



U.S. Department of the Interior

Bureau of Land Management

Wyoming State Office

Casper Field Office

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DRAFT South Powder River Basin Coal Environmental Impact Statement



North Antelope/Rochell Mine Complex



Black Thunder Mine



Antelope Mine



North Rochelle Mine

MISSION STATEMENT

It is the mission of the Bureau of Land Management to sustain the health, diversity, and productivity of the public lands for the use and enjoyment of present and future generations.

**DRAFT ENVIRONMENTAL IMPACT STATEMENT
SOUTH POWDER RIVER BASIN COAL
CAMPBELL AND CONVERSE COUNTIES, WYOMING
ABSTRACT**

Lead Agency:

USDI Bureau of Land Management
Casper Field Office
Casper, Wyoming

Cooperating Agencies:

USDA Forest Service
Medicine Bow-Routt National Forest
Douglas, Wyoming

USDI Office of Surface Mining Reclamation & Enforcement
Western Regional Coordinating Center
Denver, Colorado

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Abstract:

This Draft Environment Impact Statement (EIS) assesses the environmental consequences of decisions to hold five separate competitive, sealed-bid sales and issue leases for five tracts of federal coal located adjacent to four existing surface coal mines in Campbell and Converse Counties, Wyoming, subject to standard and special lease stipulations. A separate decision to hold or not to hold a sale would be made for each of the five tracts being considered for leasing. The five federal coal tracts are:

The NARO North and NARO South Lease By Application (LBA) Tracts, as applied for by Powder River Coal Company, include a total of approximately 4,503 acres containing approximately 564 million tons of federal coal. Powder River Coal Company operates the adjacent North Antelope/Rochelle Mine Complex and proposes to mine the NARO North and NARO South LBA Tracts as maintenance tracts for the existing mine complex, if a lease sale is held and they acquire the lease.

The Little Thunder LBA Tract, as applied for by Ark Land Company, includes approximately 3,449 acres containing approximately 479 million tons of federal coal. Thunder Basin Coal Company operates the adjacent Black Thunder Mine and proposes to mine the Little Thunder LBA Tract as a maintenance tract for the existing mine, if a lease sale is held and they acquire the lease. Ark Land Company and Thunder Basin Coal Company are both subsidiaries of Arch Coal, Inc.

The West Roundup LBA Tract, as applied for by Triton Coal Company LLC, includes approximately 1,871 acres containing approximately 173 million tons of federal coal. Triton Coal Company LLC operates the adjacent North Rochelle Mine and proposes to mine the West Roundup LBA Tract as a maintenance tract for the existing mine, if a lease sale is held and they acquire the lease.

The West Antelope LBA Tract, as applied for by Antelope Coal Company, includes approximately 3,542 acres containing approximately 294 million tons of federal coal. Antelope Coal Company operates the adjacent Antelope Mine and proposes to mine the West Antelope LBA Tract as a maintenance tract for the existing mine, if a lease sale is held and they acquire the lease.

This Draft EIS describes the physical, biological, cultural, historic, and socioeconomic resources in and surrounding the existing mines and LBA Tracts. For each of the five LBA tracts, the alternatives in the Draft EIS consider the impacts of leasing the tract as it was applied for; leasing a reconfigured tract in order to avoid bypassing federal coal and/or to increase the fair market value of the federal coal in and around the tract; and not leasing the tract. The focus for the impact analysis was based upon resource issues and concerns identified during previous coal leasing analyses and public scoping conducted for these lease applications. Potential concerns related to development include impacts to groundwater, air quality, and

wildlife and cumulative impacts related to ongoing surface coal mining and other proposed development in the Powder River Basin of Wyoming.

Other Environmental Review or Consultation Requirements:

This draft EIS, in compliance with Section 7(c) of the Endangered Species Act (as amended), identifies any endangered or threatened species, which are likely to be affected by the Proposed Action.

EXECUTIVE SUMMARY

This EIS¹ analyzes the environmental impacts of leasing five tracts of federal coal reserves adjacent to existing surface coal mines in the southern PRB. Operators of four mines, North Antelope/Rochelle Complex, Black Thunder, North Rochelle, and Antelope, have filed four applications to lease five tracts of federal coal as maintenance tracts under the regulations at Title 43 of the Code of Federal Regulations Part 3425.1 (43 CFR 3425.1) Leasing On Application. All four applications have been reviewed by the BLM Wyoming State Office, Division of Minerals and Lands Authorization. That office determined that all four lease applications met the regulatory requirements for lease by applications, or LBAs. The five LBA tracts considered in this EIS and the adjacent mines are shown in Figure ES-1. They are the NARO North and NARO South LBA Tracts, adjacent to the North Antelope/Rochelle Complex; the Little Thunder LBA Tract, adjacent to the Black Thunder Mine; the West Roundup LBA Tract, adjacent to the North Rochelle Mine; and the West Antelope LBA Tract, adjacent to the Antelope Mine. The applications are summarized below.

On March 10, 2000, PRCC filed one application with the BLM for federal coal reserves in two maintenance tracts adjacent to the North Antelope/Rochelle Complex. The tracts are referred to as the NARO North and NARO South LBA Tracts.

The NARO North LBA Tract is located in southern Campbell County, Wyoming, approximately 13 miles southeast of Wright, Wyoming. The NARO South LBA Tract is located in southern Campbell County and northern Converse County, Wyoming, approximately 19 miles southeast of Wright, Wyoming (Figure ES-1). BLM determined that the two tracts in the application would be processed separately and, if the decision is made to hold a lease sale for both tracts, they would be offered for sale separately. PRCC's coal lease application was assigned case file numbers WYW150210 (NARO North) and WYW154001 (NARO South). The North Antelope/Rochelle Complex is operated by PRCC, a subsidiary of Peabody Holding Company, Inc.

On March 23, 2000, ALC filed an application with the BLM for federal coal reserves in a maintenance tract located west of and immediately adjacent to the Black Thunder Mine. ALC is a subsidiary of Arch Coal, Inc. The tract, which is referred to as the Little Thunder LBA Tract, was assigned case file number WYW150318. The application area is located in southern Campbell County, Wyoming, approximately six miles east-southeast of Wright, Wyoming (Figure ES-1). The Black Thunder Mine is operated by TBCC, a subsidiary of Arch Western Resources, LLC.

On July 28, 2000, TCC filed an application with the BLM for federal coal reserves in a maintenance tract

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

Figure ES-1

located west of and immediately adjacent to the North Rochelle Mine. The application area is located in southern Campbell County, Wyoming, approximately 10 miles southeast of Wright, Wyoming (Figure ES-1). The tract, which is referred to as the West Roundup LBA Tract, was assigned case file number WYW151134. The North Rochelle Mine is operated by TCC, a subsidiary of Vulcan Intermediary, LLC.

On September 12, 2000, ACC filed an application with the BLM for federal coal reserves in a maintenance tract located west of and immediately adjacent to the Antelope Mine. The tract, which is referred to as the West Antelope LBA Tract, was assigned case file number WYW151643. The application area is located in southern Campbell County and northern Converse County, Wyoming, approximately 19 miles south-southeast of Wright, Wyoming (Figure ES-1). The Antelope Mine is operated by ACC, a subsidiary of Kennecott Energy Company.

These federal coal lands are located within the Powder River Federal Coal Region, which was decertified in January 1990. Although the Powder River Federal Coal Region is decertified, the PRRCT, a federal/state advisory board established to develop recommendations concerning management of federal coal in the region, has continued to meet regularly and review all federal lease applications in the region. The PRRCT reviewed these four maintenance coal lease applications at a public meeting held on October 25, 2000, in Cheyenne, Wyoming.

The PRRCT recommended that the BLM continue to process all four lease applications at that meeting.

To evaluate the environmental impacts of leasing and mining the coal, the BLM must prepare an EA or an EIS to evaluate the site-specific and cumulative environmental and socioeconomic impacts of leasing and developing the federal coal in the application area. BLM does not authorize mining by issuing a lease for federal coal, but the impacts of mining the coal are considered in this EIS because it is a logical consequence of issuing a lease. The BLM determined that one EIS would be prepared to evaluate the environmental impacts of coal mining that would result from the issuance of these five leases. This EIS has been prepared to evaluate the site-specific and cumulative environmental impacts of leasing and developing the federal coal included in these application areas, as required by NEPA. Scoping for these lease applications was conducted from October 1 to October 31, 2001. A Notice of Scoping and Notice of Intent to Prepare an EIS was published in the *Federal Register* on October 3, 2001 and in the Gillette News-Record on September 25, 2001 and October 2, 2001. A public scoping meeting was held in Gillette, Wyoming on October 10, 2001.

BLM will use the analysis in this EIS to decide whether or not to hold separate public, competitive, sealed-bid coal lease sales and issue federal coal leases for the federal coal included in each tract. For each sale that is held, the bidding at that sale

would be open to any qualified bidder; it would not be limited to the applicant. For each lease sale that is held, a federal coal lease would be issued to the highest bidder at the sale if a federal sale panel determined that the high bid at that sale meets or exceeds the fair market value of the coal as determined by BLM's economic evaluation, and if the U.S. Department of Justice determines that there are no antitrust violations if a lease is issued to the high bidder at the sale.

OSM and USFS are cooperating agencies on this EIS. OSM will use the analysis in this EIS to make decisions related to mining the federal coal in these tracts, if they are leased. The USFS is a cooperating agency on this EIS because the NARO North, Little Thunder, and West Roundup LBA Tracts include lands that are part of the TBNG, which is administered by the USFS.

The lands in the NARO North, NARO South, Little Thunder, West Roundup, and West Antelope LBA Tracts have been subjected to four coal planning screens and determined to be acceptable for consideration for leasing. A decision to lease the federal coal lands in this application would be in conformance with the *Approved Resource Management Plan for Public Lands Administered by the Bureau of Land Management Buffalo Field Office (BLM 2001a)* [an update of the *Buffalo Resource Area Resource Management Plan* (BLM 1985a)] and the *BLM Platte River Resource Area Resource Management Plan* (BLM 1985b). The federal surface lands managed by the USFS in the NARO

North, Little Thunder, and West Roundup LBA Tracts are within the area evaluated in the USFS *Medicine Bow National Forest and Thunder Basin National Grassland Land and Resource Management Plan* (USFS 1985) and the *Final EIS for the Northern Great Plains Management Plans Revision for Thunder Basin National Grassland* (USFS 2002a).

The LBA sale process is, by law and regulation, an open, public, competitive sealed-bid process. For each lease sale that is held, the applicant may not be the successful high bidder. The analysis in this EIS assumes that the applicant would be the successful bidder on each LBA tract that is offered for sale and that each tract that is leased would be mined as a maintenance tract for the applicant mine.

This draft EIS analyzes different alternatives for each tract. For each tract, the Proposed Action considers leasing the tract as it was applied for.

Alternative 1 for each tract is the No Action Alternative. Alternative 1 for each tract considers rejecting the lease application for that tract. Under each Alternative 1, the tract would not be leased but the existing leases at the adjacent mine or mines would be developed according to the existing approved mining and reclamation plans.

BLM is evaluating adding coal to or removing coal from the tracts in order to avoid potential future bypass situations or to increase the competitiveness of the tracts or the remaining unleased federal coal in

this area. These different tract configurations are considered as other alternatives in this EIS.

The Proposed Actions and alternatives for the NARO North and South, Little Thunder, West Roundup, and West Antelope LBA Tracts are shown in Figure ES-2, ES-3, ES-4, and ES-5, respectively. The Proposed Actions and alternatives are described in Tables ES-1, ES-2, ES-3, and ES-4.

Other alternatives that were considered but not analyzed in detail include holding competitive coal lease sales and issuing leases for one or more of the tracts to the successful bidder (not the applicant) for the purpose of developing a new stand-alone mine and delaying the competitive sales of one or more of the LBA tracts.

Critical elements of the human environment (BLM 1988) that could be affected by the proposed project include air quality, cultural resources, Native American religious concerns, threatened, endangered, proposed, and candidate plant and animal species, USFS sensitive species, hazardous or solid wastes, water quality, wetlands/riparian zones, environmental justice, and invasive nonnative species. Five critical elements (areas of critical environmental concern, prime and unique farmland, wild and scenic rivers, floodplains, and wilderness) are not present in the project area and are not addressed further. In addition to the critical elements that are potentially present in the project area, this EIS discusses the status

and potential effects of the project on topography and physiography, geology and mineral resources, soils, water availability and quality, AVFs, vegetation, wildlife, land use and recreation, paleontological resources, visual resources, noise, transportation resources, and socioeconomics.

The General Analysis Area, shown in Figure ES-6, is located in the PRB, a part of the Northern Great Plains that includes most of northeastern Wyoming. The NARO North, NARO South, Little Thunder, West Roundup, and West Antelope LBA Tracts are located in the south-central part of the PRB, where the elevation ranges from about 4,500 to 5,000 ft.

In the General Analysis Area, there are up to four mineable coal seams. The nomenclature of these seams varies from mine operator to mine operator and the number of mineable coal seams varies from tract to tract. There is one mineable seam in the West Roundup LBA Tract (referred to by TCC as the Wyodak); there are two mineable coal seams in the NARO North and NARO South LBA Tracts (referred to by PRCC as the Wyodak-Anderson 1 and 2); three mineable coal seams in the Little Thunder LBA Tract (referred to by TBCC as the Upper, Middle, and Lower Wyodak); and four mineable seams in the West Antelope LBA Tract (referred to by

Figure ES-2

Figure ES-3

Figure ES-4

Figure ES-5

Table ES-1. Summary Comparison of Coal Production, Surface Disturbance, and Mine Life for NARO North and NARO South LBA Tracts and North Antelope/Rochelle Complex.

Item	No Action Alternative (Existing North Antelope/Rochelle Complex)	Added by Proposed Action	Added by Alternative 2	Added by Alternative 3
In-Place Coal (as of 1/1/02)	952 mmt	564 mmt	710 mmt	464.4 mmt
Recoverable Coal (as of 1/1/02) ¹	904.4 mmt	506.9 mmt	613.9 mmt	434.9 mmt
Coal Mined Through 2001	643 mmt	—	—	—
Lease Area ²	14,895.5 ac	4,503.02 ac	5,571.19 ac	3,776.27 ac
Total Area To Be Disturbed ²	20,410 ac	5,590 ac	6,275 ac	4,863 ac
Permit Area ²	27,187 ac	21,035 ac	21,835 ac	21,035 ac
Average Annual Post-2001 Coal Production	75 mmt	15 mmt	15 mmt	15 mmt
Maximum Annual Post-2001 Coal Production (years 2004-2006)	105 mmt	0 mmt	0 mmt	0 mmt
Remaining Life Of Mine (post-2001)	12 yrs	4 yrs	5.5 yrs	3 yrs
Average No. of Employees (at maximum production rate)	1,175	10	10	10
Total Projected State Revenues (post-2001) ³	\$ 994.8 million	\$ 557.6 million	\$ 675.3 million	\$ 478.4 million
Total Projected Federal Revenues (post-2001) ⁴	\$ 745.5 million	\$ 421.8 million	\$ 514.4 million	\$ 359.4 million

¹ Assumes 95 percent recovery of leased coal (with the exception of the NARO South Tract as proposed, which is estimated to be 83 percent recovery of leased coal; the NARO South Alternative 2 Tract, which is estimated to be 79 percent recovery of leased coal; and NARO South Alternative 3 Tract, which is estimated to be 91 percent recovery of leased coal).

