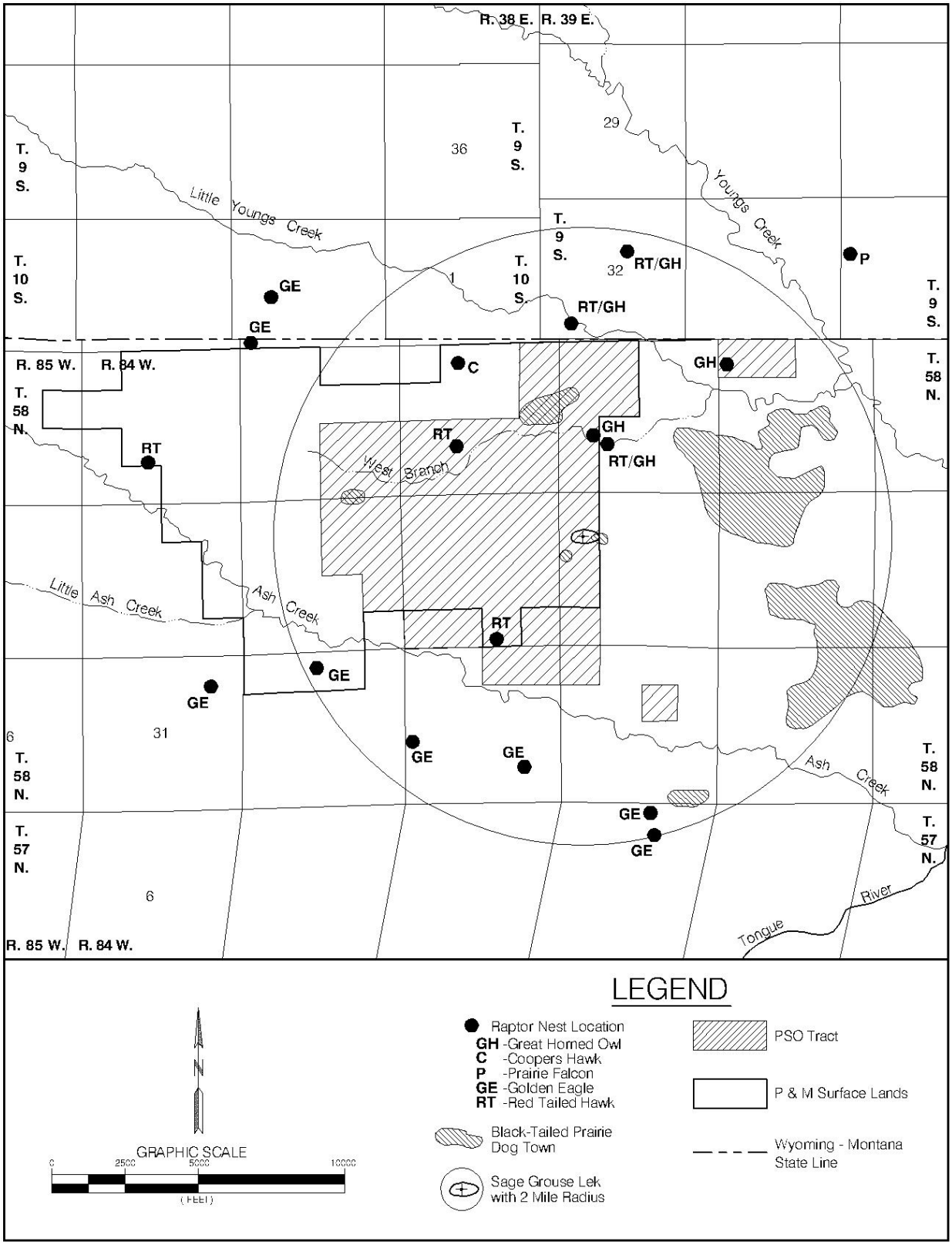

Figure 3-8. Raptor Nest Sites, Sage Grouse Leks, and Prairie Dog Towns Within and Adjacent to the PSO Tract.

shows the locations of intact raptor nest sites that have been identified since monitoring began for PSO No. 1 Mine, which includes most of the PSO Tract area. A total of six raptor species have been identified nesting within one mile of the PSO Tract area. These species include the great horned owl, red-tailed hawk, golden eagle, prairie falcon, Cooper's hawk and American kestrel. In 2001, only six nest sites were active and included two golden eagle nests, three red-tailed hawk nests and one great horned owl nest. An undetermined number of American kestrel nests were active.

Only two raptor species have been recorded nesting on the actual federal coal lands being considered for trade. The red-tailed hawk and great horned owl successfully fledged young on the site in 2001.

3.4.10.5 Game Birds

Several upland game bird species have been observed on the PSO Tract area or adjacent lands, including sage grouse (Centrocercus urophasianus), sharp-tailed grouse (Tympanuchus phasianellus), migratory mourning doves (Zenaida macroura), wild turkey (Meleagris gallopavo), pheasant (Phasianus colchicus) and gray partridge (Perdix perdix). The mourning dove only inhabits the area for breeding and reproduction from late spring to early fall.

The sage grouse is a yearlong resident and was found on the PSO Tract area. Sage grouse lek surveys in April and May of 2001 identified an active sage grouse strutting ground within the federal coal lands being considered for trade. Figure 3-8 shows the location of this active lek. The two mile radius from this lek, which research identified as the area in which most hens would nest, covers most of the federal coal lands being considered for trade. The lek is located in the NW¼ of Section 27, T.58N., R.84W. This particular lek was active intermittently from 1979 through 2001 with the maximum number of males recorded at 31 in 1982.

The sharp-tailed grouse is a yearlong resident and was also found on the Tract. Several sharp-tailed grouse lek sites have been recorded in the past but these leks were inconsistently used and none were consistently active in 2001.

The wild turkey and pheasant were commonly encountered on the area while the gray partridge was uncommon.

3.4.10.6 Migratory Birds of High Federal Interest

Table 3-7 provides a list of the MBHFI species that may occur on the PSO Tract or disturbance areas. Nine MBHFI species have been documented in the area. The northern harrier nests in the area, generally using ground nests. The ferruginous hawk nests in the region but has not been recorded nesting within one mile of the PSO Tract. The other MBHFI species observed on the area were recorded as migrants or foraging in the area, and nesting

Table 3-7. MBHFI Status in Northeast Wyoming and Expected Occurrence on or near the PSO Tract (USFWS 1995).

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

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

habitat for several of those species occurs on the site.

The Lewis' woodpecker (Melanerpes lewis) was formerly listed as a MBHFI species of concern for this specific area. This species was subsequently removed from the MBHFI list due to identification of individuals using numerous other sites within the region and state and the relatively good abundance of birds and habitat.

3.4.10.7 Other Species

Wildlife surveys completed specifically for the PSO Tract, and surveys completed for the PSO No. 1/Ash Creek Mine, have documented numerous other wildlife species that inhabit the area. All of these species were generally common inhabitants of the area and none were of specific concern to state or federal agencies. The other species observed include nine carnivores, 14 rodents, two lagomorphs, 16 waterbirds, 11 raptors, 65 other bird species, 10 herptiles and three fish species.

Under current natural conditions the PSO Tract provides limited waterfowl and shorebird habitat. This habitat is primarily provided during spring migration as ponds and streams, most of which generally dry up during the summer. Ash Creek, a perennial stream adjacent to the southern part of the PSO Tract area, can sustain limited waterfowl and shorebird populations in a very wet year. Ash Creek is typically used for irrigation purposes by the local ranchers, which in turn creates limited habitat for waterfowl and shorebirds upon these irrigated hay fields. With the addition of water being produced from CBM wells in the area, an increase in habitat for waterfowl and shorebirds will occur along all stream channels. Waterfowl and shorebird species would use the isolated ponds and drainages filled by the CBM wells if sufficient water is established.

Fish species may be found in Ash Creek, Youngs Creek, and Little Youngs Creek, as these are perennial water sources. Little Youngs Creek may go dry for prolonged periods of time during very dry years. Fish habitat may also be created and enhanced from CBM water discharges.

3.4.10.8 Threatened, Endangered and Candidate Animal Species

See Appendix C for discussion of threatened, endangered, and sensitive species that have been identified as potentially present on the PSO Tract

3.4.11 Ownership and Use of Land

The surface on the federal coal being considered for exchange is owned by the Chevron Corporation (P&M), Bluegrass Coal Development, Reserve Coal Properties Company, Flying V Cattle Company/D.S. Scott/Padlock Ranch, Neil DeLapp, and the Federal government (Figure 3-9). The principal land use within the tract is domestic grazing and wildlife habitat.

Areas of surface disturbance on the federal coal lands being considered for exchange are off road, two-track

vehicle trails associated with livestock management activities and the disturbance associated with the five CBM wells that have been drilled and the potential disturbance with the four CBM wells that are proposed. Two county roads, the Ash Creek Road and the Youngs Creek Road, pass briefly along the edges of the federal coal lands (Figure 3-9).

The oil and gas rights within the boundary of the federal coal being considered for exchange are both federally and privately owned (Figure 3-10). The majority (about 77 percent) are private. The federally owned oil and gas rights included in the tract are leased, and a list of the lessees of record for those federal oil and gas leases is included as Table 3-8.

WOGCC records show that no conventional oil and gas wells have been completed on the federal coal lands being considered for exchange. As discussed in Section 3.4.3, there is nearby production in the Ash Creek and Ash Creek South Oil Fields, which are located in T.10S., R.38E., Section 3, Big Horn County Montana, and in T. 58N., R.84W., Sections 29, 30, 31, and 32, Sheridan County, Wyoming. These two fields, which were discovered in 1952, have produced approximately 1.7 million barrels of oil and 27 million barrels of water. Most of the wells have been plugged and abandoned. Presently there are six wells completed in conventional oil reservoirs that are still producing; one in Section 29 (SW¼SW¼), two in Section 30 (SE¼SE¼ and SW¼SE¼), two in Section 31 (NE¼NE¼ and NW¼SE¼), and one in Section 32 (NW¼NW¼). No conventional oil field support facilities for the Ash Creek and Ash Creek South Oil Fields are located within the boundary of the federal coal lands being considered for exchange.

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

CBM is currently being produced adjacent to the PSO Tract. The approved well spacing pattern is one well per coal seam per 80 acres for development of CBM resources in the PRB. There would potentially be 78 CBM well locations on the federal coal lands being considered for exchange if all of the 80-acre spacing units within the tract are drilled and completed in all of the potential coal beds. CBM development has been accelerating rapidly within and adjacent to the federal coal lands being considered for exchange since 1999. A search of the WOGCC records in July 2001 revealed that there were 147 CBM wells completed or permitted to be drilled within T.58N., R.84W. All CBM wells existing within T.58N., R.84W. at that time were drilled in 2000 and 2001, and none were yet in production. In addition, five CBM wells had been drilled and four were permitted to be drilled within the boundary of the federal coal being considered for

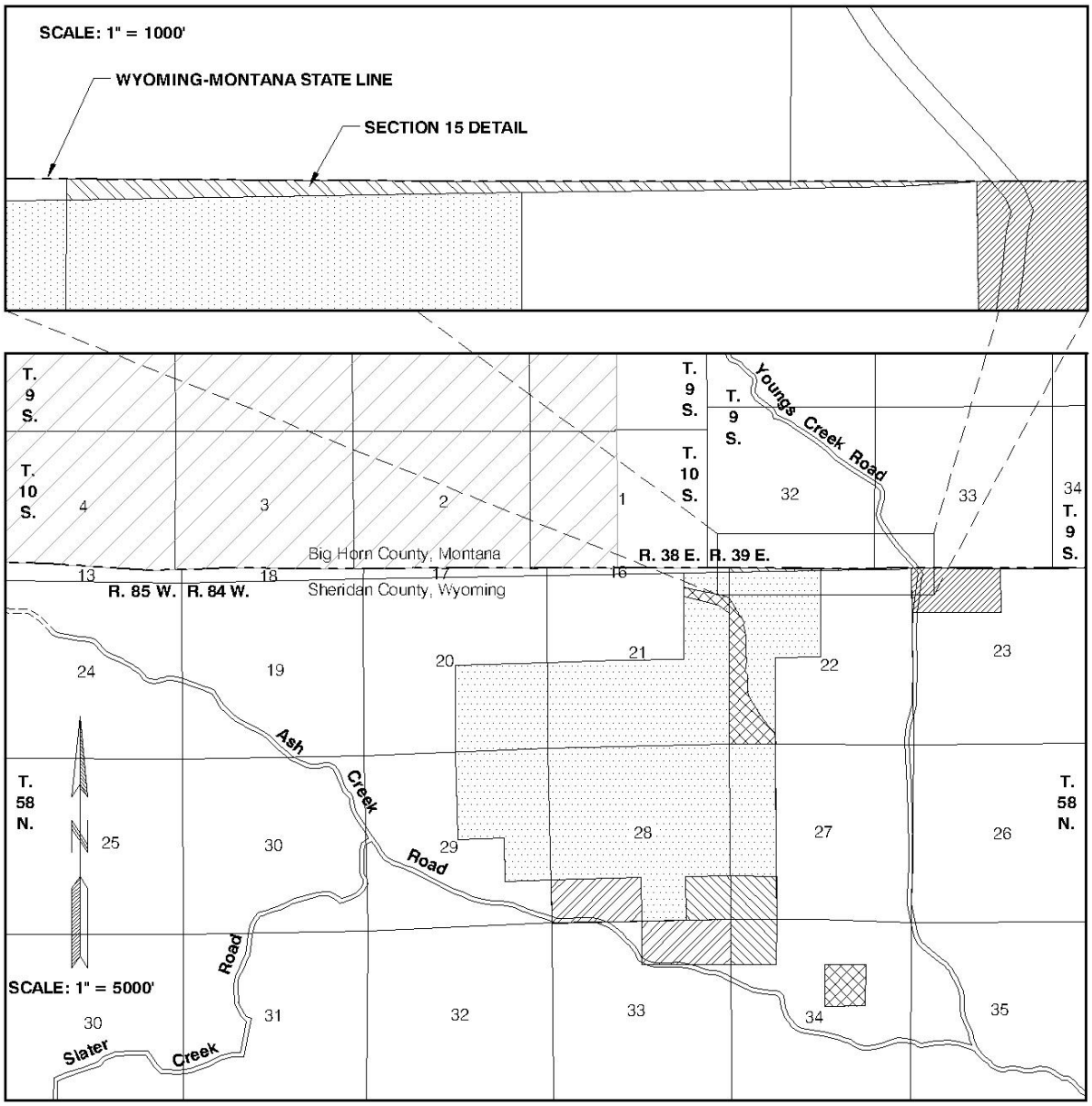

Figure 3-9. Surface Ownership Within the Boundary of the PSO Tract.

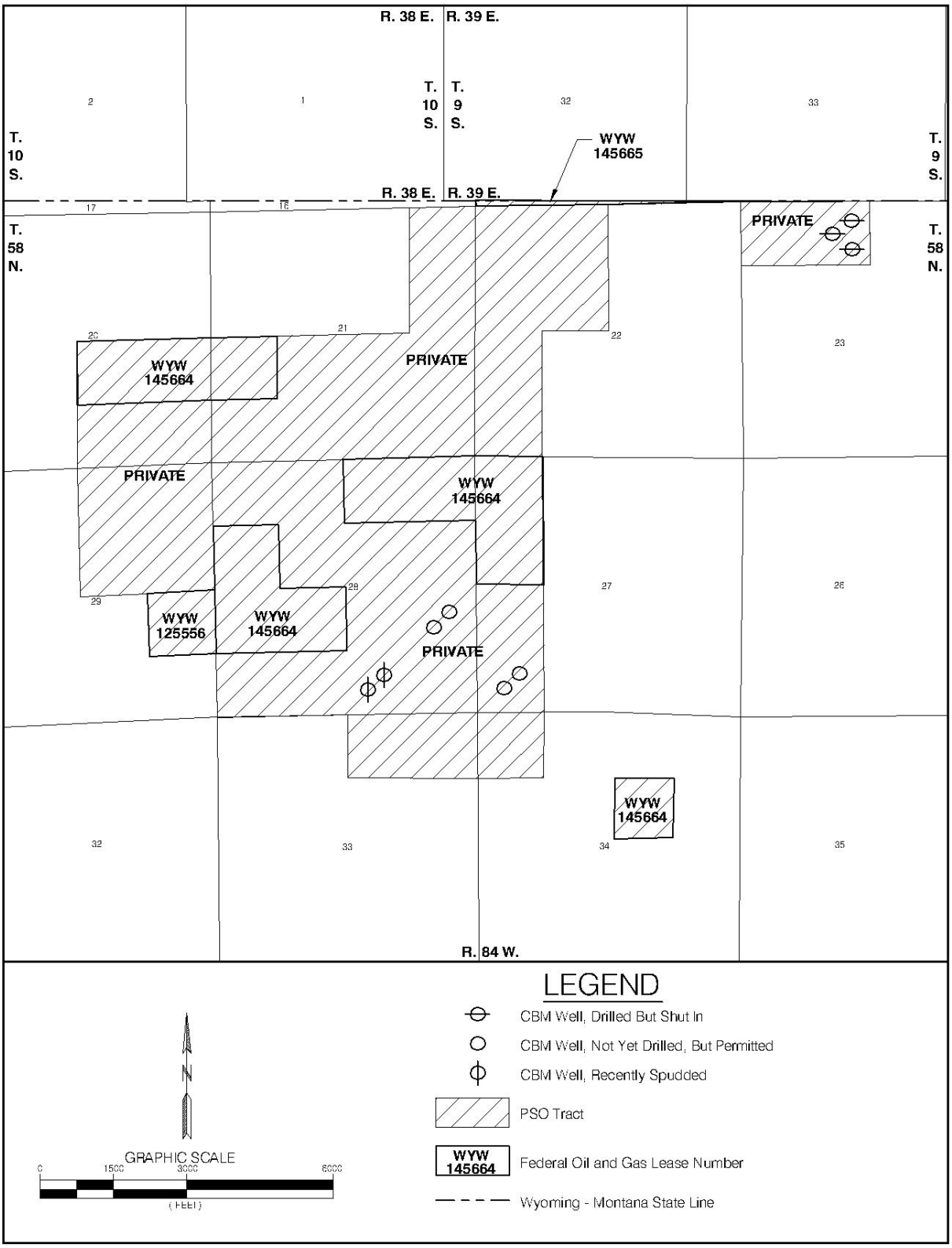

Figure 3-10. Oil and Gas Ownership Within the Boundary of the PSO Tract.

Table 3-8. Oil and Gas Ownership on the Federal Coal Lands Being Considered for Exchange.

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

Location T. 58 N., R. 84 W.	Lease Number	Expiration Date	Lessees of Record
Section 15 Lot 1	WYW 145665	7/31/2008	Louis S. Madrid Trust
Section 20 NE¼SE¼, NW¼SE¼	WYW 145664	7/31/2008	J.M. Huber Corp.
Section 21 NW¼SW¼			
Section 27 NW¼NW¼, SW¼NW¼			
Section 28 NE¼NE¼, NW¼NE¼, SW¼NW¼, NW¼SW¼, SW¼SW¼			
Section 34 SW¼NE¼			
Section 29 NE¼SE¼	WYW 125556	10/31/2001	ABO Petro Corp. Myco Industries Inc. Yates Drilling Co.