² For the Proposed Action and Alternatives 2 and 3, the disturbed acreage exceeds the leased acreage because of the need for highwall reduction, topsoil removal and other activities outside the lease boundaries. When added to the existing mine, the permit area is larger than leased or disturbed areas to assure that all disturbed lands are within the permit boundary and to allow easily defined legal land description. Permit areas under Proposed Action and Alternatives 2 and 3 are the anticipated permit amendment baseline study areas.

³ Projected revenue to the State of Wyoming is \$1.10 per ton of coal sold and includes income from severance tax, property and production taxes, sales and use taxes, and Wyoming's share of federal royalty payments and bonus bids (University of Wyoming 1994).

⁴ Federal revenues are based on \$5.00 per ton price × amount of recoverable coal × federal royalty of 12.5 percent minus State's 50 percent share, plus \$0.35 per ton for AML fees × amount of recoverable coal minus State's 50 percent share, plus \$5.00 per ton price × amount of recoverable coal × black lung tax of 4.0 percent, plus bonus payment on LBA leased coal of \$0.26 per ton (based on average of last 11 LBAs) × amount of in-place coal minus State's 50 percent share.

Table ES-2. Summary Comparison of Coal Production, Surface Disturbance, and Mine Life for Little Thunder LBA Tract and Black Thunder Mine.

Item	No Action Alternative (Existing Black Thunder Mine)	Added by Proposed Action	Added by Alternative 2	Added by Alternative 3 (North Tract)	Added by Alternative 3 (South Tract)
In-Place Coal (as of 1/1/02)	968.7 mmt	479.3 mmt	695.3 mmt	155.7 mmt	539.6 mmt
Recoverable Coal (as of 1/1/02) ¹	920.3 mmt	440 mmt	553 mmt	111.9 mmt	441.1 mmt
Coal Mined Through 2001	699.9 mmt	—	—	—	—
Lease Area ²	12,772.9 ac	3,449.32 ac	5,083.5 ac	1,065.49 ac	4,018.01 ac
Total Area To Be Disturbed ²	18,476 ac	5,424 ac	6,577 ac	1,382 ac	5,195 ac
Permit Area ²	21,238 ac	7,678 ac	7,678 ac	1,612.4 ac	6,065.6 ac
Average Annual Post-2001 Coal Production	38.3 mmt	4.2 mmt	4.2 mmt	4.2 mmt	4.2 mmt
Remaining Life Of Mine (post-2001)	24 yrs	8 yrs	10.7 yrs	0.3 yrs	8 yrs
Average No. of Employees	600	0	0	0	0
Total Projected State Revenues (post-2001) ³	\$ 1,012.3 million	\$ 484.0 million	\$ 608.3 million	\$ 123.1 million	\$ 485.2 million
Total Projected Federal Revenues (post-2001) ⁴	\$ 758.6 million	\$ 364.8 million	\$ 470.6 million	\$ 97.2 million	\$ 373.6 million

¹ Assumes 95 percent recovery of leased coal for the No Action Alternative, 92 percent recovery of leased coal for Proposed Action; 79.5 percent recovery of leased coal for Alternative 2; 71.9 percent recovery of leased coal for Alternative 3, North Tract; and 81.8 percent recovery of leased coal for Alternative 3, South Tract.

² For the Proposed Action and Alternatives 2 and 3, the disturbed acreage exceeds the leased acreage because of the need for highwall reduction, topsoil removal and other activities outside the lease boundaries. When added to the existing mine, the permit area is larger than leased or disturbed areas to assure that all disturbed lands are within the permit boundary and to allow easily defined legal land description. Permit areas under Proposed Action and Alternatives 2 and 3 are the anticipated permit amendment baseline study areas.

³ Projected revenue to the State of Wyoming is \$1.10 per ton of coal sold and includes income from severance tax, property and production taxes, sales and use taxes, and Wyoming's share of federal royalty payments and bonus bids (University of Wyoming 1994).

⁴ Federal revenues are based on \$5.00 per ton price × amount of recoverable coal × federal royalty of 12.5 percent minus State's 50 percent share, plus \$0.35 per ton for AML fees × amount of recoverable coal minus State's 50 percent share, plus \$5.00 per ton price × amount of recoverable coal × black lung tax of 4.0 percent, plus bonus payment on LBA leased coal of \$0.26 per ton (based on average of last 11 LBAs) × amount of in-place coal minus State's 50 percent share.

Executive Summary

Table ES-3. Summary Comparison of Coal Production, Surface Disturbance, and Mine Life for West Roundup LBA Tract and North Rochelle Mine.

Item	No Action Alternative (Existing North Rochelle Mine)	Added by Proposed Action	Added by Alternative 2	Added by Alternative 2 Plus Lease WYW-127221 Modification	Added by Alternative 3	Added by Alternative 3 Plus Lease WYW-127221 Modification
In-Place Coal (as of 1/1/02)	283 mmt	173.2 mmt	224.6 mmt	237.6 mmt	274.2 mmt	287.2 mmt
Recoverable Coal (as of 1/1/02) ¹	255 mmt	155.9 mmt	202.1 mmt	213.8 mmt	246.8 mmt	258.5 mmt
Coal Mined Through 2001	49.3 mmt	—	—	—	—	—
Lease Area ²	3,443.50 ac	1,870.65 ac	2,496.79 ac	2,652.69 ac	2,894.03 ac	3,049.93 ac
Total Area To Be Disturbed ²	5,288 ac	3,161 ac	3,161 ac	3,161 ac	3,591 ac	3,591 ac
Permit Area ²	7,042 ac	3,228.5 ac	3,228.5 ac	3,228.5 ac	3,228.5 ac	3,228.5 ac
Average Annual Post-2001 Coal Production	35 mmt	0 mmt	0 mmt	0 mmt	0 mmt	0 mmt
Remaining Life Of Mine (post-2001)	7.3 yrs	4.5 yrs	5.8 yrs	6.1 yrs	6.7 yrs	7.1 yrs
Average No. of Employees	224	176	176	176	176	176
Total Projected State Revenues (post-2001) ³	\$ 280.5 million	\$ 171.5 million	\$ 222.3 million	\$ 235.2 million	\$ 271.5 million	\$ 284.4 million
Total Projected Federal Revenues (post-2001) ⁴	\$ 212.1 million	\$ 129.7 million	\$ 168.1 million	\$ 177.9 million	\$ 205.3 million	\$ 215.1 million

Executive Summary

- ¹ Assumes 90 percent recovery of leased coal.
- ² For the Proposed Action and Alternatives 2 and 3, the disturbed acreage exceeds the leased acreage because of the need for highwall reduction, topsoil removal and other activities outside the lease boundaries. When added to the existing mine, the permit area is larger than leased or disturbed areas to assure that all disturbed lands are within the permit boundary and to allow easily defined legal land description. Permit areas under Proposed Action and Alternatives 2 and 3 are the anticipated permit amendment baseline study areas.
- ³ Projected revenue to the State of Wyoming is \$1.10 per ton of coal sold and includes income from severance tax, property and production taxes, sales and use taxes, and Wyoming's share of federal royalty payments and bonus bids (University of Wyoming 1994).
- ⁴ Federal revenues are based on \$5.00 per ton price × amount of recoverable coal × federal royalty of 12.5 percent minus State's 50 percent share, plus \$0.35 per ton for AML fees × amount of recoverable coal minus State's 50 percent share, plus \$5.00 per ton price × amount of recoverable coal × black lung tax of 4.0 percent, plus bonus payment on LBA leased coal of \$0.26 per ton (based on average of last 11 LBAs) × amount of in-place coal minus State's 50 percent share.
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Table ES-4. Summary Comparison of Coal Production, Surface Disturbance, and Mine Life for West Antelope LBA Tract and Antelope Mine.

Item	No Action Alternative (Existing Antelope Mine)	Added by Proposed Action	Added by Alternative 2	Added by Alternative 3
In-Place Coal (as of 1/1/02)	553.5 mmt	293.9 mmt	321.8 mmt	202.3 mmt
Mineable Coal (as of 1/1/02)	373.4 mmt	245.6 mmt	273.4 mmt	183.2 mmt
Recoverable Coal (as of 1/1/02) ¹	347.3 mmt	228.4 mmt	254.3 mmt	170.4 mmt
Coal Mined Through 2001	168.7 mmt	—	—	—
Lease Area ²	8,019.2 ac	3,542.19 ac	3,877.90 ac	2,809.13 ac
Total Area To Be Disturbed ²	8,821.1 ac	3,200 ac	3,500 ac	2,467 ac
Permit Area ²	10,848.6 ac	4,328.4 ac	4,328.4 ac	3,448.4 ac
Average Annual Post-2001 Coal Production	13.9 mmt	9.1 mmt	10.2 mmt	6.8 mmt
Remaining Life Of Mine (Post-2001)	25 yrs	0 yr	0 yr	0 yr
Average No. of Employees	215	0	0	0
Total Projected State Revenues (post-2001) ³	\$ 382.0 million	\$ 251.2 million	\$ 279.7 million	\$ 187.4 million
Total Projected Federal Revenues (post-2001) ⁴	\$ 238.8 million	\$ 195.2 million	\$ 216.7 million	\$ 143.4 million

¹ Assumes 93 percent recovery of leased coal remaining after eliminating coal that won't be mined beneath Antelope Creek and adjacent buffer zone.

² For the Proposed Action and Alternatives 2 and 3, the disturbed acreage is less than leased acreage because some of the coal is beneath Antelope Creek and the adjacent buffer zone and would not be mined. When added to the exiting mine, the permit area is larger than leased or disturbed areas to assure that all disturbed lands are within the permit boundary and to allow easily defined legal land description. Permit areas under Proposed Action and Alternatives 2 and 3 are anticipated permit amendment baseline study areas.

³ Projected revenue to the State of Wyoming is \$1.10 per ton of coal sold and includes income from severance tax, property and production taxes, sales and use taxes, and Wyoming's share of federal royalty payments and bonus bids (University of Wyoming 1994).

⁴ Federal revenues are based on \$5.00 per ton price × amount of recoverable coal × federal royalty of 12.5 percent minus State's 50 percent share, plus \$0.35 per ton for AML fees × amount of recoverable coal minus State's 50 percent share, plus \$5.00 per ton price × amount of recoverable coal × black lung tax of 4.0 percent, plus bonus payment on LBA leased coal of \$0.26 per ton (based on average of last 11 LBAs) × amount of in-place coal minus State's 50 percent share.

Figure ES-6

ACC as the Anderson, Lower Anderson, Canyon/Upper Canyon, and Lower Canyon). Average coal thickness on each LBA tract varies from around 67 ft up to around 98 ft, and interburden between the coal seams varies from 0 to around 100 ft. Average overburden on each tract ranges from around 110 ft to more than 300 ft.

The existing topography on each LBA tract that is leased and mined would be substantially changed during mining. A highwall with a vertical height equal to overburden plus coal thickness would exist in the active pits. Following reclamation, the average surface elevation would be lower due to removal of the coal. The reclaimed land surface would approximate premining contours and the basic drainage network would be retained, but the reclaimed surface would contain fewer, gentler topographic features. This could contribute to reduced habitat diversity and wildlife carrying capacity on the LBA tracts after mining and reclamation is completed. These topographic changes would not conflict with regional land use, and the postmining topography would adequately support anticipated land use for each tract.

The geology from the base of the coal to the land surface would be subject to considerable permanent change on each LBA tract that is leased and mined under any of the leasing alternatives. The overburden, interburden, and coal would be removed from each LBA tract. The replaced overburden and interburden would be a relatively homogeneous

mixture compared to the premining layered overburden.

Development of other minerals potentially present on the LBA tracts could not occur during mining, but could occur after mining. Conventional oil and gas wells would have to be plugged and abandoned during mining but could be recompleted after mining if the remaining reserves justify the expense of the recompletion.

CBM development and production are occurring in the Wyoming PRB from coal beds of the Wyodak - Anderson zone. These are the same (or equivalent) seams that are being mined along the eastern margin of the basin, including the mines which are considered in this analysis. CBM wells presently exist or have been proposed in and around the five LBA tracts in the General Analysis Area.

All facilities and equipment associated with oil and gas development (conventional or CBM) that are present on coal leases must be removed prior to mining. Royalties would be lost to both the state and federal governments if conventional oil and gas wells are abandoned prematurely, if federal CBM resources are not recovered prior to mining, or if federal coal resources are not recovered due to conflicts between oil and gas development and coal mining. Mining the coal prior to recovery of all of the CBM resources releases CBM into the atmosphere.

Consequences to soil resources from mining each LBA tract that is leased would include changes in the

physical, biological, and chemical properties. Following reclamation, the soils would be unlike premining soils in texture, structure, color, accumulation of clays, organic matter, microbial populations, and chemical composition. The replaced topsoil would be much more uniform in type, thickness, and texture. It would be adequate in quantity and quality to support planned postmining land uses (i.e., wildlife habitat and rangeland).

For surface coal mining, the major types of emissions that affect air quality occur in the form of fugitive dust and exhaust emissions from large motorized equipment. Activities such as blasting, loading, and hauling of overburden and coal, as well as the large areas of disturbed land, produce particulate emissions. Since 1989, the regulated particulate pollutant in Wyoming has been PM₁₀, which matches federal standards. PM₁₀ is particulate matter with an aerodynamic diameter of 10 microns or less. The previous regulated pollutant was TSP. Figures ES-7 through ES-10 show the results of dispersion modeling of PM-10 that was conducted for each mine to demonstrate that BACT is utilized to control emissions and that the proposed mining activities will not cause or significantly contribute to an exceedance of annual ambient air quality standards. For the results shown in Figures ES-7 through ES-10, the modeled production rates are equal to or greater than the proposed production rates for mining the LBA tracts, if they are leased.

Air quality impacts are monitored to determine if mining operations are meeting annual ambient air quality standards. At the four mines included in this analysis, there are a total of 13 TSP monitoring samplers and 11 PM₁₀ monitoring samplers. As a result of an increase in particulate emissions in 1999 and 2000, all PM₁₀ monitors are required by WDEQ/AQD to sample air quality for a 24-hour period every three days, beginning in 2002. Prior to 2002, each mine sampled air quality for a 24-hour period every six days at multiple monitoring sites. All of the mines are utilizing BACT measures to control particulate emissions and complying with the increased monitoring frequency.

Under Alternative 1, the No Action Alternative, for each of the LBA tracts, the impacts to air quality would be the same as those currently permitted. If the NARO North, NARO South, Little Thunder, West Roundup, and West Antelope LBA Tracts are leased, these moderately adverse, short-term impacts to air quality would be extended onto the newly leased lands during the time they are mined.

The PM₁₀ 24-hour NAAQS has not been exceeded at the North Antelope/Rochelle Complex. If the North Antelope/ Rochelle Complex acquires the NARO North and NARO South LBA Tracts, an increase in emissions is anticipated due to increased average annual production,

Figure ES-7

Figure ES-8

Figure ES-9

Figure ES-10

increased overburden movement, and increased blast frequency.

The PM₁₀ 24-hour NAAQS was not exceeded at the Black Thunder Mine prior to 2002. During 2002 there was one 24-hour exceedance of the PM₁₀ 24-hour NAAQS at one of the Black Thunder Mine's air quality monitoring sites. As a result of the exceedance, the Black Thunder Mine is implementing additional actions including elimination of unnecessary roads, periodic application of magnesium chloride and surfactants to roads, reducing the dump height of the draglines, and increasing efforts for timely reclamation of disturbed areas.