Note: For the rest of the federal coal lands being considered for exchange, the oil and gas rights (including CBM) are privately owned. All of the coal rights are federally owned.

exchange (Figure 3-10). A concurrent search of the Montana BOGC revealed that there were no CBM wells within T.10S., R.38E. but 67 CBM wells have been completed within three miles of the federal coal lands since 1999 and 60 are currently in production. As new CBM wells are drilled and completed on or adjacent to the PSO Tract, facilities (i.e., pipelines and compressor stations) would be constructed to produce and transport the CBM and the associated produced water.

Coal mining has been and continues to be a significant land use in the general area of the PSO Tract. The thick Fort Union coal deposits present in the Sheridan coal field have been mined extensively by either underground or surface mining methods along the Tongue River since the late 1800s. Most of the old underground mines were located near the confluence of Goose Creek and Tongue River, roughly four miles south of the PSO Tract (Figure 3-1). Underground mining continued on a fairly large scale into the 1940s. All underground mine portals were sealed by 1953. With the introduction of heavy equipment and the advent of surface mining techniques the first strip mine, locally called the Hidden Water pits, opened in Sheridan County in 1944. Mining was discontinued there in the early 1950s but the pits remained open until 1985 when final reclamation was completed with Abandoned Mine Land funds. This reclaimed surface mine (called "Old Surface Coal Mine" on Figure 3-1) is located about two miles southwest of the PSO Tract.

Surface mining at the Big Horn Coal Mine, located at the confluence of Goose Creek and Tongue River, about four miles south of the PSO Tract, began in 1951. Big Horn Coal Mine's nearest pit was about two miles south of the PSO Tract. Annual coal production from the Big Horn Coal Mine peaked in 1981 at four million tons and ended in 2000 with 38,411 tons. All coal production from Sheridan County ended with the final reclamation of the Big Horn Coal Mine in 2000. As stated previously, the PSO No. 1/Ash Creek Mine was opened in 1976 and reclaimed in 1996 after producing no coal.

Two active surface coal mining operations in Big Horn County, Montana, the Decker Coal Mine and the Spring Creek Coal Mine, are located approximately six miles and seven and one-half miles, respectively, northeast of the PSO Tract (Figure 3-1). The West Decker mine was opened in 1972, the East Decker mine was opened in 1977, and the Spring Creek mine was opened in 1979. Both the Decker and Spring Creek mines are currently producing around 11 million tons of coal annually.

According to the *Sheridan County Growth Management Plan* (City of Sheridan 2001), the designated zoning classification for the PSO Tract is agricultural. This Comprehensive Master Plan for Sheridan and Sheridan County provides no general or specific land use goals or policies for state and federal coal leases in the county.

Big game hunting is the principal recreational use in the analysis area. The surface estate within the PRB is largely privately owned (approximately 80 percent), with some private landowners permitting sportsmen to cross and/or hunt on their land. Others charge an access fee, and some do not allow any access. There has been a trend over the past two decades towards a substantial reduction in lands open and reasonably available for hunting. Access fees continue to rise and many resident hunters feel these access fees are unreasonable. This trend has created problems for the WGFD in their attempt to distribute and control harvest at optimal levels, as well as to sportsmen who desire access to these animals (WGFD 1996). Due to safety concerns, public lands contained within an active mining area are often closed to the public, further limiting recreational use. In the PRB, the 20 percent of the surface estate that is administered by BLM or USFS or the State of Wyoming is generally open to hunting if legal access is available. State school sections are normally Sections 16 and 36 of each township.

The surface of all of the lands within the boundary of the federal coal being considered for exchange, with the exception of the 6.41 acres that comprise all of Section 15, T.58N., R.84W., is currently privately owned (Figure 3-9) and recreational use is allowed only with landowner permission. P&M does not allow sport hunting on the PSO Tract.

Pronghorn, mule deer, and white-tailed deer occur on and adjacent to the PSO Tract. Sage grouse, sharp-tailed grouse, mourning dove, waterfowl, rabbit, racoon, and coyote may also be harvested in the vicinity, and some trapping of red fox may occur. No sport fisheries exist on the PSO Tract.

Specific details regarding big game herd management objectives in the project area are contained in the *Casper and Sheridan Region Annual Big Game Herd Unit Reports* (WGFD 2000).

The WGFD classifies the PSO Tract as yearlong habitat for antelope with none of the tract or areas within two miles adjacent classified as crucial or critical pronghorn habitat. Big game surveys conducted for the PSO No. 1/Ash Creek Mine have indicated that pronghorn are not abundant on the area during the spring, summer or fall, but frequented the site in normal winters and moved out of the area in harsh winters when deep snow accumulates. The PSO Tract area is within pronghorn antelope Hunt Area 15, which is contained in the WGFD Clearmont Pronghorn Antelope Herd Unit.

The Clearmont Herd is not a distinct unit as antelope are able to move in and out between Wyoming and Montana, as well as neighboring herd units to the south and east. The post-season population management objective for this herd was set in 1983 at 3,000 pronghorn. While the population is currently estimated to be above this objective, it is still below

historic levels. The herd suffered substantial losses during the 1993-94 and 1996-97 winters, accompanied by poor fawn production and adult recruitment in 1994 and 1997. Favorable environmental conditions and improved fawn production over the past three years has resulted in an increased population. Nevertheless, WGFD personnel, hunters, and landowners have noticed a decline in the actual number of antelope over the past decade. Landowners and hunters have expressed a desire for more antelope in this herd unit. The desired level does not necessarily correspond to the established post-season population management objective. Landowners have restricted hunter access due to decreased population levels. Most of the herd unit is private land (87 percent) with limited hunter access opportunities. Most landowners who allow hunting either charge access fees or lease their property for hunting. As a result there has been a steady decline in the number of resident hunters, as they are often reluctant to pay access fees. While all 300 licenses sold for this herd unit, only 79 percent of resident license holders hunted compared to 95 percent of nonresident license holders. This suggests very restricted access for resident license holders. WGFD realizes that the population objective for this herd unit is unrealistic and it is scheduled for review in January 2002.

In 2000, hunters experienced significantly lower success and higher effort while hunting in this herd unit. In the years 1996 – 2000, hunters on average harvested about 254 pronghorn per year, which is about 67 percent below the previous five-year mean (1990 - 1995). In 2000, an estimated 267 hunters harvested an estimated 184 antelope from this herd unit, with about 69 percent success, up slightly from 1999, but considerably below the previous five-year average. WGFD anticipates a similar harvest for 2001.

WGFD predicts that the Clearmont Herd population will likely stabilize or decrease over the next year due to the effects of drought and normal to above normal winter conditions. There were several wild fires within the herd unit boundary during the summer and fall of 2000 and 2001 that will likely influence over-winter survival. CBM development is occurring in a large portion of this herd unit. Impacts are unknown at this time, although increased roads, water discharge, vegetation disturbance and human presence would likely have some adverse impacts to this population.

The PSO Tract area is located within the northeastern portion of the WGFD North Bighorn Mule Deer Herd Unit. The WGFD maps show the federal coal lands being considered for exchange are totally within winter mule deer range. Crucial or critical mule deer ranges do not occur on or within several miles of the PSO Tract. Big game surveys conducted for the PSO No. 1 Mine have indicated that area is a yearlong use area and mule deer are scattered throughout the site and do not concentrate on the PSO

Tract area during any particular season. The PSO Tract is in mule deer Hunt Area 166, part of the North Bighorn Mule Deer Herd Unit, which also includes Hunt Areas 24, 25, 27, 28, 50, 51, 53, and 159. Beginning with the 2001 hunting season, hunt area 166 will be eliminated and the area will be recombined with hunt area 24. Area 166 was created from part of hunt area 24 in 1988. The North Bighorn Mule Deer Herd Unit encompasses approximately 2,568 mi^2, much of which is public land managed by the USFS and the BLM, although Hunt Areas 24 and 166 contain predominantly private lands with limited hunting opportunities, especially for resident hunters. Private lands are fairly restrictive and access fees are common, resulting in high hunting pressure on public lands. In 2000, 1,918 mule deer were harvested from the North Bighorn Mule Deer Herd Unit by an estimated 2,774 resident and 1,945 non-resident hunters. Hunter success was 41 percent overall, up slightly from 1999. Resident hunter success (27.2 percent) is considerably less than non-resident success (59.1 percent) and resident effort (15.7 days per hunt) was still considerably higher than nonresident effort (7.1 days per hunt), suggesting a decrease in deer numbers on public lands where residents generally have access to hunt.

Since 1996 the post-season population management objective for the North Bighorn Mule Deer Herd Unit has been 25,000. WGFD's 2000 post-season population estimate of 20,300 is about 19 percent below the desired objective. Management in most of the herd is to increase deer numbers, and the 2001 post-season population is estimated to increase to about 21,600 deer. Continued harvest strategies are designed to maintain this herd near the current population.

White-tailed deer are uncommonly observed on the PSO Tract area which is within the WGFD Powder River White-tailed Deer Herd Unit. The site is generally considered to be out of normal white-tailed deer range, but the WGFD classified the adjacent areas associated with Ash Creek and Little Youngs Creek as yearlong habitat. No crucial white-tailed deer range exists within several miles of the PSO Tract area. The PSO Tract are in white-tailed deer Hunt Area 166, part of the Powder River White-tailed Deer Herd Unit, which encompasses a large portion of north-central Wyoming and also includes Hunt Areas 17, 19, 23, 24, 25, 27, 28, 29, 30, 31, 32, 33, 163, and169. The Powder River White-tailed Deer Herd Unit contains 8,610 mi^2 total area, but only about 880 mi^2 (10 percent) is considered occupied habitat. Most white-tailed deer are found along riparian areas, agricultural lands and mountain shrub communities, the majority of which are on private lands. Private lands make up about 88 percent of the delineated occupied land. WGFD's management strategy for white-tailed deer is to manage numbers based on landowner tolerance and access. Urban development is a major problem with white-tailed deer management in

Sheridan County. Subdivisions in Sheridan County are generally in areas currently inhabited by whitetails. In 2000, 2,708 white-tailed deer were harvested from this herd unit, an increase of about 1,000 animals from 1999 by an estimated 3,508 resident and 1,047 non-resident hunters. The population objective for this herd unit is 8,000 deer. Generally, the population of white-tailed deer has been expanding during the past several years and it is estimated that the herd exceeded the objective by as much as 100 percent during recent years. Harvest strategies are designed to limit the growth of this herd unit, although WGFD feels that they will not be able to reduce this population to objective with only harvest.

3.4.12 Cultural Resources

Cultural resources are defined as the physical remains of past human activity, generally inclusive of all manifestations more than fifty years old. Cultural resources can be classified as artifacts, features, sites, districts or landscapes. The goal of cultural resource management is the conservation of archaeological and historical remains and information for research, public interpretation and enjoyment, and for appreciation by future generations.

Prehistoric resources are physical locations with remains that are the result of human activities occurring prior to written records. Historic resources are remains left by human activity after written records were common. These resources are most commonly recorded as sites: clusters of artifacts and/or features with definable boundaries, or as isolated artifacts. Cultural resources, both historic and prehistoric, are often termed "historic properties" in regulatory literature.

Environment

The study area for heritage resources encompasses an area of approximately 3,520 acres which is privately owned by P&M. The study area is about 10 air miles north of Sheridan, Wyoming, just south of the Montana border. It is encompassed by an area about 2.25 miles north-south by 4.75 miles east-west. The study area lies within the watersheds of Ash Creek and Little Youngs Creek, both tributaries of the Tongue River. The area lies on the southern edge of what archaeologists refer to as the "Pine Breaks" region, an area which extends roughly from the Musselshell River in central Montana southeastward to the western foothills of the Black Hills. The Pine Breaks has been distinguished from neighboring areas on the plains by its more rugged topography, a relatively abundant fuel and water supply, and by its more diverse ecology which provides a variety of opportunities for resource procurement (Fredlund 1981a). The drainages have riparian environments with a wide variety of flora. The uplands area includes patches of open grassland and ponderosa pine forest. A geological phenomenon, important to archaeology in the Pine Breaks, is the abundance of the lithic material *porcellanite*, created by underground

coal fires which thermally metamorphosed surrounding shales and sandstones. Porcellanite is by far the most abundant lithic material encountered in the region and was widely used for stone tool manufacture.

Sandstone from the Tongue River member of the Fort Union Formation is exposed in several places within the project area. The sandstone outcrops commonly form small bluffs along the steeper slopes. In places, cavities have been weathered into the sandstone, creating small shelters. Sandstone outcrops in the area are also associated with prehistoric rock art, including petroglyphs (carvings) and pictographs (paintings).

Existing Cultural Resources Inventory

A Class III cultural resources survey is a professionally conducted, intensive inventory of a target area, designed to locate all cultural properties which have surface and exposed profile indications. Cultural properties are recorded and sufficient information collected on them to allow evaluation for possible inclusion in the NRHP. That determination is made by the managing federal agency in consultation with SHPO. Consultation with SHPO must be completed prior to approval of the MLA mining plan.

Once a Class III survey is completed, site-specific testing or limited excavation is utilized, if necessary, to gather additional data which would: 1) determine the final evaluation status of a site and/or 2) form the basis of additional work that would be conducted during implementation of a treatment plan if the site is eligible for the NRHP. A treatment plan is then developed for those sites that are eligible for the NRHP and are within the area of potential effect. Treatment plans are implemented prior to mining and can include such mitigative measures as avoidance (if possible), large scale excavation, complete recording, Historic American Building Survey/Historic American Engineering Record documentation, archival research, and other acceptable scientific practices.

The goal of the inventory was to locate and evaluate for the NRHP all cultural resources 50 years and older within the study area.

A comprehensive investigation of the cultural resources within the study area which surrounds and encompasses the APE has recently been completed (Ferguson and Meyer 2001). This includes a review of cultural inventories conducted previously in the region as well as a review of pertinent literature and records on the history and prehistory of the area. A great number of cultural resource studies have taken place in the surrounding Pine Breaks Region, primarily in conjunction with coal mining. These studies, undertaken since the 1970s, include a number of inventories very near or intersecting the current study area, along with several studies conducted a few miles to the north, associated with coal mine development near Decker, Montana. Major archaeological reports from the

surrounding area which contain information relevant to the context of local historic and prehistoric resources include: Brumley and Dickerson 2000; Carmichael, et al. 1979; Fox 1977; Fredlund 1977, 1979, 1981b; Gregg 1977a, 1977b, 1978; Haberman 1973; Larhen 1977; Munson 1990; Munson et al. 1992; Munson and Ferguson 1998; and Taylor, et al. 1984.

Additionally, five regional archaeological overviews have been written which provide a generalized background for the area prehistory. Although the current body of archaeological data has rendered some of these overviews somewhat dated, they are presented as general references to the archaeology of the region and include: Beckes and Keyser 1983; Deaver and Deaver 1988; Fredlund 1981a; Frison 1991; and Wettstaed 1989.

Despite the great volume of work that has been done, no overviews adequately synthesize currently available data. Beckes' and Keyser's (1983) overview of the Custer National Forest includes a section on the Ashland Ranger District within the Pine Breaks. However, the incorporated data is confined almost exclusively to National Forest land. Deaver and Deaver's (1988) overview of southeastern Montana includes general information on the Pine Breaks area, with a chronological overview. Both of these studies are somewhat dated in light of subsequent investigations. Fredlund's (1981a) dissertation deals explicitly with the Pine Breaks area, but concentrates only on the Late Prehistoric Period. Benson's Butte is a multicomponent site excavated between 1972 and 1978 and located about 2.2 miles north of the current study area. The results of the excavations are summarized in Fredlund (1979). The site includes components dating from the late Paleoindian to the Late Prehistoric periods. Again, subsequent investigations have rendered some of Fredlund's findings at Benson's Butte out of date.

More recent excavations in the area are reported in Munson (1990), Brumley and Dickerson (2000), and elsewhere. Large scale inventory projects have been conducted immediately north of the current study area in Montana, including Fredlund (1981b) and Gregg (1977a). The reader is referred to the studies referenced above for additional background information.

Cultural resource inventory work, in compliance with regulations established in the 1966 National Historic Preservation Act, 36 CFR Part 800 (BLM Class III level), was conducted in the PSO Tract area, including the APE, in August 2000 (Ferguson and Meyer 2001). The pedestrian inventory covered the terrain at intervals of about 30 meters. Twenty-one sites and fourteen isolated artifacts were located and recorded in the approximately 3,520 acres study area. Two prehistoric sites, 48SH1127 and 48SH1134, found during this inventory are recommended as eligible for the

NRHP under Criterion D. Temporal-cultural affiliations of the recorded sites range in age from Paleoindian to Historic.

3.4.12.1 Prehistoric Resources

Prehistoric sites are classified into cultural/temporal periods based on the types of artifacts, generally projectile points, recovered on-site, and the chronometric dating of the site through techniques such as radiocarbon dating of bone or charcoal extracted from buried features at the sites. Site types are indicative of function or prehistoric activity which occurred at the site and are based on site location, types of artifacts remaining on the site and types of features observed. Cultural periods are given a temporal span, but because of the range and variation of radiocarbon dates, the dates for the beginning and end of a period may vary by several hundred years depending on the researcher and the geographic location of the site. Those given below pertain generally to the Northwestern Plains area as defined by Frison (1991), and may not strictly apply to the Pine Breaks area *per se*. For example, no diagnostic artifacts or radiocarbon dates have been documented in the Pine Breaks for the earliest portion of the Paleoindian period. Late Paleoindian components are present here, but are rare, as they are elsewhere on the Northwestern Plains.

Paleoindian Period

Occupation of the Pine Breaks area has been documented as early as 9,000 years ago (Brumley and Dickerson 2000); however, on adjacent areas of the Northwestern Plains occupation extends back some 12,000 years. This initial settlement of the high steppe environment, the Paleoindian period (12,000 - 8,500 years BP/10,000 BC - 6,500 BC), is characterized by the use of large, well-made lanceolate projectile points and the hunting of large, now-extinct bison, mammoths and other large fauna. Through time the point styles changed and, with the changing climate, the subsistence strategies of the early hunters and gatherers changed as well. The earliest dated human occupation in Wyoming is the Colby site in the Big Horn Basin, which contained Clovis points in association with at least seven mammoths which dated at ca. 9,250 BC. The Hell Gap site is a stratified Paleoindian site in the North Platte drainage which dates from 9,000 BC to 5,500 BC and exhibits changing point types from Goshen through Folsom, Midland, Agate Basin, Hell Gap, Alberta, Cody and Frederick, and ends with a point type known as Lusk. The Carter-Kerr McGee, Agate Basin, Medicine Lodge Creek, Casper and Sister's Hill sites and others are known Paleoindian sites in the Powder River and Bighorn Basins. Paleoindian sites are uncommon due to the passage of time and the erosional and depositional effects of various climatic changes. They are most likely to occur as out-of-context surface finds on stable landforms

such as ridgetops, or deeply buried in depositional settings.