Emissions associated with mining the Little Thunder LBA Tract are expected to increase over those modeled in Black Thunder Mine's current air permit if the tract is leased. Maximum coal production is anticipated to be 68.5 mmtpy with or without the Little Thunder LBA Tract, but production at this rate would occur for a longer time with the LBA tract. Overburden thickness would increase. Black Thunder Mine, in conjunction with WDEQ/AQD, is developing improvements in emission control activities to remedy current elevated levels of emissions. If the mine cannot demonstrate compliance in a permit for the proposed maximum production rate of 100 mmtpy, a lower maximum production rate and/or further expansion of emission control activities at the mine would have to be evaluated for compliance prior to approval of mining operations on the Little Thunder LBA Tract.

The PM₁₀ 24-hour NAAQS was not exceeded at the North Rochelle Mine prior to 2002. During 2001 and early 2002, there were a total of 10 exceedances of the PM₁₀ 24-hour NAAQS at the North Rochelle air quality monitoring sites. Specific measures implemented at the North Rochelle Mine so far as a result include chemical stabilization of disturbed ground, surface roughening through creation of windrows, and mulching and crimping activities. These measures are being implemented on disturbed acres susceptible to wind scouring, including stockpiles, areas stripped for mine advance, and areas being brought to final grade. In addition, the mine is inter-seeding areas where the recent drought has hindered revegetation success.

An increase in emissions is projected if the West Roundup LBA Tract is leased and mined as compared to the currently permitted North Rochelle Mine operation. Coal production is anticipated to be approximately 35 mmtpy, with or without the West Roundup LBA Tract, but production at this rate would occur for a longer time with the LBA tract. Overburden thickness would increase. North Rochelle Mine, in conjunction with WDEQ/AQD, is developing improvements in emission control activities to remedy current elevated levels of emissions. If compliance cannot be demonstrated in a permit for the proposed production rate of 35 mmtpy, a lower annual production rate and/or further expansion of emission control activities at the mine would have to be evaluated for compliance prior to approval of

mining operations on the West Roundup LBA Tract.

The PM₁₀ 24-hour NAAQS has not been exceeded at the Antelope Mine. If the Antelope Mine acquires the West Antelope LBA Tract, the emissions due to coal and overburden removal operations (i.e., haulage, blasting, etc.) at the maximum planned production rate of 32 mmtpy would occur for a longer period of time than is shown in the current approved air quality permit.

Blasting is responsible for another type of emission from surface coal mining. Overburden blasting sometimes produces gaseous orange-colored clouds that contain NO₂. NO₂ is one of several products resulting from the incomplete combustion of the explosives used in the blasting process. There have been no reported events of public exposure to NO₂ from blasting activities at the North Antelope/Rochelle Complex, North Rochelle Mine or Antelope Mine through 2001. There were several reported incidences of public exposure to NO₂ from blasting at the Black Thunder Mine prior to 2001.

These mines have all employed measures to control and/or limit public exposure to intermittent, short-term (blasting) releases. Measures have been implemented at the Black Thunder Mine to control/limit public exposure to intermittent, short-term (blasting) releases, including notification of neighbors and workers in the general area of the mine prior to the blast; timing blast detonation to avoid temperature inversions and minimize

inconvenience to neighbors; monitoring of weather and atmospheric conditions prior to the decision to detonate a blast; posting of signs on major public roads that enter the general mine area and on all locked gates accessing the active mine area; and closing public roads when appropriate to protect the public. No reports of public exposure to NO₂ related to blasting at the Black Thunder Mine have been received since early 2001. According to OSM, no citizen complaints related to any blasting in the Wyoming PRB were received by OSM or WDEQ during the 2001 evaluation year, which ended on September 30, 2001 (OSM 2002).

Changes in runoff characteristics and sediment discharges would occur during mining of each LBA tract, and erosion rates could reach high values on the disturbed areas because of vegetation removal. However, state and federal regulations require that surface runoff from mined lands be treated to meet effluent standards, so sediment would be deposited in ponds or other sediment-control devices at each mine. After mining and reclamation are completed on each tract, surface water flow, quality, and sediment discharge would approximate premining conditions.

Mining the NARO North, NARO South, Little Thunder, West Roundup, and West Antelope LBA Tracts would enlarge the area of lowered groundwater levels in the coal and overburden aquifers associated with the existing mining operations, as well as the area where the existing coal and overburden aquifers would

be removed and replaced by mine backfill. At each mine, drawdown in the adjacent continuous coal aquifer would be expected to increase roughly in proportion to the increase in area affected by mining and would extend farther than drawdown in the discontinuous overburden aquifers. The data available indicate that hydraulic properties of the backfill would be comparable to the premining overburden and coal aquifers. TDS concentration levels of groundwater in the backfill would initially be expected to be higher than in the premining overburden and coal aquifers, but would be expected to meet Wyoming Class III standards for use as stock water.

AVF investigations conducted within the General Analysis Area have identified AVFs that occur along Porcupine Creek, Antelope Creek, Little Thunder Creek, and North Prong Little Thunder Creek downstream of the LBA tracts. Based on preliminary AVF determinations, it is unlikely that any potential AVFs on the NARO North, NARO South, Little Thunder, or West Roundup LBA Tracts meet the criteria to be significant to agriculture. AVFs that are not significant to agriculture can be disturbed during mining but must be restored as part of the reclamation process. A portion of Antelope Creek within the current Antelope Mine permit area has been designated by WDEQ/LQD as “possible subirrigated AVF of minor importance to agriculture”. A portion of this declared AVF is within the West Antelope LBA Tract, however, ACC’s current approved mining and reclamation plan avoids disturbing

Antelope Creek and an adjacent designated buffer zone on existing leases, and ACC does not plan to disturb Antelope Creek and the designated buffer zone if they acquire the West Antelope LBA Tract.

Jurisdictional wetlands have been identified on the NARO North, NARO South, Little Thunder, West Roundup, and West Antelope LBA Tracts. A maximum of 62.16 acres of jurisdictional and 51.58 acres of non-jurisdictional wetlands would be disturbed if all five LBA tracts are leased and subsequently mined. Special permitting procedures are required to assure that, after mining, there will be no net loss of jurisdictional wetlands. In Wyoming, once a wetland delineation is completed and verified by COE, it is made a part of the mine permit document. The reclamation plan is then revised to incorporate restoration of at least equal types and number of jurisdictional wetlands.

Mining would progressively remove the native vegetation on each LBA tract that is leased. Reclamation and revegetation of this land would occur contemporaneously with mining. Re-established vegetation would be dominated by species mandated in the reclamation seed mixtures, which are approved by the WDEQ. The majority of these species would be native to the LBA tracts. Initially, the reclaimed land on each tract would be dominated by grassland vegetation which would be less diverse than the premining vegetation. Estimates for the time it would take to restore sagebrush to premining density levels range from 20 to 100 years. An

indirect impact associated with this vegetative change would potentially be a decreased big game habitat carrying capacity. However, a diverse, productive, and permanent vegetative cover would be established on each LBA tract within about 10 years following reclamation, prior to release of the final reclamation bond. The decrease in plant diversity would not seriously affect the potential productivity of the reclaimed areas, and the proposed postmining land uses (wildlife habitat and rangeland) should be achieved even with the changes in vegetation composition and diversity. The reclamation plans for each LBA tract that is leased would also include steps to control invasion by weedy (invasive, nonnative) plant species. The surface of each LBA tract includes privately owned land, and the private landowners would have the right to manipulate the vegetation on their lands as they desire, once the final reclamation bond is released.

One threatened plant species, Ute ladies'-tresses, has been found on Antelope Creek, in northwestern Converse County. Surveys of potentially suitable habitat were conducted on the NARO North, NARO South, Little Thunder, West Roundup and West Antelope LBA Tracts during times of flowering of the known population. Ute ladies'-tresses orchid individuals were not identified during these surveys.

Site-specific wildlife data for the NARO North, NARO South, Little Thunder, West Roundup and West Antelope LBA Tracts were principally obtained from WDEQ/LQD permit

applications and annual wildlife reports for the applicant mines. Baseline and annual monitoring surveys cover large perimeters around the existing mine permit areas. Consequently, a majority of the LBA tracts have been surveyed during baseline and annual wildlife surveys for Jacobs Ranch Mine, Black Thunder Mine, North Rochelle Mine, Antelope Mine, and the North Antelope/Rochelle Complex. No crucial big game habitat or migration corridors are recognized by the WGFD in the General Analysis Area. In the short term, wildlife would be displaced from the LBA tracts in areas of active mining. Habitat would be disturbed in parcels, with reclamation progressing as new disturbance occurs. In the long term, following reclamation, carrying capacity and habitat diversity may be reduced due to flatter topography, less diverse vegetative cover, and reduction in sagebrush density.

Federally listed T&E wildlife species that may occur in the General Analysis Area include bald eagle (threatened), black-footed ferret (endangered), mountain plover (proposed threatened), and black-tailed prairie dog (candidate). Some wildlife surveys conducted on the NARO North and South, Little Thunder, West Roundup, and West Antelope LBA Tracts have been specifically conducted for T&E species, others did not specifically target T&E species, but habitats for listed species and occurrences of listed species were observed and noted. Bald eagles have been observed in the vicinity of each of the five LBA tracts, and were observed

during recent (2001) wildlife surveys in or around the NARO North, NARO South, and West Antelope LBA Tracts. Bald eagle roosts and unique or concentrated sources of carrion or prey have not been documented in the study areas for any of the LBA tracts. Black-footed ferrets are rare and very unlikely to occur in the vicinity of any of the LBA tracts. They are closely associated with prairie dogs. With the exception of a single skull collected during baseline studies for the Antelope Mine in 1979, no evidence of ferrets has been recorded during surveys in or around the LBA tracts. Mountain plovers may also be associated with prairie dog colonies. There have been no sitings of mountain plover in the vicinity of the West Roundup LBA Tract. There have been sitings of mountain plovers in the vicinity of the NARO North, NARO South, and Little Thunder LBA Tracts, but there were no such sitings during recent (2000-2001) surveys on these tracts. The mountain plover is a regular migrant and summer resident in the vicinity of the Antelope Mine and portions of the West Antelope LBA Tract. There are a number of black-tailed prairie dog colonies located on existing coal leases, on the LBA tracts, or in the vicinity of the LBA tracts.

Active mining would preclude other land uses. Recreational use is severely limited during mining operations. The surface estate of the NARO South and West Antelope LBA Tracts is all privately owned. On private lands, access for recreational use is determined by the landowner. Portions of the surface estate of the NARO North, Little Thunder, and

West Roundup LBA Tracts are part of the TBNG, which is administered by the USFS. Access to these lands would be restricted during mining and reclamation. Energy development in the PRB (primarily coal mining and oil and gas development) has and will continue to contribute to a reduction in hunting opportunities for some animals (pronghorn, mule deer, and sage grouse).

Mining would also impact oil and gas development on both federal and private oil and gas leases, if the federal coal tracts are leased. As discussed above, existing CBM and conventional oil and gas wells would have to be plugged and abandoned, and all facilities and equipment associated with oil and gas development that are present on coal leases would have to be removed prior to mining. New drilling would not be possible in areas of active mining, but could potentially take place in areas not being mined, or in reclaimed areas. CBM that is not recovered prior to mining would be vented and irretrievably lost as the coal is removed.

Cultural resources on the NARO North, NARO South, Little Thunder, West Roundup, and West Antelope LBA Tracts would be impacted by mining, but adverse impacts would be mitigated through data recovery and/or avoidance of significant properties. Formal Wyoming SHPO consultation is required for concurrence with determination of the eligibility of sites for inclusion on the NRHP prior to mining. The eligible cultural properties on each

LBA tract which cannot be avoided or which have not already been subjected to data recovery action would be carried forward in the mining and reclamation plan as requiring protective stipulations until a testing, mitigation, or data recovery program is developed in consultation with the SHPO.

No sites of Native American religious or cultural importance have been identified on the NARO North, NARO South, Little Thunder, West Roundup, or West Antelope LBA Tracts. If such sites or localities are identified at a later date, appropriate action must be taken to address concerns related to those sites.

No unique or significant paleontological resources have been identified on the NARO North, NARO South, Little Thunder, West Roundup, and West Antelope LBA Tracts, and the likelihood of encountering significant paleontological resources is small.

Mining activities at the existing North Antelope/Rochelle Complex, and Black Thunder, North Rochelle, and Antelope Mines are currently visible from State Highway 450, State Highway 59, County Road 37, Antelope Road, Reno Road and Edwards Road. Mining activities on the NARO North, NARO South, Little Thunder, West Roundup, and West Antelope LBA Tracts would also be visible from these roads. No unique visual resources have been identified on or near any of the LBA tracts. The landscape character would not be significantly changed following reclamation.

Noise levels on the NARO North, NARO South, Little Thunder, West Roundup, and West Antelope LBA Tracts would be increased considerably by mining activities such as blasting, loading, and hauling. Because of the remoteness of the LBA tracts and because mining is already ongoing in the area, there would be few new off-site noise impacts. After mining and reclamation are completed, noise would return to premining levels.

No new or reconstructed transportation facilities would be required if the NARO North, NARO South, Little Thunder, West Roundup, and West Antelope LBA Tracts are leased and subsequently mined. Leasing the LBA tracts would extend the length of time that coal is shipped from the permitted North Antelope/Rochelle Complex, Black Thunder Mine, and North Rochelle Mine. Mine life would not be increased for the Antelope Mine, but average productions levels would be higher. Active pipelines and utility lines would have to be relocated in accordance with previous agreements, or agreements would have to be negotiated for their removal or relocation.

Socioeconomic impacts resulting from the leasing and subsequent mining of the NARO North, NARO South, Little Thunder, West Roundup, and West Antelope LBA Tracts would include an increase in federal, state, and local revenues as a result of the coal bonus and royalty payments as well as severance and property taxes.

Royalty and bonus payments for the federal coal in the LBA tracts would be split with the state. If the five LBA tracts are leased and mined as proposed, cumulative federal revenues would be about \$1.1 billion, assuming a coal bonus of 26 cents per ton (the average of bonus payments for past coal lease sales in the Wyoming PRB) and a coal price of \$5.00 per ton.

A 1994 University of Wyoming study estimated that the total direct fiscal benefit to the State of Wyoming from coal mining taxes and royalties is \$1.10 per ton of coal mined. Using that estimate, if the five LBA tracts are leased and mined as proposed, cumulative state revenues would be about \$1.5 billion.

Mine life would be extended and employment would be increased or maintained at the North Antelope/Rochelle Complex, Black Thunder Mine, and North Rochelle Mine. Mine life and employment would be stable at the Antelope Mine, but maximum production levels would be extended. Economic stability would be maintained in the communities in this area without placing major additional demands on the existing infrastructure or services.

With regard to Environmental Justice issues, it was determined that potentially adverse impacts would not disproportionately affect minorities, low-income groups, or Native American tribes or groups. No tribal lands or Native American communities are included in the General Analysis Area, and no Native American treaty rights or Native

American trust resources are known to exist for this area.

Under the No Action Alternative, the impacts described in the preceding paragraphs to topography and physiology, geology and minerals, soils, air quality, water resources, AVFs, wetlands, vegetation, wildlife, threatened, endangered, proposed, and candidate species, USFS sensitive species, land use and recreation, cultural resources, Native American concerns, paleontological resources, visual resources, noise, transportation, and socioeconomics would occur on the existing North Antelope/Rochelle Complex, Black Thunder Mine, North Rochelle Mine, and Antelope Mine coal leases, but these impacts would not be extended onto the LBA tracts. Portions of the LBA tracts adjacent to the existing applicant mines would be disturbed to recover the coal in the existing leases.

If impacts are identified during the leasing process that are not mitigated by existing required mitigation measures, BLM can include additional mitigation measures, in the form of stipulations on new leases, within the limits of its regulatory authority. BLM has not identified additional special stipulations that should be added if the NARO North, NARO South, Little Thunder, West Roundup, or West Antelope LBA Tracts are leased, or areas where additional or increased monitoring measures are recommended.