A few Paleoindian manifestations are known in the area. A Hell Gap point was collected from the Chuggy Site, 48SH1134, during the inventory of the current study area (Ferguson and Meyer 2001). Gregg (1977b) reports an isolated Hell Gap projectile point fragment found about 6 miles to the northeast of the study area in the Squirrel Creek watershed. Fredlund (1979) reported Eden, Browns Valley, Frederick and "Agate Basin-like" projectile points recovered from various contexts at the Benson's Butte site, located about 2.2 miles north of the current study area.

The Archaic Period

The Archaic period (8,500 - 1,500 BP/6,500 BC- 500 AD) begins at a time when the climate was becoming generally drier than the present and ends with the climate relatively similar to the climate of today. Few sites are known in the Pine Breaks (Brumley and Dickerson 2000) and adjacent areas that date to the Early Archaic, and these few are characterized by large side-notched dart points (Deaver and Deaver 1988). As the climate stabilized around 3,500 BC, McKean lanceolate points became popular and the overall number of sites in this area increases considerably. This probably reflects a human population increase accompanying a relatively stable climatic cycle and a subsistence base and settlement pattern that changed relatively little over the next 4,000 years. Stone ring features have been dated to this time. Middle Archaic sites seem to be found in all environments. A McKean-Middle Archaic point was found at site 48SH1124 during the Ferguson and Meyer (2001) study.

The Late Archaic appears to mark another increase in the human population. The number of sites known from this period is large and there is a reliance on bison obtained in sophisticated communal kills. Three point types and three cultural complexes characterize this period: Powers-Yonkee, Pelican Lake and Besant. Besant may be a terminal Late Archaic manifestation (i.e., associated with atlatl darts) or Late Prehistoric I manifestation (i.e., associated with the bow and arrow). In addition, Woodland ceramics are occasionally found with Besant, but no pottery is associated with the Powers-Yonkee or Pelican Lake assemblages. Pelican Lake sites are associated with arroyo bison kills and jumps while the Besant people tended to rely on corral systems. Powers-Yonkee points are associated with all three bison procurement methods (Ferguson 1993). Late Archaic sites are generally associated with high landforms with diverse vegetation (ecotones) to maximize the species in the immediate area. A Late Archaic corner-notched point was found at site 48SH1119 during the Ferguson and Meyer (2001) study.

Prehistoric and Protohistoric Periods

The Late Prehistoric period is associated with the common use of the bow and arrow and an increasing

use of ceramics by the local inhabitants. It is also characterized by another increase in the number and size of sites and a wide variety of cultures moving into the area, particularly during the latter part of the period. During the early part of the Late Prehistoric (LPI), small corner-notched points and small, well made, side-notched points called Avonlea are found in the Pine Breaks and extend north from eastern Wyoming into Canada. During the latter part of the Late Prehistoric (LPII), a greater variety of point types and evidence of numerous incursions by other cultural groups into the region appears to be the norm. LPI dates from AD 500 to AD 1,100, and LPII from AD 1,100 to ca. AD 1,800 or upon evidence of Euroamerican contact. A LPI point was found at site 48SH1121 during the Ferguson and Meyer (2001) study.

Whether the increasing number of bison or socio-economic pressures from various geographic areas on the plains was the cause of the influx of tribal groups into the plains, LPII appears to be marked by northern Athabascan groups moving south, Plains Woodland and Upper Republican people moving into the plains from the east and Shoshone moving from the southwest and west. Ethnohistoric and ethnographic information suggests the presence of several tribal groups in the general area at some time during LPII: Crow, Northern Cheyenne, Shoshone, Kiowa, and Kiowa Apache. Correlating historical tribes with archaeological phases or complexes is difficult because of the widely fluctuating character of tribal territories. Reher (1979) developed an elaborate model for the changing cultural history of the area from ca. AD 1,400 to historic times, and the reader is referred to this for more detail on historically known tribal use of the area. An isolated LPII point was found during the Ferguson and Meyer (2001) study.

Prehistoric Site Types

Prehistoric site types represented in the archaeological literature as common to the surrounding region include: lithic workshops; campsites (including the sub-types of open camp, stone circle [tipi ring] site and rock shelter); rock art sites; bison processing sites; kill sites; lithic quarries; surface stone features (including rock alignments, cairns, etc.); vision quest/fasting beds and fortification structures. Of greatest importance to the interpretation of sites (and most difficult to obtain) is information on subsistence, intra-site patterns, seasonality and exact dates of various activities and occupations.

3.4.12.2 Historic Resources

Seven sites with historic components were recorded in the study area during the baseline inventory (Ferguson and Meyer 2001). The historic components are related to homesteading or stockherding and date to the period after ca. 1900. Sites with historic components include two homesteads, two cairns, two panels of graffiti, and the remains of a log structure, or possibly a tent platform, associated with either small

scale logging or stock herding. The homesteads were claimed in 1909 and 1916, and neither was occupied for more than a few years (GLO Post-1908 General Land Entry Files; States 2000). No significant historic resources occur within the proposed mine plan area.

Historic Context

The study area is located on the northern edge of Sheridan County, Wyoming, approximately 10 miles north of Sheridan, historically the biggest town in the northern part of the state and the commercial center for the region. Coal mining has long been a central facet of the region's historical development. The study area is about five miles north of the vanished coal mining camps of Monarch, Carneyville (later Kleenburn), and Acme; the interurban railway that connected them in the 1910s and 1920s; and the railway main line of the historic Burlington Route (still operated by BNSF Railroad).

Several geographical contexts apply to the region – the town of Sheridan, the coal mining district, and the county – after the arrival of the railroad in 1892, which led to the period of major settlement, agricultural development, and industrial growth. Previous historical events, such as those related to the Bozeman Trail, the Indian wars of the 1860s and 1870s, and open-range livestock grazing, left few surviving marks on the landscape. Historic resources specific to the study area are limited to agricultural development, ca. 1910s-1940s.

While the arrival of the railroad made the 1890s a time of major change, the following decade saw even greater growth. Between 1900 and 1910 the population of the county more than tripled, from 5,122 to 16,324 (USDC, BC 1913). Coal mining boomed. In the corridor from six miles north to fifteen miles northwest of Sheridan, operators opened several new mines and adjacent camps between 1903 and 1907. To carry passengers and express between Sheridan and the several coal mine camps, an electric interurban railway was built from Sheridan to Monarch, a distance of 11 miles. Completed in 1912, it lasted for 14 years until replaced by busses (Kuzara 1977). Coal mining provided income to the area's farmers. Some found occasional work at the mines or sold timber to the mines for use as props underground.

Agriculture in Sheridan County rapidly expanded from 1900 to 1910. The improved land in farms grew 70 percent, from 55,567 to 95,368 acres. Sheridan County led the state in production of wheat and barley. The harvest of wheat grew 60 percent during the decade and the output of barley tripled (USDI, Census Office 1902; USDC, BC 1913). The growth continued through the 1910s. The major agricultural commodities consisted of livestock (cattle, sheep, and horses), feed crops (hay, oats and barley), wheat and sugar beets. Farmers in the study area could, with one day's round trip travel by team and wagon, easily reach the coal

camps along the interurban and Burlington main line, and with a longer day on the road, get to the town of Sheridan (USDA 1925).

Industrial facilities in Sheridan processed some of the crops grown locally. Of several flour mills, the last and largest ground wheat from 1921 until 1972. A sugar beet refinery operated between 1915 and 1947 (Popovich 1997).

The historic economic activities of the railway and coal mines, with many employees and extensive works, lasted into 1950s. On the railway, the replacement of steam locomotives by diesel-electrics and other modernization greatly reduced the workforce in Sheridan, while traffic actually grew. The last underground coal mine, at Monarch, closed in 1953 (Kuzara 1977). Open-pit mining, begun in 1943, needed far fewer workers to produce greater amounts of coal (Kuzara 1977). The changing economics of agriculture resulted in fewer, larger farms, shipping products to distant plants for processing. While the area still hosts the three economic activities that began on a large scale in the early 1890s – railroading, coal mining, and agriculture – they operate with technology, labor practices, and physical properties that are very different from the historic period.

Vern States first came to this area in 1934 and began buying land here in 1940. He bought three homesteads, including two found in the study area: Baker, Stringary (Negri), and Charles Monsini. His holdings included the whole of the study area. He operated a cattle ranch here until he sold out to an energy developing company in the mid-1970s. Mr. States was interviewed on August 8, 2000, by David Ferguson and provided the following information about the property.

The Monsini place is where Vern built his house (there is no trace remaining of the original homestead). The Monsini family lived in a dugout and had a shack and a hand dug well. Mr. States filled in these features long ago, which were about where the corrals are now. The Frank Baker Place (48SH1138) was bought by Mr. States in the early 1940s. Vern remembers that the Bakers had lived there from about 1905 to 1910, then moved to town after "proving up." The house was burned down to make more room for the hay field. Only the dugout and granary remain. The Stringary place (48SH1130) was abandoned prior to 1934. Stringary proved up and moved to town as well. Vern said it looked about the same then (in the 1940s) as it does now. Vern thought they homesteaded around 1905 but were long gone by 1934.

Mr. States recalls that when he came to this country there were almost no deer at all, as they were heavily hunted to feed the mining community of Acme, as well as the local homesteaders, who he describes as "terribly poor." He recalled that a deer was reported in the area in 1934, and several cow hands from neighboring ranches turned out on

horse back to ride out to try to see it. Merriam's turkeys, now plentiful along the creeks, were introduced in the 1950s. Logging was done on State's property in 1936 and 1937. Logs were skidded by horse team (Ferguson and Meyer 2001).

Table 3-9 summarizes the Class III cultural resource inventory of the PSO Tract study area.

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

3.4.13 Native American Consultation

Any effects the Proposed Action might have on traditional use and traditional cultural sites of Native Americans must be considered as directed by the National Historic Preservation Act, the American Indian Religious Freedom Act, PL 95-341 and the Archaeological Resources Protection Act of 1979.

Native American heritage sites can be classified as prehistoric or historic. Some may be presently in use as offering sites, fasting or vision quest sites and selected rock art sites. Other sites of cultural interest and importance may include rock art sites, stone circles, and various rock features, fortifications or battle sites, burials, as well as locations which are sacred or part of the oral history and heritage that have non man-made features. No Native American heritage sites have been identified to date.

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

The study area is immediately south of the Northern Cheyenne and Crow Indian Reservations in Montana. Both groups favored this region in the Protohistoric Period. It is believed that these groups entered the area in the protohistoric period as a result of population movements and technological change. By the time of the earliest Euro-American contacts, horse dependent tribes such as Crow, Sioux, and Cheyenne dominated the region although Shoshonean groups also existed in the region.

Crow emigration from Hidatsa occupations on the Middle Missouri to the upper Yellowstone is well documented (Beckes and Keyser 1983). By the nineteenth century the

Table 3-9. Summary of Class III Cultural Resource Inventory of the PSO Tract Study Area.

Smithsonian Number	Site Type, Temporal Association, and Description	NRHP status and Criteria
48SH1119	Prehistoric campsite, rockshelter with extensive lithic scatter; Late Archaic projectile collected. Historic graffiti also present.	Not eligible
48SH1120	Stone circle, prehistoric campsite.	Not eligible
48SH1121	Lithic scatter, a Late Prehistoric corner-notched projectile point was collected.	Not eligible
48SH1122	Lithic scatter.	Not eligible
48SH1123	Lithic scatter.	Not eligible
48SH1124	Prehistoric cairn and lithic scatter. Middle Archaic Duncan projectile point collected.	Not eligible
48SH1125	Historic graffiti.	Not eligible
48SH1126	Stone circle, surface lithic, source, lithic scatter, prehistoric campsite.	Not eligible
48SH1127	Lithic scatter, prehistoric campsite, Late Plains Archaic bifacial knife collected. Historic debris and possible tent platform also present.	Eligible under Criterion D
48SH1128	Surface lithic source.	Not eligible
48SH1129	Prehistoric campsite, stone ring, and lithic scatter.	Not eligible
48SH1130	Negri/Stringary homestead.	Not eligible
48SH1131	Prehistoric cairn.	Not eligible
48SH1132	Lithic scatter.	Not eligible
48SH1133	Historic cairn.	Not eligible
48SH1134 Chuggy Site	Prehistoric campsite, prehistoric rock art panel, lithic scatter and rockshelter, Paleoindian Hell Gap projectile point.	Eligible under Criterion D
48SH1135	Historic cairn.	Not eligible
48SH1136	Surface lithic source, lithic scatter.	Not eligible
48SH1137	Prehistoric campsite, stone circle, lithic scatter, surface lithic source.	Not eligible
48SH1138	Baker homestead.	Not eligible
48SH1139	Surface lithic source, lithic scatter.	Not eligible

Crow occupied much of southeastern Montana and northcentral Wyoming. Vision quest structures and other traditional sites are known in the Pine Breaks. A variety of plant species of ethnobotanical importance are currently harvested in the general area.

No traditional use sites were positively identified during the archaeological inventory. Several stone circle sites (48SH1120, 48SH1126, 48SH1129 and 48SH1137) and two probable prehistoric cairns (48SH1124 and 48SH1131) were found during the baseline inventory. While these sites can offer little archaeological information, they may be of interest to Native Americans.

Native American tribes were consulted at a general level in 1995-1996 as part of an effort to update the BLM *Buffalo Resource Management Plan*. Tribes that have been potentially identified as having concerns about actions in the Powder River Basin include: the Crow, Northern Cheyenne, Shoshone, Arapaho, Oglala Lakota, Rosebud Sioux, Flandreau Santee Sioux, Santee Sioux, Crow Creek Sioux, Lower Brule Sioux, Standing Rock Sioux, and Cheyenne River Sioux. These tribal governments and representatives were sent scoping notices and will receive copies of the DEIS. Tribal consultation will be conducted to assess the traditional cultural significance of the study area to support an exchange decision on the federal coal.

3.4.14 Paleontological Resources

The sedimentary rocks exposed on the surface of the PRB are the Eocene age Wasatch Formation and Paleocene age Fort Union Formation, both of which are known to contain fossil remains. Some paleontological surveys have been conducted in the PRB. Vertebrate fossils that have been described from the Wasatch Formation in the PRB include fish, turtle, champosaur, crocodile, alligator, and mammal specimens. The Fort Union also contains fossils of plants, reptiles, fish, amphibians, and mammals. No Wasatch Formation occurs within the PSO Tract area. No vertebrate-bearing localities have been reported from the Fort Union Formation of the Sheridan coal field or adjacent areas (Lillegraven 1981).

Invertebrate fossils recorded from the vicinity of the Sheridan coal field within the Fort Union Formation appear to be restricted to the Mollusca (Lillegraven 1981). These include freshwater clams (Pelecypoda) and, more commonly, freshwater snails (Gastropoda). Glass' (1975) detailed measured sections of the Fort Union Formation in the Sheridan coal field found no invertebrates.

A paleontological survey of the potential for vertebrate and invertebrate fossils was conducted in 1981 throughout much of the Big Horn Coal Mine area south of the PSO lands area by Jason A. Lillegraven (Professor, Department of Geology and Geophysics, and Curator, Geological Museum,

University of Wyoming). The surveyed lands included approximately 3,280 acres in T.57N., R.84W., Sections 4, 9, 10, 13, 14, and 22-27. At its closest point, Lillegraven's field investigation was less than two miles south of the PSO lands area. Lillegraven reported that only two localities with vertebrate remains were discovered during his survey of the Big Horn Coal Mine area. Both contained only isolated gar pike scales and are without scientific consequence. Only one complete invertebrate fossil was discovered, that being an isolated shell of a snail. The same general area had some poorly-preserved bits of clam shells. There were no indications of abundant accumulations of molluscan fossils, and the few specimens found were judged to be of no taxonomic, stratigraphic, or ecologic consequence. Within his conclusion, Lillegraven stated that there is little probability that important vertebrate or invertebrate paleontological resources exist in the area.

3.4.15 Visual Resources

Visual sensitivity levels are determined by people's concern for what they see and the frequency of travel through an area. The landscape within the general analysis area is described as somewhat rugged topography consisting of dissected uplands created by the Ash Creek and Youngs Creek drainages. The ephemeral tributaries of these perennial streams have formed numerous, steeply sloping ravines that are separated by rounded uplands. The ravines are forested with scattered ponderosa pine and juniper trees, and the gently-rolling upland benches are covered with patches of open grassland and sagebrush. Small bluffs and ledges of resistant sandstone and scoria outcrops occur intermittently along the steeper slopes of the ravines and the sides of the larger valleys. The drainages of Ash Creek and Youngs Creek have relatively lush riparian environments. This type of topography is common within the Pine Breaks region of the PRB.

None of the existing or reclaimed surface mines in the Sheridan coal field are visible from the general analysis area. Major man-made intrusions include ranching activities (i.e., fences, ranch houses and associated structures, homesteads, livestock), transportation facilities, electrical power lines, and recent CBM development activities. The Ash Creek oil field is nearby and accessed by the Ash Creek Road, although the rugged topography, forested ravines, hay meadows and deciduous trees in the Ash Creek valley block the view of the oil field from the road.

The PSO Tract area is only partially visible from Wyoming State Highway 338 and a high percentage of people traveling this highway are commuting to work at the Decker and Spring Creek coal mines. However, during periods of peak recreational activity, primarily to and from the Tongue River Reservoir, this highway receives higher traffic volume. The PSO Tract area lies adjacent to the Ash Creek and Youngs Creek roads (Figure 3-11)