Cumulative impacts result from the incremental impacts of an action added to other past, present, and

reasonably foreseeable future actions, regardless of who is responsible for such actions. Cumulative impacts can result from individually minor, but collectively significant, actions occurring over time.

Since decertification of the Powder River Federal Coal Region in 1990, the BLM Wyoming State Office has issued 11 new federal coal leases containing approximately 3.2 billion tons of coal using the LBA process. This leasing process has undergone the scrutiny of two appeals to the Interior Board of Land Appeals and one audit by the General Accounting Office.

Applications have been received for nine additional federal coal tracts, including the applications for the NARO North, NARO South, Little Thunder, West Roundup, and West Antelope LBA Tracts. These pending LBA applications contain approximately 2.3 billion tons of coal. All of the pending applications have been reviewed and recommended for processing by the PRRCT.

Four regional EISs evaluating coal development in the PRB in Wyoming have previously been prepared. They are:

Final Environmental Impact Statement, Eastern Powder River Coal Basin of Wyoming, BLM, October 1974;

Final Environmental Impact Statement, Eastern Powder River Coal, BLM, March 1979;

Final Environmental Impact Statement, Powder River Coal Region, BLM, December 1981;

Draft Environmental Impact Statement, Round II Coal Lease Sale, Powder River Region, BLM, January 1984.

Since 1989, coal production in the PRB has increased by approximately 6.8 percent per year. The increasing state production is primarily due to increasing sales of low-sulfur, low-cost PRB coal to electric utilities who must comply with Phase I requirements of Title III of the 1990 Clean Air Act Amendments. Electric utilities account for 97 percent of Wyoming's coal sales.

Oil production has decreased in the Wyoming PRB since 1990, but natural gas production has been increasing, particularly in Campbell County. This is due to the development of shallow CBM resources west of the coal mines. CBM exploration and production are currently ongoing throughout the Wyoming PRB. Since the early 1990s, BLM has completed numerous EAs and EISs analyzing CBM projects. The latest of these is the *Draft Environmental Impact Statement and Draft Planning Amendment for the Powder River Basin Oil and Gas Project*, which was completed in January 2002. The project area for this EIS includes almost eight million acres of mixed federal, state, and private lands within the Wyoming portion of the PRB. The EIS is evaluating the impacts of drilling, completing, operating, and reclaiming almost 39,400 new federal, state, and private CBM wells in addition to the

roughly 12,100 federal, state, and private CBM wells already drilled or permitted within the project area. The draft EIS also analyzes the impacts of developing 3,200 new conventional oil and gas wells, as well as constructing, operating, and reclaiming various ancillary facilities needed to support the new CBM and conventional wells, including roads, pipelines for gathering gas and produced water, electrical utilities, and compressors (BLM 2002a). A final EIS is in preparation. Under the current process for approving CBM drilling, CBM wells can be drilled on private and state oil and gas leases after approval by the WOGCC and the Wyoming SEO. On federal oil and gas leases, BLM must analyze the individual and cumulative environmental impacts of all drilling, as required by NEPA, before CBM drilling can be authorized.

CBM wells have been drilled in or around the NARO North, NARO South, Little Thunder, West Roundup, and West Antelope LBA Tracts. CBM drilling and production are expected to continue in the areas around the coal mines and on the LBAs. Due to the proximity of the coal mining and CBM production operations, cumulative impacts to groundwater, surface water, air quality, and wildlife have occurred and are likely to continue as more CBM resources are developed adjacent to existing surface coal mines.

Other minerals or materials that are produced in the Wyoming PRB include uranium, bentonite, and scoria. Other mineral development

levels in the Wyoming PRB are currently lower than predicted in the regional EISs.

In addition to the ongoing coal mining and leasing and the CBM development, there are other projects which are in progress or have been proposed in the Wyoming PRB. These projects include the Wygen I 90-Mw coal-fired power plant currently under construction by Black Hills Energy, Inc. near the Wyodak Mine east of Gillette; the Two Elk 300-Mw coal-fired power plant proposed for construction by NAPG east of the Black Thunder Mine; the Wygen II 500-Mw coal-fired power plant that would be built near Wyodak Mine east of Gillette by Black Hills Energy, Inc.; the proposed DM&E rail line; the Two Elk Unit Two 500-Mw coal-fired power plant, which NAPG also proposes to build east of the Black Thunder Mine; construction and operation by NAPG of another 500-Mw coal-fired power plant, the Middle Bear facility, near the Cordero-Rajo Mining Complex; and the ENCOAL coal enhancement facility, which was proposed for construction at the North Rochelle Mine but has been indefinitely delayed.

The existing development in the PRB has resulted in the introduction of roads, railroads, power lines, fences, mine structures, and oil and gas production equipment, and this will continue as development in the PRB continues. This area has already undergone change from a semi-agricultural-based economy to a coal mining and oil and gas economy. Environmentally, the open, basically treeless landscape has been visibly

altered by construction, equipment, and human activities. Leasing the NARO North, NARO South, Little Thunder, West Roundup, and West Antelope LBA Tracts would increase the total area that would be affected by mining but would not cause a significant cumulative change in daily impacts because they would be extensions of ongoing operations at existing mines and mining disturbance is progressive with reclamation proceeding contemporaneously. Cumulative impacts vary by resource and range from being almost undetectable to being substantial. Cumulative impacts on air quality, groundwater quantity and quality, and wildlife habitat have created the greatest concern.

An air quality impact assessment predicting potential far-field cumulative air quality impacts, using the EPA CALMET/CALPUFF dispersion modeling system, has been prepared to predict maximum potential air quality impacts at mandatory federal PSD Class I areas downwind of proposed oil and gas development in the PRB in northeast Wyoming and southeast Montana.

The assessment considered potential air pollutant emission sources from proposed CBM development in Wyoming and Montana combined with other reasonably foreseeable development (RFD) emission sources to predict the total potential cumulative impact to air quality. Surface coal mining operations in Montana and Wyoming were included as other RFD emission sources in this assessment.

The cumulative far-field impacts predicted in this air quality impact assessment would be the same under the Proposed Action and all of the Alternatives for leasing or not leasing federal coal considered in this EIS because the NARO North, NARO South, Little Thunder, West Roundup, and West Antelope LBA Tracts are all maintenance tracts, which would be leased to extend operations at existing mines. Selection of any of the leasing alternatives considered in this EIS would not introduce new sources of impacts to air quality, but would change the location of the sources of those impacts to the newly leased tracts and would extend the period of time that those existing sources would be in operation. Selection of any or all of the No-Action alternatives (Alternative 1) considered in this EIS (not leasing the coal included in one or more of the LBA tracts) would not affect any of the currently approved mining operations on existing leases.

Coal mines develop predictive models to assess the potential air quality impacts of their mining operations. The predictive modeling conducted for PRB mines indicates that mining operations do not have significant off-site particulate pollution impacts, even when production and pollution from neighboring mines are considered. This modeling is based on the assumption that mining activities are sufficiently removed from the permit boundaries and that neighboring mines are not actively mining in the immediate vicinity (within 0.6 to 2.5 miles). In cases where mines are in close proximity (within two miles), WDEQ/AQD

follows a modeling protocol which accounts for all mine-generated particulate air pollutants from all nearby mines to determine impacts to ambient air quality. Examples of the impacts predicted by these models are shown in Figures ES-7 through ES-10.

Figure ES-11 shows modeled and extrapolated worst-case coal aquifer drawdown as a result of surface coal mining at the mines located south and east of Wright, Wyoming, if the NARO North, NARO South, Little Thunder, West Roundup, and West Antelope LBA Tracts are leased. Currently, coal drawdowns from the Jacobs Ranch, Black Thunder, and North Rochelle Mines have coalesced, and drawdowns from the North Antelope/Rochelle Complex and Antelope Mine have coalesced. The areas of drawdown from the five southern mines will coalesce in the future with or without the addition of mining activity on the five LBA tracts considered in this EIS. Dewatering activities associated with reasonably foreseeable CBM development would be expected to overlap with and expand the area of groundwater drawdown in the coal aquifer in the PRB. Monitoring of backfill areas indicates that reclaimed areas are being recharged with water generally suitable for livestock use (the premining use).

Wildlife habitat quality has declined in the PRB due to a continuing trend of landscape fragmentation from roads, rail lines, oil and gas wells, coal mines, and fences. Mining of the NARO North, NARO South, Little Thunder, West Roundup, and West

Antelope LBA Tracts would add to this habitat fragmentation. Wildlife monitoring indicates that wildlife use reclaimed areas.

This EIS presents the BLM's analysis of environmental impacts under authority of the NEPA and associated rules and guidelines. The BLM will use this analysis to make separate decisions to lease or not lease the federal coal included in the NARO North, NARO South, Little Thunder, West Roundup, and West Antelope LBA Tracts. A decision to hold a competitive sale and issue a lease for the lands in any of these applications is a prerequisite for mining, but it is not the enabling action that would allow mining to begin. The BLM does not authorize mining operations by issuing a lease. After a lease has been issued, but prior to mine development, the lessee must file a permit application package with the WDEQ/LQD and OSM for a surface

Figure ES-11

mining permit and approval of the MLA mining plan. An analysis of a detailed site-specific mining and reclamation plan occurs at that time.

DRAFT

**ENVIRONMENTAL IMPACT STATEMENT FOR THE
SOUTH POWDER RIVER BASIN COAL LEASE APPLICATIONS
(FEDERAL COAL LEASE APPLICATION WYW 127221)**

Prepared for

**U.S. Department of the Interior
Bureau of Land Management
Casper Field Office
Casper, Wyoming**

and

Cooperating Agency

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Abbreviations and Acronyms Used in this Report

ACC	Antelope Coal Company
ALC	Ark Land Company
ANC	acidification neutralization capacity
ac-ft	acre-foot, acre-feet
ac-ft/yr	acre-foot per year, acre-feet per year
AML	Abandoned Mine Land
AQRV	air quality related values
ARCO	Atlantic Richfield Company
AREV	SEO water rights database and program
AVF	alluvial valley floor
BACT	best available control technology
bcy	bank cubic yards
BLM	Bureau of Land Management
BN-UP, BN&UP	Burlington Northern-Union Pacific
B.P.	before present
Btu	British thermal units
Btu/lb	British thermal units per pound
CAA	Clean Air Act
CBM	coal bed methane
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	Code of Federal Regulations
cfs	cubic feet per second
CHIA	Cumulative Hydrologic Impact Assessment
CO	carbon monoxide
COE	U.S. Army Corps of Engineers
CREG	Consensus Revenue Estimating Group
cy	cubic yards
dBA	A-weighted decibels
DEIS	Draft Environmental Impact Statement
DM&E	Dakota, Minnesota & Eastern Railroad Corporation
DOI	Department of the Interior
dv	deciview, a measure of view impairment
EA	Environmental Assessment
EC	elemental carbon particles (re: air quality)
EIS	Environmental Impact Statement
ENCOAL	Encoal Corporation
EPA	Environmental Protection Agency
F	Fahrenheit
FCLAA	Federal Coal Leasing Act Amendments of 1976
FDM	Fugitive Dust Model
FEA	Final Environmental Assessment
FEIS	Final Environmental Impact Statement
FLM	Federal Land Management
FLPMA	Federal Land Policy Management Act of 1976
FR	Federal Register
ft	feet, foot
ft/day	feet per day
ft/mile	feet per mile

Abbreviations and Acronyms Used in this Report

g	gram
GAGMO	Gillette Area Ground Water Monitoring Organization
GDP	Gross Domestic Product
gpm	gallons per minute
GSP	Gross State Product
HAP	Hazardous Air Pollutant
hp	horsepower
hr	hour
IBLA	Interior Board of Land Appeals
IMPROVE	Interagency Monitoring of Protected Environments
IWAQM	Interagency Workgroup on Air Quality Monitoring
JRCC	Jacobs Ranch Coal Company
Km	kilometers
KMCC	Kerr-McGee Coal Corporation
Kv	kilovolts
LAC	limits of acceptable change (re: air quality)
LBA	lease by application
lbs/mmBtu	pounds per million British thermal units
LFC	Liquids From Coal
LOP	Life of Project
LRMP	Land and Resource Management Plan
LW	Lower Wyodak coal seam
MBHFI	migratory birds of high federal interest
µeq/L	microequivalents per liter
µg/m ³	micrograms per cubic meter
µmhos/cm	micromhos per centimeter
MCF	thousand cubic feet
MEI	maximally exposed individual
mg/L	milligrams per liter
MLA	Mineral Leasing Act of 1920
MLE	most likely exposure
mm	million
mmbcy	million bank cubic yards
mmt	million tons
mmtpy	million tons per year
mph	miles per hour
MW	Middle Wyodak coal seam
Mw	megawatts
NAAQS	National Ambient Air Quality Standards
NADP	National Atmospheric Deposition Program
NAPG	North American Power Group
NEPA	National Environmental Policy Act of 1969
NO	nitrogen oxide
NO ₂	nitrogen dioxide
NO _x	nitrogen oxides
NPS	National Park Service
NRCS	National Resource Conservation Service
NRHP	National Register of Historic Places
NWI	National Wetlands Inventory

Abbreviations and Acronyms Used in this Report

O ₃	photochemical oxidants
OC	organic carbon particles
OSM	Office of Surface Mining Reclamation & Enforcement
PECS	passive enclosure control systems
P.M.	Prime Meridian
PM _{2.5}	particulates finer than 2.5 microns in effective diameter
PM ₁₀	particulates finer than 10 microns in effective diameter
PMT	postmining topography
PP&L	Pacific Power and Light Company
PRB	Powder River Basin
PRBRC	Powder River Basin Resource Council
PRCC	Powder River Coal Company
PRRCT	Powder River Regional Coal Team
PSD	prevention of significant deterioration
R2P2	Resource Recovery and Protection Plan
RH	relative humidity
RMP	Resource Management Plan
ROD	Record of Decision
ROW	Right-of-Way
SARA	Superfund Amendment & Reauthorization Act of 1986
SEO	State Engineer's Office
scf/ton	standard cubic feet per ton
SHPO	State Historic Preservation Office
SLAMS	State and Local Air Monitoring Stations
SMCRA	Surface Mining Control and Reclamation Act of 1977
SO ₂	sulfur dioxide
SPRB	South Powder River Basin
T&E	threatened and endangered
TBCC	Thunder Basin Coal Company, LLC
TBNG	Thunder Basin National Grassland
TCC	Triton Coal Company, LLC
TDS	total dissolved solids
TSP	total suspended particulates
U.S.	United States
USC, U.S.C.	United States Code
USDA	U.S. Department of Agriculture
USDI	U.S. Department of the Interior
USFS	U.S. Forest Service
USGS	U.S. Geological Survey
USFWS	U.S. Fish and Wildlife Service
UW	Upper Wyodak coal seam
VMT	vehicle miles traveled
VOCs	volatile organic compounds
VRM	visual resource management
WAAQS	Wyoming Ambient Air Quality Standards
WARMS	Wyoming Air Resources Monitoring System
WCIC	Wyoming Coal Information Committee
WDEQ	Wyoming Department of Environmental Quality
WDEQ/AQD	Wyoming Department of Environmental Quality/Air Quality Division

Abbreviations and Acronyms Used in this Report

WDEQ/LQD	Wyoming Department of Environmental Quality/Land Quality Division
WGFD	Wyoming Game and Fish Department
WMA	Wyoming Mining Association
WOC	Wyoming Outdoor Council
WOGCC	Wyoming Oil and Gas Conservation Commission
WSBLC	Wyoming State Board of Land Commissioners
WSGS	Wyoming State Geological Survey
WSO-RMG	Wyoming State Office Reservoir Management Group

1.0 INTRODUCTION

This EIS¹ analyzes the environmental impacts of leasing five tracts of federal coal reserves adjacent to operating mines in the southern PRB. Operators of four mines, North Antelope/Rochelle Complex, Black Thunder, North Rochelle, and Antelope, filed four applications to lease five tracts of federal coal as maintenance tracts under the regulations at 43 CFR 3425, Leasing On Application. All four applications have been reviewed by BLM, Wyoming State Office, Division of Minerals and Lands Authorization. That office determined that all four lease applications met the regulatory requirements for lease by applications, or LBAs. The five LBA tracts considered in this EIS and the adjacent mines are shown in Figure 1-1. They are the NARO North and NARO South LBA Tracts, adjacent to the North Antelope/Rochelle Complex; the Little Thunder LBA Tract, adjacent to the Black Thunder Mine; the West Roundup LBA Tract, adjacent to the North Rochelle Mine; and the West Antelope LBA Tract, adjacent to the Antelope Mine. The applications are summarized below.

On March 10, 2000, PRCC filed an application with the BLM for federal coal reserves in two separate tracts located north and south of and immediately adjacent to the North Antelope/Rochelle Complex. The tracts are referred to as the NARO North and NARO South LBA Tracts.

The NARO North Tract is located in southern Campbell County, Wyoming, approximately 13 miles southeast of Wright, Wyoming. The NARO South Tract is located in southern Campbell County and northern Converse County, Wyoming, approximately 19 miles southeast of Wright, Wyoming (Figure 1-1). The federal coal reserves were applied for as maintenance tracts for the North Antelope/Rochelle Complex. BLM determined that the two tracts in the application would be processed separately and, if the decision is made to conduct a lease sale, would be offered for sale separately. The North Antelope/Rochelle Complex is operated by PRCC, a subsidiary of the Peabody Holding Company, Inc. PRCC's coal lease application was assigned case file numbers WYW150210 (NARO North) and WYW154001 (NARO South).

On March 23, 2000, ALC filed an application with the BLM for federal coal reserves in a tract located west of and immediately adjacent to the Black Thunder Mine. ALC is a wholly owned subsidiary of Arch Coal, Inc. The Black Thunder Mine is operated by TBCC, a subsidiary of Arch Western Resources, LLC. In this EIS, ALC is referred to as the applicant and TBCC is referred to in discussions of mine operations. The tract is referred to as the Little Thunder LBA Tract. The application area is located in southern Campbell County, Wyoming, approximately six miles east-southeast of Wright, Wyoming (Figure 1-1). The federal coal reserves were applied for as a

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

Figure 1-1

maintenance tract for the Black Thunder Mine. ALC's coal lease application was assigned case file number WYW150318.

On July 28, 2000, TCC filed an application with the BLM for federal coal reserves in a tract located west of and immediately adjacent to the North Rochelle Mine. The application area is located in southern Campbell County, Wyoming, approximately 10 miles southeast of Wright, Wyoming (Figure 1-1). The tract is referred to as the West Roundup LBA Tract. The federal coal reserves were applied for as a maintenance tract for the North Rochelle Mine. The North Rochelle Mine is operated by TCC, a subsidiary of Vulcan Intermediary, LLC. TCC's coal lease application was assigned case file number WYW151134.

On September 12, 2000, ACC filed an application with the BLM for federal coal reserves in a tract located west of and immediately adjacent to the Antelope Mine. The tract is referred to as the West Antelope LBA Tract. The application area is located in southern Campbell County and northern Converse County, Wyoming, approximately 19 miles south-southeast of Wright, Wyoming (Figure 1-1). The federal coal reserves were applied for as a maintenance tract for the Antelope Mine. The Antelope Mine is operated by ACC, a subsidiary of Kennecott Energy Company. ACC's coal lease application was assigned case file number WYW151643.

These federal coal lands are located within the Powder River Federal Coal Region, which was decertified in

January 1990. Although the Powder River Federal Coal Region is decertified, the PRRCT, a federal/state advisory board established to develop recommendations concerning management of federal coal in the region, has continued to meet regularly and review all federal lease applications in the region. The PRRCT reviewed these four maintenance coal lease applications at a public meeting held on October 25, 2000, in Cheyenne, Wyoming. The PRRCT recommended that the BLM continue to process all four lease applications at that meeting.

On June 14, 2001, ALC filed an application with the BLM to modify the Little Thunder LBA Tract configuration to increase the lease area and coal volume. BLM reviewed the modified tract configuration and notified the company by letter dated July 20, 2001 that their application had been modified.

On June 27, 2001, ACC filed an application with the BLM to modify the West Antelope LBA Tract configuration to increase the lease area and coal volume. BLM reviewed the modified tract configuration and notified the company by letter dated July 18, 2001 that their application had been modified.

In order to process an LBA, the BLM must evaluate the quantity, quality, maximum economic recovery, and fair market value of the federal coal and fulfill the requirements of NEPA by evaluating the environmental impacts of leasing the federal coal. BLM does not authorize mining by issuing a lease for federal coal, but the impacts

of mining the coal are considered in this EIS because it is a logical consequence of issuing a lease. The BLM determined that one EIS would be prepared to evaluate the environmental impacts of coal mining that would result from the issuance of these five leases. This EIS has been prepared to evaluate the site-specific and cumulative environmental impacts of leasing and developing the federal coal included in these application areas. Scoping for these lease applications was conducted from October 1 to October 31, 2001. A Notice of Scoping and Notice of Intent to Prepare an EIS was published in the *Federal Register* on October 3, 2001 and in the Gillette News-Record on September 25, 2001 and October 2, 2001. A public scoping meeting was held in Gillette, Wyoming on October 10, 2001.

BLM will use the analysis in this EIS to make a decision on whether or not to hold a public, competitive, sealed-bid coal lease sale for each of the five coal tracts and issue federal coal leases. A separate Record of Decision will be issued for each tract and a separate sale will be held for each tract that the BLM decision maker approves for leasing. For each lease sale that is held, the bidding will be open to any qualified bidder; bidding will not be not limited to the applicants. For each lease sale that is held, a lease will be issued to the highest bidder if a federal sale panel determines that the high bid at that sale meets or exceeds the fair market value of the coal as determined by BLM's economic evaluation and if the U.S. Department of Justice determines that there would be no

antitrust violations if a lease is issued to the high bidder at that sale.

Since decertification of the Powder River Federal Coal Region, 11 federal coal leases have been sold at competitive sealed-bid sales and one federal coal lease has been exchanged in the Wyoming portion of the Powder River Federal Coal Region (Table 1-1). One tract (the Belle Ayr 2000 LBA Tract) was offered for sale, but the bid received was rejected. The Belle Ayr 2000 Tract is now included in the Belle Ayr LBA Tract shown in Figure 1-1. All of the mines with applications being considered in this EIS have been issued maintenance leases since decertification (Table 1-1 and Figure 1-1).

Table 1-2 summarizes the applications that are currently pending. One application, the Little Thunder Extension LBA Tract, has been withdrawn by the applicant, Kennecott Energy Company. A coal exchange proposed by Pittsburg and Midway Coal Mining Company is also currently being evaluated. As proposed, federal coal in Sheridan County, Wyoming would be exchanged for privately owned lands and minerals in Lincoln, Carbon, and Sheridan Counties, Wyoming.

Other agencies may use this analysis to make decisions related to leasing and mining the federal coal in these tracts. OSM, the federal agency responsible for regulating surface coal mining operations, is a cooperating

Table 1-1. Leases Issued Since Decertification, Powder River Basin, Wyoming.

LBA/Exchange Name (Lease #) Lessee Effective Date	Acres¹	Mineable Tons of Coal¹	Successful Bid
Jacobs Ranch LBA (WYW117924) Jacobs Ranch Mine 10/1/1992	1,708.620	147,423,560	\$20,114,930.00
West Black Thunder LBA (WYW118907) Black Thunder Mine 10/1/1992	3,492.495	429,048,216	\$71,909,282.69
North Antelope/Rochelle LBA (WYW119554) N. Antelope/Rochelle Complex 10/1/1992	3,064.040	403,500,000	\$86,987,765.00
West Rocky Butte LBA (WYW122586) No Existing Mine ² 1/1/1993	463.205	56,700,000	\$16,500,000.00
Eagle Butte LBA (WYW124783) Eagle Butte Mine 8/1/1995	1,059.175	166,400,000	\$18,470,400.00
Antelope LBA (WYW128322) Antelope Mine 2/1/1997	617.200	60,364,000	\$9,054,600.00
North Rochelle LBA (WYW127221) North Rochelle Mine 1/1/1998	1,481.930	157,610,000	\$30,576,340.00
Powder River LBA (WYW136142) N. Antelope/Rochelle Complex 9/1/1998	4,224.225	532,000,000	\$109,596,500.00
Thundercloud LBA (WYW136458) Black Thunder Mine 1/1/1999	3,545.503	412,000,000	\$158,000,008.50
EOG (Belco) I-90 Lease Exchange (WYW150152) EOG (formerly Belco) 4/1/2000	599.170	106,000,000	Exchanged for rights to Belco I-90 Lease (WYW0322794)
Horse Creek LBA (WYW141435) Antelope Mine 12/1/2000	2,818.695	275,577,000	\$91,220,120.70
North Jacobs Ranch LBA (WYW146744) Jacobs Ranch Mine 5/1/2002	4,982.939	537,500,000	\$379,504,652.00
TOTALS	28,057.197	3,284,122,776	\$991,934,598.89

¹ Information from Sale Notice.² The West Rocky Butte Lease is now owned by the Caballo Mine.

Table 1-2. Pending LBAs, Powder River Basin, Wyoming.

LBA Lease # Applicant Mine	Application Date	Acres	Estimated Tons of Coal¹ (mmt)	Status
NARO North WYW150210 North Antelope/ Rochelle	3/10/00	2,369.380	323.0	PRRCT reviewed on 10/25/00
NARO South WYW154001 North Antelope/ Rochelle	3/10/00	2,133.635	241.0	PRRCT reviewed on 10/25/00
Little Thunder WYW150318 Black Thunder	3/23/00	3,449.317	479.3	PRRCT reviewed on 10/25/00
West Roundup WYW151134 North Rochelle	7/28/00	1,870.638	173.2	PRRCT reviewed on 10/25/00
West Hay Creek WYW151634 Buckskin	8/31/00	838.098	130.0	PRRCT reviewed on 10/25/00
West Antelope WYW151643 Antelope	9/12/00	3,542.190	293.9	PRRCT reviewed on 10/25/00
Little Thunder Expansion² WYW154429 Jacobs Ranch	9/14/01	0.000	0.0	Withdrawn by applicant 4/12/2002
Maysdorf (formerly Mt. Logan) WYW154432 Cordero-Rojo	9/20/01	2,809.480	296.3	PRRCT reviewed 5/30/2002
West Extension WYW155132 Eagle Butte	12/28/01	1,642.590	200.0	PRRCT reviewed 5/30/2002
Belle Ayr WYW141568 Belle Ayr	3/20/97	1,578.760	200.0	PRRCT reviewed 4/23/97, 10/27/99, & 5/30/2002
TOTALS		20,234.088	2,336.7	

¹ Estimated tons of in-place coal as reported in the lease application.

² This application overlapped and expanded the Little Thunder LBA Tract.

agency on this EIS. OSM will use this EIS to make decisions related to the approval of the MLA mining plans for these tracts, if any or all of these leases are issued. The USFS is also a cooperating agency in the preparation of this EIS, because the surface of some of the land included for consideration for leasing in three of the tracts is owned by the Federal government and administered by the USFS as part of the TBNG.

NARO North and NARO South LBA Tracts

The NARO North and NARO South LBA Tracts as applied for and the existing federal coal leases in the adjacent North Antelope/Rochelle Complex are shown in Figure 1-2. As applied for, the NARO North LBA Tract includes approximately 2,369.4 acres and an estimated 323 million tons of in-place coal reserves. PRCC estimates that approximately 306.9 million tons of coal will be produced from the NARO North LBA Tract as applied for, assuming a recovery factor of 95 percent. As applied for, the NARO South LBA Tract includes approximately 2,133.6 acres and an estimated 241 million tons of in-place coal reserves. Not all of the coal included in the NARO South LBA Tract is mineable, however. For example, some of the coal included in the South Tract is located within the BNSF & UP railroad ROW. This coal will not be mined because it has been determined to be unsuitable for mining according to the coal leasing unsuitability criteria (43 CFR 3461), but it was included in the tract to allow maximum recovery of all the mineable coal adjacent to the ROW.

PRCC estimates that approximately 10 million tons of coal are within the ROW, and an additional 20 million tons of coal are in partially burned areas that are therefore not recoverable. The fact that the coal within the ROW and partially burned area cannot all be recovered will be considered by BLM in the fair market value determination for the LBA tract. PRCC estimates that approximately 200 million tons of coal will be produced from the NARO South LBA Tract as applied for.

The NARO North LBA Tract is contiguous with the North Antelope/Rochelle Complex and the NARO South LBA Tract is contiguous with both the North Antelope/Rochelle Complex and the Antelope Mine, which is operated by ACC. Portions of both tracts lie within the North Antelope/Rochelle Complex's current mining permit boundary (Figure 1-2). The area applied for is substantially similar to the adjacent mines for which detailed site-specific environmental data have been collected and for which environmental analyses have previously been prepared to secure the existing leases and the necessary mining permits.

The surface of the NARO North LBA Tract is owned by the United States of America and PRCC. The federally owned surface is part of the TBNG, administered by the USFS. The surface of the NARO South LBA Tract is owned by PRCC, the Bridle Bit Ranch Company, and the Dilts brothers (John, Jerry, and Steve).

Figure 1-2

Current land uses of the tracts include grazing by domestic animals and wildlife, oil and gas production, and recreation.

If PRCC acquires federal coal leases for the NARO North and NARO South LBA Tracts, the coal resources would be mined to extend the life of the North Antelope/Rochelle Complex. The mining method would be a combination of truck and shovel and dragline, which are the mining methods currently in use at this mine. The coal would be used primarily for electric power generation.

After mining, the land would be reclaimed for livestock grazing and wildlife use as is the current practice at the North Antelope/Rochelle Complex.

Little Thunder LBA Tract

The Little Thunder LBA Tract as applied for and the existing federal coal leases in the adjacent Black Thunder Mine are shown in Figure 1-3. As applied for, the Little Thunder LBA Tract includes approximately 3,449.3 acres and an estimated 479.3 million tons of in-place coal reserves. Not all of the coal included in the tract is mineable, however. For example, some of the coal included in the tract is located within the BNSF & UP railroad and Wyoming Highway 450 ROWs. This coal will not be mined because it has been determined to be unsuitable for mining according to the coal leasing unsuitability criteria (43 CFR 3461), but it was included in the tract to allow maximum recovery of all the

mineable coal adjacent to the ROWs. The fact that the coal within the ROWs cannot all be recovered will be considered by the BLM in the fair market value determination for the LBA tract. TBCC estimates that approximately 440 million tons of coal will be produced from the Little Thunder LBA Tract as applied for.

The Little Thunder LBA Tract is contiguous with the Black Thunder Mine. A portion of the tract lies within the Black Thunder Mine's current mining permit boundary (Figure 1-3). The area applied for is substantially similar to the adjacent mine for which detailed site-specific environmental data have been collected and for which environmental analyses have previously been prepared to secure the existing leases and the necessary mining permit.