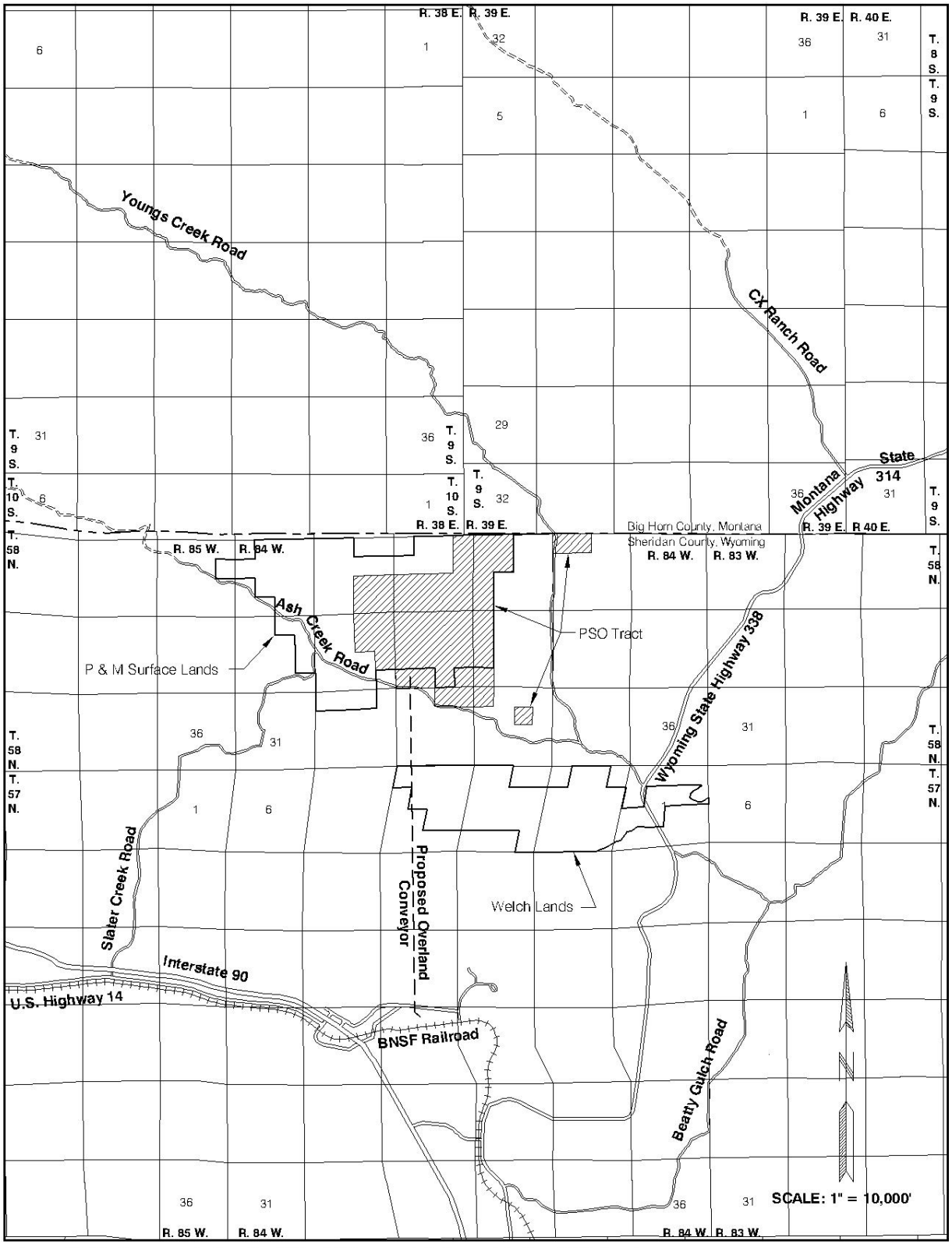

Figure 3-11. Transportation Facilities Within and Adjacent to the PSO Tract.

and is therefore plainly visible to passers-by. Those traveling these improved, aggregate-surfaced roads are typically local residents and the traffic volume is light. The natural scenic quality of the general analysis area is fairly high due to the relatively unaltered condition of the rugged topography and native vegetation, yet it is predominantly hidden from the view of the general public.

For management purposes, BLM evaluated the visual resources on lands under its jurisdiction in the *Buffalo Resource Management Plan*. A VRM inventory identifies, sets, and meets objectives for the maintenance of scenic values and visual quality based on research designed to objectively assess aesthetic qualities of the landscape. The VRM classification ratings range from I to V as follows:

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

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

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

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

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

The federal coal lands being considered for exchange are generally classified as VRM Class II. After the surface has been reclaimed the visual impact of coal mining would not likely be discernible to the average observer.

3.4.16 Noise

An individual's judgement of the loudness of a noise correlates well with the A-weighted sound level, or A-scale, system of measurement. Figure 3-12 presents dBA readings for some commonly heard sounds of daily life.

Existing noise sources in the PSO lands area include activities associated with agriculture, CBM development, local traffic on the Ash Creek and Youngs Creek Roads, intermittent oil well servicing associated with the Ash Creek and Ash Creek South oil fields, and birds and animal life. The distance to State Highway 338 is in excess of three miles; therefore, highway traffic noise is very slight or non-existent. Due to the isolated, remote nature of the area, the current noise level from all these sources in the PSO lands area

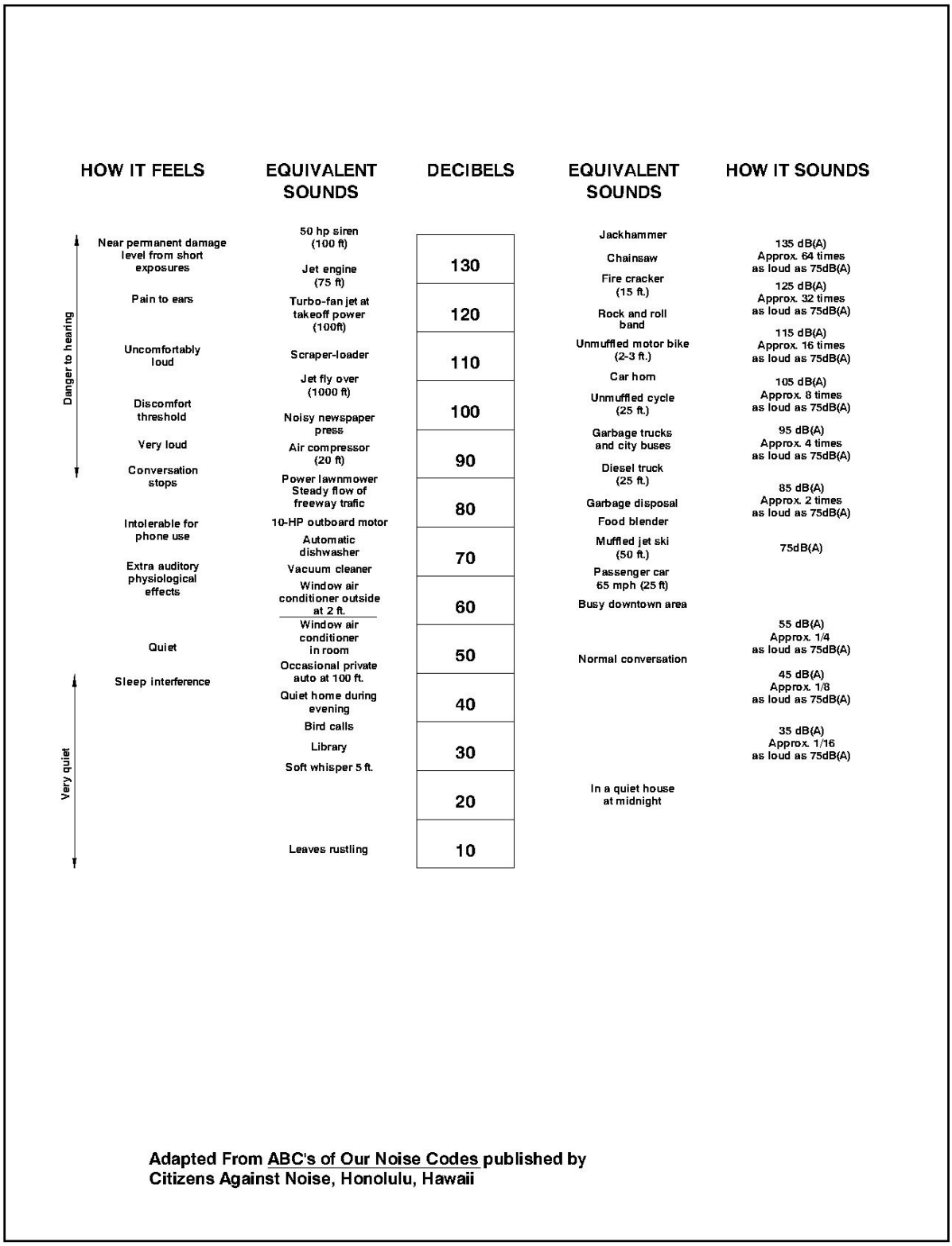

Figure 3-12. Relationship Between A-Scale Decibel Readings and Sounds of Daily Life.

is probably in the range of 30 to 50 dBA.

Mining activities are characterized by noise levels of 85-95 dBA at 50 ft from actual mining operations and activities (BLM 1992). The nearest occupied dwellings are all located at a distance of approximately ¼ mile outside of the boundary of the federal coal being considered for exchange. Two of these nearby dwellings are in Montana; one being in the SE¼SE¼ of Section 1, T.10S., R.38E., the other being in the NW¼SE¼ of Section 33, T.9S., R.39E. Three of these nearby dwellings are in Wyoming; one being in the SE¼NW¼ of Section 23, T.58N., R.84W., another being in the NW¼NW¼ of Section 33, T.58N., R. 84W., and the third dwelling being in the NE¼SW¼ of Section 29, T.58N., R.84W.

3.4.17 Transportation Facilities

The transportation facilities in the vicinity of the PSO Tract area include Wyoming State Highway 338; the BNSF Railroad; improved county roads including the Ash Creek Road and the Youngs Creek Road; unimproved local roads and two-track trails related to ranching activities, the Ash Creek and Ash Creek South oil fields, and the CBM industry; and numerous pipelines associated with both the conventional oil field and the CBM development.

Current transportation facilities within and adjacent to the PSO Tract lands are depicted on Figure 3-11. Since the development of the Ash Creek Mine would require a coal transportation facility, the proposed 24,000-ft long overland conveyor running due south from the mine to a loadout facility on the BNSF mainline is depicted on this figure.

3.4.18 Socioeconomics

The social and economic study area for the proposed project involves primarily Sheridan County and the City of Sheridan. The community of Sheridan and nearby communities of Ranchester and Dayton would most likely attract the majority of any new residents due to their current population levels and the availability of services and shopping amenities.

3.4.18.1 Population

According to 2000 census data, Sheridan County had a population of 26,560, with Sheridan accounting for 15,804 of the county's residents, Ranchester 701 and Dayton 678 (USDC 2001). The 1990 population of Sheridan County was 23,562. Thus there was an increase of 2,998 persons or 12.7 percent over the 10-year period. Sheridan County's population change from 1990 to 2000 ranked 1,158 out of 3,141 counties in the U.S. (U.S. Census Bureau 2001b).

Sheridan County is an area of relatively low growth (1-2 percent per year), and facilities (hospitals, schools, etc.) are adequate. School enrollment is actually declining due to an aging population. The average age in Sheridan County is 40.6 years, compared to a state-wide average of

36.2 (Wyoming Department of Administration and Information July 2001).