The surface of the Little Thunder LBA Tract is owned by ALC (a wholly owned subsidiary of Arch Coal, Inc.), the Naomi M. Hopkins Trust, TBCC, and the United States of America. The federally owned surface is part of the TBNG, administered by the USFS. Current land uses of the tract include grazing by domestic animals and wildlife, oil and gas production, and recreation.

If ALC acquires a federal coal lease for these lands, the Little Thunder LBA Tract coal resources would be mined to extend the life of the Black Thunder Mine. The mining method would be a combination of truck and shovel and dragline, which are the mining methods currently in use at

Figure 1-3

this mine. The coal would be used primarily for electric power generation.

After mining, the land would be reclaimed for livestock grazing and wildlife use as is the current practice at the Black Thunder Mine.

West Roundup LBA Tract

The West Roundup LBA Tract as applied for and the existing federal coal leases in the adjacent North Rochelle Mine are shown in Figure 1-4. As applied for, the West Roundup LBA Tract consists of two tracts separated by the North Rochelle Mine railroad spur and facilities and a county road (Reno Road). The two tracts include approximately 1,870.7 acres and an estimated 173.2 million tons of in-place coal reserves. TCC estimates that approximately 155.9 million tons of coal will be produced from the West Roundup LBA Tract as applied for assuming a recovery factor of 90 percent.

The West Roundup LBA Tract is contiguous with both the North Rochelle Mine and the Black Thunder Mine, which is operated by TBCC. A portion of the tract lies within both the North Rochelle Mine's and the Black Thunder Mine's current mining permit boundaries (Figure 1-4). The area applied for is substantially similar to the adjacent mines for which detailed site-specific environmental data have been collected and for which environmental analyses have previously been prepared to secure the existing leases and the necessary mining permits.

The surface of the West Roundup LBA Tract is owned by TCC, TBCC, and the United States of America. The federally owned surface is part of the TBNG, administered by the USFS. Current land uses of the tract include grazing by domestic animals and wildlife, oil and gas production, and recreation.

If TCC acquires a federal coal lease for these lands, the West Roundup LBA Tract coal resources would be mined to extend the life of the North Rochelle Mine. The mining method would be a combination of truck and shovel and dragline, which are the mining methods currently in use at this mine. The coal would be used primarily for electric power generation.

After mining, the land would be reclaimed for livestock grazing and wildlife use as is the current practice at the North Rochelle Mine.

West Antelope LBA Tract

The West Antelope LBA Tract as applied for and the existing federal coal leases in the adjacent Antelope Mine are shown in Figure 1-5. As applied for, the West Antelope LBA Tract includes approximately 3,542.2 acres and an estimated 293.9 million tons of in-place coal reserves. Not all of the coal included in the tract is mineable, however. For both operational and environmental reasons, ACC's approved mining plan avoids disturbing Antelope Creek and an adjacent buffer zone, so any coal reserves that are beneath Antelope Creek would not be recovered. No

Figure 1-4

Figure 1-5

disturbance except for haulroads and conveyor crossings are allowed within Antelope Mine's Antelope Creek buffer zone without prior approval of the WDEQ/LQD. Although it has not been determined to be unsuitable for mining according to the coal leasing unsuitability criteria (43 CFR 3461), this coal will not be mined; however, it was included in the tract to allow maximum recovery of the reserves adjacent to the Antelope Creek buffer zone. The fact that the coal within the buffer zone will not be mined will be considered by BLM in the fair market value determination for the LBA tract. ACC estimates that approximately 228.4 million tons of coal will be produced from the West Antelope LBA Tract as applied for.

The West Antelope LBA Tract is contiguous with the Antelope Mine. A small portion of the tract lies within the Antelope Mine's current mining permit boundary (Figure 1-5). The area applied for is substantially similar to the adjacent mine for which detailed site-specific environmental data have been collected and for which environmental analyses have previously been prepared to secure the existing leases and the necessary mining permits.

The surface of the West Antelope LBA Tract is owned by ACC and Gene and Patricia Litton. Current land uses of the tract include grazing by domestic animals and wildlife and recreation.

If ACC acquires a federal coal lease for these lands, the West Antelope LBA Tract coal resources would be mined to extend the life of the Antelope Mine. The mining method

would be a combination of truck and shovel and dragline, which are the mining methods currently in use at this mine. The coal would be used primarily for electric power generation.

After mining, the land would be reclaimed for livestock grazing and wildlife use as is the current practice at the Antelope Mine.

1.1 Purpose and Need for Action

BLM administers the federal coal leasing program under the Mineral Leasing Act of 1920. A federal coal lease grants the lessee the exclusive right to obtain a mining permit for, and to mine coal on, the leased tract subject to the terms of the lease, the mining permit, and applicable state and federal laws. Before a new lease can be mined, the lessee must obtain approval of a detailed mining and reclamation plan.

In return for receiving a lease, a lessee must pay the federal government a bonus equal to the amount it bid at the time the lease sale was held (the bonus can be paid in five yearly installments), make annual rental payments to the federal government, and make royalty payments to the federal government when the coal is mined. Federal bonus, rental, and royalty payments are equally divided with the state in which the lease is located.

The North Antelope/Rochelle Complex, as currently permitted, includes 27,187 acres and originally contained approximately 1,645.8 million tons of mineable coal. As of

January 1, 2002, PRCC had an estimated 952 million tons of in-place coal reserves remaining at the mine, and the company estimates that approximately 904.4 million tons of those remaining reserves are recoverable. PRCC's currently approved (by WDEQ/AQD in August 2001) air quality permit allows two alternative mining scenarios, both of which will require modification of the existing mine plan. One scenario permits a maximum of 105 million tons of coal per year to be mined (during years 2004 through 2006), while the other scenario permits a maximum of 84 million tons of coal per year to be mined (during years 2002 through 2007). The mine produced approximately 68.9 million tons of coal in 1999, 70.8 million tons of coal in 2000 and 74.8 million tons of coal in 2001. Based upon a plan for increasing, then diminishing annual coal production over the life of the mine, PRCC estimates that the existing recoverable reserves at the North Antelope/Rochelle Complex will be depleted within approximately 12 years at an average production rate of approximately 75 mmtpy (the annual production rate will range from 8.7 mmtpy to 105 mmtpy). The company has applied for the coal reserves in the NARO North and NARO South LBA Tracts in order to increase average annual coal production and to extend the life of the North Antelope/Rochelle Complex. According to the most recent information from PRCC, beginning year 2002 they plan to produce an average of approximately 90 mmtpy for 16 years if they acquire the two NARO LBA Tracts (the annual production rate would range between

26 mmtpy and 105 mmtpy). Thus, acquiring these new leases would enable them to increase their average annual coal production by approximately 15 million tons and production life by four years. If the LBA tracts are leased to PRCC as maintenance tracts, the permit area for the adjacent mine would have to be amended to include the new lease areas before they could be disturbed. This process takes several years to complete. PRCC is applying for federal coal reserves now so that they can complete the permitting process in time to mine the new federal reserves in a logical progression as existing reserves are depleted.

The Black Thunder Mine, as currently permitted, includes 21,238 acres and originally contained approximately 1,494.5 million tons of mineable federal coal reserves. As of January 1, 2002, TBCC had an estimated 968.7 million tons of in-place coal reserves remaining at the mine, and the company estimates that approximately 920.3 million tons of those remaining reserves are recoverable. TBCC's currently approved (by WDEQ/AQD in July 1999) air quality permit allows up to 100 million tons of coal per year to be mined through year 2027. The mine produced approximately 48.7 million tons of coal in 1999, 60.1 million tons of coal in 2000 and 67.6 million tons of coal in 2001. Based upon diminishing annual coal production over the life of the mine, TBCC estimates that the existing recoverable reserves at the Black Thunder Mine will be depleted within approximately 24 years at an average production rate of approximately 38.3

mmtpy (the annual production rate will range between 9.0 mmtpy and 68.5 mmtpy). The company has applied for the coal reserves in the Little Thunder LBA Tract in order to increase annual coal production and to extend the life of the Black Thunder Mine. According to the most recent information from TBCC, beginning year 2002 they plan to produce an average of approximately 42.5 mmtpy for 32 years if they acquire a lease for the Little Thunder LBA Tract (the annual production rate would range between 10.5 mmtpy and 68.5 mmtpy). Thus acquiring the new lease would enable them to increase their average annual coal production by approximately 4.2 million tons and production life by eight years. If the LBA tract is leased to ALC as a maintenance tract, the permit area for the adjacent mine would have to be amended to include the new lease area before it could be disturbed. This process takes several years to complete. ALC is applying for federal coal reserves now so that they can negotiate new contracts and then complete the permitting process in time to meet anticipated new contract requirements.

The North Rochelle Mine, as currently permitted, includes 7,042 acres and originally contained approximately 337 million tons of mineable coal. As of January 1, 2002, TCC had an estimated 283 million tons of in-place coal reserves remaining at the mine, and the company estimates that approximately 255 million tons of those remaining reserves are recoverable. TCC's currently approved (by WDEQ/AQD in May 2000) air quality permit allows up to

35 million tons of coal per year to be mined through year 2018. The mine produced approximately 8.2 million tons of coal in 1999, 17.2 million tons of coal in 2000 and 23.9 million tons of coal in 2001. Based upon increasing annual coal production over the life of the mine, TCC currently estimates that the existing recoverable reserves at the North Rochelle Mine will be depleted within approximately seven years at an average production rate of approximately 35 mmtpy. The company has applied for the coal reserves in the West Roundup LBA Tract in order to extend the life of the North Rochelle Mine. According to the most recent information from TCC, beginning year 2002 they plan to produce an average of approximately 35 mmtpy for 11.8 years if they acquire a lease for the West Roundup LBA Tract. Thus acquiring the new lease would enable them to increase their productive life by 4.5 years. If the LBA tract is leased to TCC as a maintenance tract, the permit area for the adjacent mine would have to be amended to include the new lease area before it could be disturbed. This process takes several years to complete. TCC is applying for federal coal reserves now so that they can negotiate new contracts and then complete the permitting process in time to meet anticipated new contract requirements.

The Antelope Mine, as currently permitted, includes 10,848.6 acres and originally contained approximately 554.8 million tons of mineable coal. As of January 1, 2002, ACC had an estimated 373.4 million tons of mineable coal reserves

remaining at the mine, and the company estimates that approximately 347.3 million tons of those remaining reserves are recoverable. ACC's currently approved (by WDEQ/AQD in April 2001) air quality permit allows up to 32 million tons of coal per year to be mined through year 2017. The mine produced approximately 22.7 million tons of coal in 1999, 23 million tons of coal in 2000 and 24.6 million tons of coal in 2001. Based upon diminishing annual coal production over the life of the mine, ACC estimates that the existing recoverable reserves at the Antelope Mine will be depleted within approximately 25 years at an average production rate of approximately 13.9 mmtpy. The company has applied for the coal reserves in the West Antelope LBA Tract in order to increase average annual coal production by 9.1 million tons, but they do not plan to prolong the expected mine life beyond 2026. According to the most recent information from ACC, beginning year 2002 they plan to produce an average of approximately 23 mmtpy for 25 years with a maximum of 32 mmtpy if they acquire a lease for the West Antelope LBA Tract. If the LBA tract is leased to ACC as a maintenance tract, the permit area for the adjacent mine would have to be amended to include the new lease area before it could be disturbed. This process takes several years to complete. ACC is applying for federal coal reserves now so that they can negotiate new contracts and then complete the permitting process in time to meet anticipated new contract requirements.

This EIS analyzes the environmental impacts of issuing federal coal leases and mining the federal coal in the NARO North, NARO South, Little Thunder, West Roundup, and West Antelope lease applications as required by NEPA and associated rules and guidelines. A decision to hold a competitive sale and issue a lease for the lands in any of these applications is a prerequisite for mining but it is not the enabling action that would allow mining to begin. The BLM does not authorize mining operations by issuing a lease. After a lease has been issued but prior to mine development, the lessee must file a permit application package with the WDEQ/LQD and OSM for a surface mining permit and approval of the MLA mining plan. An analysis of a detailed site-specific mining and reclamation plan occurs at that time. Authorities and responsibilities of the BLM and other concerned regulatory agencies are described in the following sections.

1.2 Regulatory Authority and Responsibility

The coal lease applications filed by PRCC, ALC, TCC, and ACC were submitted and will be processed and evaluated under the following authorities:

- MLA, as amended;
- the Multiple-Use Sustained Yield Act of 1960;
- NEPA;
- FCLAA;
- FLPMA; and
- SMCRA.

The BLM is the lead agency responsible for leasing federal coal lands under the MLA as amended by FCLAA and is also responsible for preparation of this EIS to evaluate the potential environmental impacts of issuing each coal lease. For each of the coal lease applications included in this analysis (the NARO North, NARO South, Little Thunder, West Roundup, and West Antelope lease applications), the BLM must decide whether to hold a competitive, sealed-bid lease sale for the tract as applied for, hold a competitive sealed-bid lease sale for a modified tract, or reject the current lease application and not offer the tract for sale at this time.

The tracts proposed for leasing are within an area that has been included in several EIS planning documents, including the *BLM Approved Resource Management Plan for Public Lands Administered by the Bureau of Land Management Buffalo Field Office (BLM 2001a)* [an update of the *Buffalo Resource Area Resource Management Plan* (BLM 1985a)] and the *BLM Platte River Resource Area Resource Management Plan* (BLM 1985b). Federal surface lands managed by the USFS are included in the NARO North, Little Thunder, and West Roundup LBA Tracts. These lands are within the area evaluated in the *USFS Medicine Bow National Forest and Thunder Basin National Grassland Land and Resource Management Plan* (USFS 1985) and the *Final EIS for the Northern Great Plains Management Plans Revision for Thunder Basin National Grassland* (USFS 2002a). As a result, the USFS is a cooperating agency on this EIS and USFS consent

will be required before a lease sale can be held for each of these three tracts.

OSM is a cooperating agency on this EIS. After a coal lease is issued, SMCRA gives OSM primary responsibility to administer programs that regulate surface coal mining operations and the surface effects of underground coal mining operations. Pursuant to Section 503 of SMCRA, the WDEQ developed, and in November 1980 the Secretary of the Interior approved, a permanent program authorizing WDEQ to regulate surface coal mining operations and surface effects of underground mining on nonfederal lands within the state of Wyoming. In January 1987, pursuant to Section 523(c) of SMCRA, WDEQ entered into a cooperative agreement with the Secretary of the Interior authorizing WDEQ to regulate surface coal mining operations and surface effects of underground mining on federal lands within the state.

Pursuant to the cooperative agreement, a federal coal lease holder in Wyoming must submit a permit application package to OSM and WDEQ/LQD for any proposed coal mining and reclamation operations on federal lands in the state. WDEQ/LQD reviews the permit application package to insure the permit application complies with the permitting requirements and the coal mining operation will meet the performance standards of the approved Wyoming program. OSM, BLM, and other federal agencies review the permit application package to insure it complies with the terms of

the coal lease, the MLA, NEPA, and other federal laws and their attendant regulations. If the permit application package does comply, WDEQ issues the applicant a permit to conduct coal mining operations. OSM recommends approval, approval with conditions, or disapproval of the MLA mining plan to the Assistant Secretary of the Interior, Land and Minerals Management. Before the MLA mining plan can be approved, the BLM must concur with this recommendation. USFS must also concur if USFS lands are included.

If a proposed LBA tract is leased to an existing mine, the lessee is required to revise its coal mining permit prior to mining the coal, following the processes outlined above. As a part of that process, a new mining and reclamation plan would be developed showing how the lands in each LBA tract that is leased would be mined and reclaimed. The revised permit area would be larger than the revised lease area in order to allow for disturbances outside the actual coal removal areas for such purposes as overstripping, matching to undisturbed topography, constructing flood control and sediment control facilities, and related activities. Specific impacts which would occur during the mining and reclamation of the LBA tract would be addressed in the mining and reclamation plans, and specific mitigation measures for anticipated impacts would be described in detail at that time.

WDEQ enforces the performance standards and permit requirements for reclamation during a mine's operation and has primary authority

in environmental emergencies. OSM retains oversight responsibility for this enforcement. BLM and USFS have authority in those emergency situations where WDEQ or OSM cannot act before environmental harm and damage occurs.

Appendix A presents other federal and state permitting requirements that must be satisfied to mine these LBA tracts.

BLM also has the responsibility to consult with and obtain the comments of other state or federal agencies which have jurisdiction by law or special expertise with respect to potential environmental impacts.

1.3 Relationship to BLM Policies, Plans, and Programs

In addition to the federal acts listed under Section 1.2, guidance and regulations for managing and administering public lands, including the federal coal lands in the PRCC, ALC, TCC, and ACC applications, are set forth in 40 CFR 1500 (Protection of Environment), 43 CFR 1601 (Planning, Programming, Budgeting), and 43 CFR 3400 (Coal Management).

Specific guidance for processing applications follow BLM Manual 3420, Competitive Coal Leasing (BLM 1989) and the 1991 *Powder River Regional Coal Team Operational Guidelines For Coal Lease-By-Applications* (BLM 1991). The *National Environmental Policy Act Handbook* (BLM 1988) has been followed in developing this EIS.

As put forth in Executive Order 13212, dated May 18, 2001, all BLM decisions must take into consideration adverse impacts on the President's National Energy Policy. According to BLM Instruction Memorandum No. 2002-053, dated December 12, 2001, it is BLM policy to prepare a "Statement of Adverse Energy Impact" whenever a BLM decision or action will have a direct or indirect adverse impact on energy development, production, supply or distribution. If there is no adverse impact, no Statement needs to be prepared. However, the ROD must note this fact.

The Proposed Actions, to lease federally-owned coal, would have no adverse energy impact. The No Action Alternatives, rejection of the lease applications, could adversely affect energy production if it results in any one of the LBA tracts never being mined or if there is a long delay in mining the coal. If the No Action Alternative is selected by BLM for any one of the LBA tracts, the ROD will have to contain a Statement of Adverse Energy Impact which will address the following:

- rationale why the coal lease cannot coexist with other uses of the land;
- alternatives considered in adoption of the No Action Alternative; and
- a qualitative judgement of the impacts of the decision in regards to production lost as well as steps taken to offset the loss.

1.4 Conformance with Existing Land Use Plans

FCLAA requires that lands considered for leasing be included in a comprehensive land use plan and that leasing decisions be compatible with that plan. The BLM *Approved Resource Management Plan for Public Lands Administered by the Bureau of Land Management Buffalo Field Office* (BLM 2001a) [an update of the *Buffalo Resource Area Resource Management Plan* (BLM 1985a)] governs and addresses the leasing of federal coal in Campbell County, and the BLM *Platte River Resource Area Resource Management Plan* (BLM 1985b) governs the management of the BLM-administered lands and minerals in Converse County. The current land and resource management plan for the TBNG governs the management of USFS (public) lands in Campbell and Converse Counties, Wyoming. The USFS completed the USFS *Medicine Bow National Forest and Thunder Basin National Grassland Land and Resource Management Plan* in 1985 (USFS 1985). The *Final EIS for the Northern Great Plains Management Plans Revision for the Thunder Basin National Grassland* (USFS 2002a) and the *Land and Resource Management Plan for the Thunder Basin National Grassland* (USFS 2001) address revisions to the 1985 TBNG LRMP. The *Final EIS and Land and Resource Management Plans Revision Record of Decision for the Thunder Basin National Grassland* was signed on July 31, 2002.

Coal land use planning involves four planning screens to determine

whether the subject coal is acceptable for further lease consideration. The four coal screens are:

- development potential of the coal lands;
- unsuitability criteria application;
- multiple land use decisions that eliminate federal coal deposits; and
- surface owner consultation.

Only those federal coal lands that pass these screens are given further consideration for leasing. These coal screens were applied to federal coal lands in Campbell and Converse Counties in the early 1980s by the BLM and USFS. The results were published in the BLM Buffalo RMP, the Platte River RMP, and the TBNG LRMP in 1985. The five LBA tracts considered in this EIS are located in the area covered by the USFS screening analysis published in the TBNG LRMP in 1985. In 1993, BLM, USFS, and USFWS began the process of reapplying these screens to federal coal lands in Campbell, Converse and Sheridan Counties. The results of this analysis are included as Appendix D in the *Approved Resource Management Plan for Public Lands Administered by the Bureau of Land Management Buffalo Field Office* (BLM 2001a) and can be viewed on the Wyoming BLM website at <<http://www.wy.blm.gov>> in the NEPA documents section.

A coal tract that is acceptable for further consideration for leasing must be located within areas that have been determined to have coal development potential. The lands in

these coal lease applications are within the area identified as having coal development potential by the BLM and the USFS in the coal screening analyses published in both the 1985 and 2001 BLM planning documents.

The coal mining unsuitability criteria listed in the federal coal management regulations (43 CFR 3461) have been applied to high to moderate coal development potential lands in the Wyoming PRB. Appendix B of this EIS summarizes the unsuitability criteria, describes the general findings for the 1985 BLM Buffalo and Platte River RMPs, the 1985 TBNG LRMP, the 2001 BLM *Approved Resource Management Plan for Public Lands Administered by the Bureau of Land Management Buffalo Field Office* (BLM 2001a), and the 2002 USFS *Final EIS for the Northern Great Plains Management Plans Revision for Thunder Basin National Grassland* (USFS 2002a) and presents a validation of these findings for the NARO North, NARO South, Little Thunder, West Roundup, and West Antelope LBA Tracts.

As indicated in Appendix B, no lands in the NARO North or West Antelope LBA Tracts have been found to be unsuitable for mining. The lands in the NARO South LBA Tract within the BNSF & UP railroad ROW, and the lands in the Little Thunder LBA Tract within the BNSF & UP railroad and Highway 450 ROWs have been found to be unsuitable for mining under Unsuitability Criteria Numbers 2 and 3. USFS has determined that lands under a USFS special use permit for ancillary facilities at the North

Rochelle Mine are unsuitable for mining under Unsuitability Criterion Number 2 (USFS 2002a). TCC did not include these lands in their application for the West Roundup LBA Tract, but BLM is considering leasing a tract that would include these lands as an alternative to the tract as applied for. Although the lands described above have been determined to be unsuitable for mining, they would be included in the LBA tracts to allow recovery of all the mineable coal outside of the railroad and highway ROWs, associated buffer zones, and the USFS special use permit for ancillary facilities at the North Rochelle Mine and to comply with the coal leasing regulations, which do not allow leasing in less than 10-acre aliquot parts. A stipulation stating that no mining activity may be conducted in the portion of the leases within the BNSF & UP railroad and Highway 450 ROWs and USFS special use permit will be attached if leases are issued for these tracts. The exclusion of the coal underlying the railroad and highway ROWs and USFS special use permit from mining activity by lease stipulation honors the finding of unsuitability for mining under Unsuitability Criteria Numbers 2 and 3 for the BNSF & UP railroad and Highway 450 ROWs and USFS special use permit for ancillary facilities at the North Rochelle Mine.

Surface owner consultation was completed during the preparation of coal screening analyses published in the 1985 and 2001 RMPs and LRMPs. Qualified private surface owners in the Gillette coal development potential area were provided the

opportunity to express their preference for or against surface mining of federal coal under their private surface estate during both these screenings (see Chapter 7 for a definition of a “qualified surface owner”). The current surface ownership of the NARO North, NARO South, Little Thunder, West Roundup, and West Antelope LBA Tracts is discussed in Section 1.0 of this chapter and in Section 3.11. For each tract that is offered for sale, BLM will review the current surface ownership in the tracts, and any private surface owners who are determined to be qualified will be consulted prior to holding the lease sale.

As part of the coal planning for the 1985 BLM Buffalo and Platte River RMPs and the 1985 TBNG LRMP, a multiple land use conflict analysis was completed to identify and “eliminate additional coal deposits from further consideration for leasing to protect resource values of a locally important or unique nature not included in the unsuitability criteria,” in accordance with 43 CFR 3420.1-4e(3). The 1985 multiple use conflict evaluation in the BLM Buffalo RMP identified approximately 221,000 acres within Campbell, Sheridan, and Johnson Counties that were potentially affected by multiple use conflicts in four categories (producing oil and gas fields, communities, recreation and public purpose facilities, and cultural resources). The multiple use conflict evaluation referenced in the 1985 TBNG LRMP determined that there were no multiple use conflicts that were significant enough to require any

lands to be withdrawn from leasing consideration in the area covered by the USFS screening analysis. The 1985 BLM Platte River RMP relied on the 1985 TBNG LRMP analysis as the basis for coal planning. As discussed above, the NARO North, NARO South, Little Thunder, West Roundup, and West Antelope LBA Tracts are located within the 1985 TBNG LRMP analysis area.

No additional lands were specifically identified as potentially affected by multiple use conflicts in the multiple use analysis referenced in the 2001 *Approved Resource Management Plan for Public Lands Administered by the Bureau of Land Management Buffalo Field Office* (BLM 2001a) and the 2002 *Final EIS for the Northern Great Plains Management Plans Revision for Thunder Basin National Grassland* (USFS 2002a).

The 1985 BLM Buffalo RMP addressed coal and oil and gas development conflicts in two planning decisions. Decision MM-4 recommended authorizing oil and gas drilling on coal leases only where drilling would not conflict with coal mining, and Decision MM-5 recommended deferring coal leasing in producing oil and gas fields until coal development would not interfere with economic recovery of the oil and gas resource, as determined on a case by case basis. An EIS which will be used to update the Buffalo RMP with respect to oil and gas development is currently in progress. The *Draft EIS and Draft Planning Amendment for the Powder River Basin Oil and Gas Project* was published in early 2002 (BLM 2002a). Decision M-2 in the

1985 BLM Platte River RMP included similar decisions to those in the 1985 BLM Buffalo RMP. The BLM Casper Field Office is currently initiating an update of the 1985 BLM Platte River RMP. The 1985 TBNG LRMP deferred mineral leasing decisions to the Department of Interior. The multiple use analysis published in the 2001 BLM Buffalo RMP update did not recommend changes to the existing 1985 RMP and LRMP decisions related to mineral development conflicts for either the BLM or the USFS.

As indicated in Section 1.0 of this EIS, the PRRCT reviewed the lease applications included in this EIS at a public meeting on October 25, 2000, in Cheyenne, Wyoming. At that meeting, the PRRCT heard presentations from representatives of some of the oil and gas lessees who might be affected by leasing the tracts included in this analysis regarding deferring leasing the federal coal in these tracts until the CBM is recovered. The PRRCT recommended that the BLM proceed with leasing these tracts. The BLM has followed the PRRCT's recommendation regarding processing the applications for the NARO North, NARO South, Little Thunder, West Roundup, and West Antelope LBA Tracts.

CBM wells presently exist or have been proposed in and around the LBA tracts in the General Analysis Area (see Mineral Resources discussion in Section 3.3). BLM has also identified federal oil and gas leases and corresponding lessees within existing coal leases and coal lease application areas. Those oil and gas lessees have

been and are being contacted and encouraged to develop and recover the CBM resources prior to coal mining. This approach is consistent with BLM's policy on conflicts between coal and CBM development, which is explained in BLM Instruction Memorandum No. 2000-081. BLM's policy is to optimize the recovery of both resources and ensure that the public receives a reasonable return.

In summary, all of the lands in the PRCC, ALC, TCC, and ACC coal lease applications have been subjected to the four coal planning screens and determined acceptable for further lease consideration. Thus, a decision to lease the federal coal lands in this application would be in conformance with the existing management plans for the BLM and USFS.

1.5 Consultation and Coordination

Initial Involvement

BLM received the NARO North and NARO South coal lease applications on March 10, 2000, the Little Thunder coal lease application on March 23, 2000, the West Roundup coal lease application on July 28, 2000, and the West Antelope coal lease application on September 12, 2000. The applications were initially reviewed by the BLM, Wyoming State Office, Division of Mineral and Lands Authorization. The BLM ruled that these applications and lands involved met the requirements of regulations

governing coal leasing on application (43 CFR 3425).

The BLM Wyoming State Director notified the Governor of Wyoming on April 5, 2000, that PRCC had filed a lease application with BLM for the NARO North and NARO South LBA Tracts. The BLM Wyoming State Director notified the Governor of Wyoming on April 15, 2000 that ALC filed a lease application with BLM for the Little Thunder LBA Tract. The BLM Wyoming State Director notified the Governor of Wyoming on August 24, 2000 that TCC filed a lease application with BLM for the West Roundup LBA Tract. The BLM Wyoming State Director notified the Governor of Wyoming on October 3, 2000 that ACC filed a lease application with BLM for the West Antelope LBA Tract. A notice announcing the receipt of the PRCC, ALC and TCC coal lease applications published in the *Federal Register* on September 12, 2000 served as public notice that the PRCC, ALC, and TCC coal lease applications had been received. Copies were sent to voting and nonvoting members of the PRRCT, including the governors of Wyoming and Montana, the Northern Cheyenne Tribe, the Crow Tribal Council, the USFS, OSM, USFWS, National Park Service, and U.S. Geological Survey.

The PRRCT reviewed all four lease applications at a public meeting held on October 25, 2000, in Cheyenne, Wyoming. Each of the applicants presented information about their existing mine and pending lease application to the PRRCT at that meeting. The PRRCT recommended

that the BLM continue to process all four lease applications. The major steps in processing an LBA are shown in Appendix C.

The BLM published a Notice of Intent to Prepare an Environmental Impact Statement and Notice of Scoping in the *Federal Register* on October 3, 2001 and in the Gillette News Record on September 25, 2001 and October 2, 2001. The publications served as public notice that the ACC coal lease application had been received, announced the time and location of a public scoping meeting, and requested public comment on all four applications. Letters requesting public comment and announcing the time and location of the public scoping meeting were mailed to all parties on the distribution list in September, 2001.

A public scoping meeting was held on October 10, 2001 in Gillette, Wyoming. At the public meeting, PRCC, TBCC, TCC, and ACC personnel orally presented information about their mines and their needs for the coal. The presentation was followed by a question and answer period, during which one oral comment was made. The scoping period extended from October 1 through October 31, 2001, during which time BLM received 12 written comments.

Chapter 5 provides a list of other federal, state, and local governmental agencies that were consulted in preparation of this EIS and the distribution list for this EIS.

Issues and Concerns

Issues and concerns expressed by the public and government agencies relating to the PRCC, ALC, TCC, and ACC coal lease applications and previous coal lease applications included:

- potential conflicts with existing conventional oil and gas development and existing and proposed CBM development;
- cumulative impacts of mineral development to all other resources;
- validity and currency of resource data;
- public access;
- potential impacts to threatened and endangered species and other species of concern;
- potential air quality impacts (including cumulative impacts to visibility);
- potential surface and groundwater quality and quantity impacts;
- potential impacts of and possible mitigation for nitrogen oxide emissions resulting from blasting of coal and overburden;
- the need to include reasonably foreseeable actions such as the construction and operation of the DM&E railroad and power plants in the cumulative analysis;
- the need to address increasing coal production in the Powder River Basin in the cumulative analysis;
- potential impacts on cultural and paleontological resources;
- wetland impacts; and
- short- and long-term impacts on fish and wildlife.