3.4.18.2 Local Economy

Coal production, as reported by the Wyoming State Inspector of Mines, showed the State's coal producers set a new yearly production record of 338.9 million tons in 2000. This was an increase of less than 1 percent over the 336.5 million tons produced in 1999, a much slower growth rate than had occurred in recent years. Sheridan County's last remaining coal mine, the Big Horn Coal Mine, closed down and began reclamation in 2000. Its production in 2000 was only 38,411 tons. The Big Horn Coal Mine employed 11 persons in 2000 (Wyoming State Inspector of Mines 2000).

The national economy grew rapidly through the 1990s and is currently in a period of slower growth, due to a variety of factors complicated by higher energy prices. Higher prices for commodities such as coal, oil and gas, and agricultural goods have helped Wyoming's economy as they have hurt the national economy. Recent increases in coal, oil, and gas prices have provided significant increases to state revenues in the form of increased severance taxes, royalties, sales and use taxes, and employment. The mining sector, including oil and gas, is expected to remain strong through at least 2009 (Wyoming Department of Administration and Information April 2001).

Total mineral income to the State of Wyoming in 2000 was $900,441,458. This income was comprised of ad valorem taxes ($290,174,806 or 32 percent), royalty returns $276,720,872 or 31 percent), severance taxes ($275,143,604 or 31 percent) and sales and use taxes, state rent, state royalties, and filing fees ($57,538,838 or 6.4 percent) (Wyoming Business Council 2000).

Mineral valuation in Wyoming in 2000 was $4,075,053,783. This is 52 percent of the state's total valuation and places Wyoming among the top ten mineral producing states in the nation. Sheridan County's mineral valuation in 2000 was only $1,805,204, a fraction of a percent of the state's total (Wyoming Business Council 2000). Minerals accounted for only 1.2 percent of Sheridan County's total assessed valuation in April 2000 of $145,093,161 (Wyoming Department of Revenue 2001).

3.4.18.3 Employment

As of April 2001, the total labor force in Sheridan County stood at 14,172 with an unemployment rate of 3.6 percent, compared to 4.3 percent in April 2000 (Wyoming Department of Employment, Research and Planning 2001b). At the beginning of 1999 around 2,808 people in Wyoming were directly employed in coal mining, representing about 15 percent of the employed labor force (Wyoming Department of Employment 2001b).

Total employment in Sheridan County has generally increased since 1990,

when it stood at 11,416. In April 2001 there were 13,411 employed persons in the county.

In 1997, the largest employment sector in Wyoming was the service sector, with 2,647 employees. This was followed by retail trade (2,295), local government (1,821), construction (760), and federal government (623). Together, these sectors accounted for nearly 80 percent of the county's employment. Mining, which includes oil and gas, employed only 29 persons in Sheridan County in 1997 (Wyoming Department of Employment July 2001).

The preceding statistics obviously do not account for employees at the Decker and Spring Creek Coal Mines. These mines are located in Montana, which receives the payroll taxes, royalties, and production taxes, but most of the employees reside in Sheridan County. In 2000, the Decker and Spring Creek mines employed 235 and 135 people with estimated payrolls of $10,600,000 and $8,900,000, respectively (Montana Coal Council 2001).

Employment in northeastern Wyoming has certainly been affected by the recent CBM development, although state employment experts say it's difficult to track the impact on employment in Sheridan County. Some employers are saying employees leaving for higher paying CBM jobs have left a shortage of quality workers. Large gains in the oil and gas industry were responsible for 4,800 new jobs in Wyoming in April 2001, a growth rate of 21 percent, and the largest state employment gains were in the mining industry with a 12.9 percent increase in jobs from April 2000 to April 2001 (Sheridan County Roundup August 2001).

3.4.18.4 Housing

In 2000, Sheridan County contained 12,577 housing units. Of these, 7,413 were in Sheridan, 304 in Dayton and 290 in Ranchester (U.S. Census Bureau 2001a). Of Sheridan County's 12,577 housing units in 2000, 11,167 were occupied and 1,410 were vacant for seasonal use. Of the 11,167 occupied units, 7,689 were owner occupied and 3,478 were renter occupied. Similar low vacancy rates were seen for the City of Sheridan and the towns of Dayton and Ranchester. According to Census 2000 data, rental vacancy rates were 4.7 percent for the entire county, 4.5 percent for the City of Sheridan, 7.9 percent for the town of Dayton and 1.3 percent for the town of Ranchester. Very few residential building permits were issued for Sheridan County in the 1980s, but reached a high of 172 in 1996, then declined to 90 in 1999 (Wyoming Department of Administration and Information, Division of Economic Analysis July 2001)

Sheridan County had the fourth highest cost of living index in the state as of January 2001. It ranked highest of all the counties for food, third in housing and transportation (tied with four other counties), fourth in apparel and medical, and fifth in

recreation/personal care. Housing rental rates are rising much faster than the general consumer price index. Comparing the fourth quarters of 2000 and 1999, rental rates in Sheridan County had risen 8.3 percent for apartments, 7.1 percent for mobile home lots, 9.8 percent for houses, and 17.7 percent for mobile homes. This compares with a statewide overall inflation rate of 3.2 percent (Wyoming Department of Administration and Information March 2001).

According to the Department of Employment, the population in Wyoming's northeast area grew by 12.7 percent over the past decade, but housing stock only increased by 6.2 percent (Sheridan County Roundup August 2001).

3.4.18.5 Local Government Facilities and Services

Most of the tax revenues in Sheridan County come from sales and use taxes and property taxes. Mineral production provides a minor source of revenues to local governments in Sheridan County. This is a change from the 1980s, before the Big Horn Coal Mine began to close down their operations and prepare for final reclamation. Production at Big Horn Coal Mine peaked at 4 mmpty in 1981 and declined steadily after a long-term contract with Chicago's Commonwealth Edison expired in 1988. During the peak production years Big Horn Coal accounted for nearly half the county's assessed valuation (Sheridan Press, March 12, 1994). In 2000, the mine produced only 38,400 tons and employed just 11 persons (Wyoming State Inspector of Mines 2001). The mine is now being reclaimed. State-wide, the assessed valuation for minerals was 51.6 percent of the total assessed valuation in fiscal year 2000 (Wyoming Taxpayers Association 2001). In Sheridan County, the total assessed valuation for 2000 was $145 million, up 8.6 percent from the prior year. Only $1.8 million of that was from mineral production. Total 2000 property taxes levied in Sheridan County were $10.1 million, up 7.2 percent from the prior year. Minerals are taxed at 100 percent of assessed valuation, while industrial property is taxed at 11.5 percent of assessed valuation and all other real and personal property at 9.5 percent.

Most of Wyoming's property taxes fund education (about 69.7 percent), with the remainder going to county governments (20.6 percent), special districts (4.0 percent), community college (3.8 percent), and municipalities (1.9 percent). Because minerals are taxed at full valuation, counties vary in property tax wealth. For example, in Niobrara county one mill raises $30,862 in taxes, while in mineral-rich Campbell County one mill raises $1.6 million (Wyoming Taxpayers Association 2001).

In Sheridan county there are 17 jurisdictions levying property taxes. These include 5 municipalities, 3 school districts, 2 recreation districts, 1 community college, 1 weed and pest control district and 5 fire districts.

Public facilities in Sheridan County are meeting current needs. School enrollment is declining due to the aging population. Memorial Hospital of Sheridan County, owned by the county, recently underwent a major expansion, funded in large part by AML funds.

3.4.18.6 Social Conditions

Sheridan County is experiencing a relatively stable social setting. Coal mining is no longer a major force in the local economy as it once was, but employees of the Spring Creek and Decker mines in Montana reside primarily in Sheridan County. There is interest in CBM development in the County, but this development has been delayed due to difficulties in disposing of the produced water. WDEQ is currently not issuing permits to discharge CBM water into tributaries of the Tongue River (Maggie Davison, June 15, 2001).

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

Wyoming's economy reached the bottom of an energy bust in 1987 and started to recover. That recovery began to slow in 1996, due to low prices for coal, oil and gas. In 1999, for the first time since 1977, minerals comprised less than half the State's total assessed valuation. Since then energy and fuel prices have risen, and this trend is expected to continue. The forecast is for slow growth through 2009; Wyoming's population is projected to increase at 1.0 percent per year. Non-agricultural employment is projected to increase by 10.2 percent by 2009, increasing 1.1 percent per year. Mining employment is projected to grow by 7.5 percent by 2009, mostly within the oil and gas sector. In 2000 there were 17,160 jobs in the mining sector, of which 9,300 were in the oil and gas sector (Wyoming Department of Administration and Information, April 2001).

3.4.18.7 Environmental Justice

Environmental Justice issues are concerned with actions that unequally impact a given segment of society either as a result of physical location, perception, design, noise, or other factors. 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 Sheridan County, entities with interests in the area, and individuals with ties to the area all may have concerns about the presence of a new coal mine within the area. Communities potentially impacted by the presence or absence of a coal mine have been identified in this section of the EIS. Environmental Justice concerns are usually directly associated with impacts on the natural and physical environment, but these impacts are likely to be interrelated with social and economic impacts as well. Native American access to cultural and religious sites may fall under the umbrella of Environmental Justice concerns if the sites are on tribal lands or access to a specific location has been granted by treaty right.

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

3.4.19 Hazardous and Solid Waste

Potential sources of hazardous or solid waste on P&M's proposed Ash Creek Mine would include spilling, leaking, or dumping of hazardous substances, petroleum products, and/or solid waste associated with mineral, coal, oil and/or gas exploration and development or agricultural or livestock activities. No such hazardous or solid wastes are known to be present on the tract at this time. All wastes produced by the reclaimed PSO No. 1/Ash Creek Mine were disposed of according to WDEQ-approved disposal plans. Wastes produced by the proposed Ash Creek Mine would also be handled according to the procedures described in Chapter 2.