Draft EIS

Parties on the distribution list are being sent copies of this DEIS, and copies are being made available for review at the BLM offices in Casper and Cheyenne.

Due to the amount of information available on these tracts, a separate document entitled *Supplementary Information on the Affected Environment in the General Analysis Area for the South Powder River Basin Coal EIS* has been prepared and is being made available on request. This supplementary document provides more detailed information on the affected environment in each tract.

A notice announcing the availability of the DEIS will be published in the *Federal Register* by the EPA. The BLM will publish a Notice of Availability/Notice of Public Hearing in the *Federal Register*. A 60-day comment period on the DEIS will commence with publication of the EPA Notice of Availability. The BLM *Federal Register* notice will announce the date and time of a public hearing and will be used to solicit public comments on the DEIS and on the fair market value, the maximum economic recovery, and the proposed competitive sale of coal from the five LBA tracts. A formal public hearing will be held during the 60-day comment period.

Final EIS and Future Involvement

All substantive comments received on the DEIS will be included, with agency responses, in the FEIS. Availability of the FEIS will be published in the *Federal Register* by the BLM and the EPA. After a 30-day availability period, BLM will make a separate decision to hold or not to hold a competitive lease sale for each of the federal coal in these five tracts. A public ROD for each of the tracts will be mailed to parties on the mailing list and others who commented on these LBAs during the NEPA process. The public and/or the applicants can appeal the BLM decision to hold or not to hold a competitive sale and issue a lease for any of the five tracts. The BLM decision must be appealed within 30 days after it is signed. The decision can be implemented at that time if no appeal is received. If competitive lease sales are held, the lease sales will follow the procedures set forth in 43 CFR 3422, 43 CFR 3425, and BLM Handbook H-3420-1, Competitive Coal Leasing (BLM 1989).

Department of Justice Consultation

After each competitive coal lease sale, but prior to issuance of a lease, the BLM will solicit the opinion of the Department of Justice on whether the planned lease issuance creates a situation inconsistent with federal antitrust laws. The Department of Justice is allowed 30 days to make this determination. If the Department of Justice has not responded in writing within the 30 days, the BLM can proceed with issuance of the lease.

2.0 PROPOSED ACTION AND ALTERNATIVES

This chapter describes the Proposed Action and alternatives to this action for each of the five LBA¹ tracts being evaluated in this EIS. The five LBA tracts are the NARO North and NARO South LBA Tracts as applied for by PRCC, the Little Thunder LBA Tract as applied for by ALC, the West Roundup LBA Tract as applied for by TCC, and the West Antelope LBA Tract as applied for by ACC. For each tract, the Proposed Action is to hold a separate competitive lease sale and issue a separate lease for the federal coal lands included in the tract. The No Action Alternative (Alternative 1) for each tract is to reject the lease application for that tract and not offer that tract for competitive sale at this time. Alternatives 2 and 3 evaluate alternate tract configurations considered by BLM. Under Alternatives 2 and 3, separate competitive sales would be held and leases issued for federal coal lands included in one or more of the five LBA tracts as modified by the BLM.

Other alternatives considered but not analyzed in detail include :

- holding a competitive lease sale and issuing a lease for federal coal lands included in one or more of the five LBA tracts (as applied for or as modified by BLM), with the assumption that one or more of the tracts would be developed as a new mine (Alternative 4); and

- delaying the sale of one or more of the five LBA tracts as applied for to wait for possible higher coal prices and/or to allow recovery of the CBM resources in the tract prior to mining (Alternative 5). Under this alternative, it is assumed that one or more of the five LBA tracts could be developed later as a maintenance tract or a new start mine, depending on how long the sale was delayed.

Under each Proposed Action, a tract would be offered for lease as applied for at a separate, sealed-bid, competitive lease sale, subject to standard and special lease stipulations developed for the PRB and that tract. The boundaries of each tract would be consistent with the tract configuration proposed by each applicant. For each tract, the Proposed Action assumes that the applicant for that tract would be the successful bidder on that tract and that each tract would be mined as a maintenance lease for an existing mine.

The No Action Alternative for each tract assumes that the application for that tract would be rejected, the tract would not be offered for competitive sale, and the coal contained within the tract would not be mined as proposed. The No Action Alternative assumes that rejection of an application would not affect currently permitted mining activities on existing leases at any of the existing mines and would not preclude an application to lease any rejected tract in the future. Portions of the surface of each of the LBA tracts would

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

probably be disturbed due to overstripping to allow coal to be removed from the adjacent, existing leases.

Under Alternatives 2 and 3, BLM has evaluated the unleased federal coal included in and adjacent to each LBA tract and is considering offering a larger or smaller tract for competitive sale, based on that evaluation. The alternate tract configurations analyzed vary for each tract. No alternate tract configurations were identified for the NARO North LBA Tract. For each of the other four LBA Tracts, BLM identified two additional tract configurations to analyze.

LBA tracts are nominated for leasing by companies with an interest in acquiring them but, as discussed in Chapter 1, the LBA process is, by law and regulation, an open, public, competitive sealed-bid process. If a tract is offered for lease, the applicant for that tract may or may not be the high bidder when the lease sale is held.

For each tract, if a decision is made to hold a separate competitive lease sale and there is a successful bidder, a detailed mining and reclamation plan must be developed by the successful bidder and approved before mining can begin on that tract. As discussed in Section 1.2, each mining and reclamation plan would undergo detailed review by state and federal agencies as part of the approval process. Those plans could potentially differ from the plans used to analyze the impacts of the Proposed Action and Alternatives 2 and 3 in this EIS, but the differences

would not be expected to significantly change the impacts described here. These differences would typically be related to the details of mining and reclaiming the tracts but major factors like tons of coal mined, yards of overburden removed, acres disturbed, etc. would not be significantly different from the plans used in this analysis.

An estimate of the coal included in each tract provided by the applicant is given in the following descriptions of the Proposed Action and alternatives for each tract. BLM will independently evaluate the volume and average quality of the coal resources included in each tract offered for sale as part of the fair market value determination process. BLM's estimate of the recoverable federal coal reserves and average quality of the coal included in each tract will be published in the sale notice for each tract that is offered for sale. Some general coal quality information in the area of the LBA Tracts considered in this EIS is included in Section 3.3 of this document.

Under the Proposed Action and the alternatives for each tract it is assumed that an area larger than the tract would have to be disturbed in order to recover all of the coal in that tract. The disturbances outside the coal removal area would be due to activities like overstripping, matching undisturbed topography, and construction of flood control and sediment control structures.

Hazardous and Solid Waste

Under all of the Proposed Actions and alternatives, the procedures and requirements for handling of hazardous and solid wastes would be the same as the procedures and requirements for the existing mining operations. Solid waste that is produced at the existing North Antelope/Rochelle Complex, Black Thunder, North Rochelle, and Antelope Mines consists of floor sweepings, shop rags, lubricant containers, welding rod ends, metal shavings, worn tires, packing material, used filters, and office and food wastes. North Antelope/Rochelle Complex, Black Thunder, North Rochelle, and Antelope Mines dispose of a portion of their solid wastes within their permit boundaries in accordance with WDEQ-approved solid waste disposal plans. Solid waste is also disposed of at the Campbell County landfill. Sewage is handled by WDEQ-permitted sewage systems present on the existing mine facilities. Maintenance and lubrication of most of the equipment takes place at existing shop facilities at all four mines.

Major lubrication, oil changes, etc., of most equipment are performed inside the service building lube bays at the North Antelope/Rochelle Complex, Black Thunder, North Rochelle, and Antelope Mines, where used oil is currently contained and deposited in storage tanks. All of the collected used oils are then recycled off site. These practices would not change if the applicants acquire these LBA tracts.

PRCC, TBCC, TCC, and ACC have reviewed the EPA's *Consolidated List*

of Chemicals Subject to Reporting Under Title III of the Superfund Amendments and Re-authorization Act (SARA) of 1986 (as amended) and EPA's List of Extremely Hazardous Substances as defined in 40 CFR 355 (as amended) for hazardous substances used at their mining operations. PRCC, TBCC, TCC, and ACC maintain files containing Material Safety Data Sheets for all chemicals, compounds and/or substances which are or would be used during the course of mining.

PRCC, TBCC, TCC, and ACC are responsible for ensuring that all production, use, storage, transport, and disposal of hazardous and extremely hazardous materials as a result of mining are in accordance with all applicable existing or hereafter promulgated federal, state, and local government rules, regulations, and guidelines. All mining activities involving the production, use, and/or disposal of hazardous or extremely hazardous materials are and would continue to be conducted so as to minimize potential environmental impacts.

PRCC, TBCC, TCC, and ACC must comply with emergency reporting requirements for releases of hazardous materials. Any release of hazardous or extremely hazardous substances in excess of the reportable quantity, as established in 40 CFR 117, is reported as required by the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA)*, as amended. The materials for which such notification must be given are the extremely hazardous substances

2.0 Proposed Action and Alternatives

listed in Section 302 of the *Emergency Planning and Community Right to Know Act* and the hazardous substances designated under Section 102 of CERCLA, as amended. If a reportable quantity of a hazardous or extremely hazardous substance is released, immediate notice must be given to the WDEQ Solid and Hazardous Waste Division, WDEQ Water Quality Division, and all other appropriate federal and state agencies.

Each mining company is expected to prepare and implement several plans and/or policies to ensure environmental protection from hazardous and extremely hazardous materials. These plans/policies include:

- Spill Prevention Control and Countermeasure Plans;
- Spill Response Plans;
- Stormwater Pollution Prevention Plans;
- Inventories of Hazardous Chemical Categories Pursuant to Section 313 of SARA, as Amended; and
- Emergency Response Plans.

All mining operations are also required to be in compliance with regulations promulgated under the Resource Conservation and Recovery Act, Federal Water Pollution Control Act (Clean Water Act), Safe Drinking Water Act, Toxic Substances Control Act, Mine Safety and Health Act, Department of Transportation, and

the Federal Clean Air Act. In addition, mining operations must comply with all attendant state rules and regulations relating to hazardous material reporting, transportation, management, and disposal.

Compliance with these rules is the current practice at the North Antelope/Rochelle Complex, Black Thunder, North Rochelle, and Antelope Mines. Acquisition of the LBA tracts by the applicants would not change these current practices nor the type of any wastes generated or disposed at the mines, although quantities of some wastes would increase in proportion to anticipated increases in coal production (e.g., fuel, lubricants, and shop and office wastes).

2.1 Proposed Action and Alternatives for the NARO North LBA Tract

2.1.1 NARO North LBA Tract Proposed Action

PRCC has applied for two separate LBA tracts (NARO North and NARO South). Each tract will be evaluated separately and if a decision is made to lease both of these tracts, a separate competitive lease sale will be held for each tract.

Under the Proposed Action for the NARO North LBA Tract, the tract as applied for by PRCC would be offered for lease at a separate, sealed-bid, competitive lease sale, subject to standard and special lease stipulations developed for the PRB (Appendix D). The boundaries of the tract would be consistent with the tract configuration proposed in the

NARO North LBA Tract lease application (Figure 2-1). The Proposed Action assumes that PRCC will be the successful bidder on the NARO North LBA Tract if it is offered for sale.

The legal description of the proposed NARO North LBA Tract coal lease lands as applied for by PRCC under the Proposed Action is as follows:

T.42N., R.70W., 6th P.M., Campbell County, Wyoming

Section 28: Lots 5 through 16;
495.59 acres

Section 29: Lots 5 through 16;
495.89 acres

Section 30: Lots 9 through 20;
443.67 acres

T.42N., R.71W., 6th P.M., Campbell County, Wyoming

Section 25: Lots 5 through 15;
447.19 acres

Section 26: Lots 7 through 10;
162.22 acres

Section 35: Lots 1, 2, 7 through 10,
15 and 16;
324.82 acres

Total surface area applied for:
2,369.38 acres

Land descriptions and acreage are based on the BLM Status of Public Domain Land and Mineral Titles approved Coal Plats as of July 26, 2000, May 9, 2001 and September 6, 2001.

As indicated in Chapter 1, Section 1.4, no lands in the NARO North LBA Tract were found to be unsuitable for mining. The NARO North Tract as

applied for includes approximately 2,369.38 mineable acres. PRCC estimates that the NARO North Tract includes approximately 323 million tons of in-place coal reserves. Assuming a recovery factor of 95 percent, PRCC estimates that about 306.9 million tons of coal would be recovered from the NARO North LBA Tract as applied for.

BLM will independently evaluate the volume and average quality of the coal resources included in the NARO North LBA Tract as part of the fair market value determination process. BLM's estimate of the mineable reserves and average quality of the coal included in the tracts will be published in the sale notice if the tract is offered for sale. Some coal quality information in the area of the NARO North LBA Tract is included in Section 3.3 of this document.

The approved North Antelope/Rochelle Complex Permit 569 Term T5 includes monitoring and mitigation measures for the North Antelope/Rochelle Complex that are required by SMCRA and Wyoming State Law. If the NARO North LBA Tract is acquired by PRCC, these monitoring and mitigation measures

Figure 2-1

would be extended to cover operations on the NARO North LBA Tract when the coal mining permit is revised to include the tract. This permit would have to be approved before mining operations could take place on the tract. These monitoring and mitigation measures are considered to be part of the Proposed Action and other action alternatives during the leasing process because they are regulatory requirements.

The NARO North LBA Tract would be mined as an integral part of the North Antelope/Rochelle Complex under the Proposed Action. The North Antelope/Rochelle Complex is already operating under both an approved state mining permit and MLA mining plan. Both the approved state mining permit and MLA mining plan would require amendment to include the LBA tract. Since the NARO North LBA Tract would be an extension of the existing North Antelope/Rochelle Complex, the facilities and infrastructure would be the same as those identified in the WDEQ/LQD Mine Permit 569 Term T5 approved December 1, 1999 and the BLM Resource Recovery and Protection Plan approved July 23, 2001 for the North Antelope/Rochelle Complex.

PRCC's currently approved air quality permit from the WDEQ/AQD allows up to 105 million tons of coal per year to be mined in years 2004 through 2006. The North Antelope/Rochelle Complex produced 68.9 million tons of coal in 1999, 70.8 million tons of coal in 2000, and 74.8 million tons of coal in 2001 (Wyoming State Inspector of Mines 1999, 2000, and 2001). Under the No Action

Alternative, the North Antelope/Rochelle Complex would mine its remaining 952 million tons of in-place coal reserves in approximately 12 years at an average production rate of 75 mmtpy (the production rate ranges between 8.7 mmtpy to 105 mmtpy). Under the Proposed Action, PRCC estimates that average annual coal production would be 90 million tons (the production rate ranges between 26 mmtpy to 105 mmtpy), and the life of the mine would be extended by approximately four years.

If PRCC acquires both the NARO North and NARO South LBA Tracts as applied for, they estimate that a total of 1,411.3 million tons of coal would be mined after January 1, 2002, with an estimated 506.9 million tons coming from the two LBA tracts. As of December 31, 2001, 643 million tons of coal had been mined from within the current permitted area of the mine.

Topsoil removal with heavy equipment would proceed ahead of overburden removal. Whenever possible, direct haulage to a reclamation area would be done, but due to scheduling, some topsoil would be temporarily stockpiled. As required by the reclamation plan, heavy equipment again would be used to haul and distribute the stockpiled topsoil.

The North Antelope/Rochelle Complex is one of several mines currently operating in the PRB where the coal seams are notably thick and the overburden is relatively thin. Mining would be conducted in semi-

independent pits. Overburden removal has been and would continue to be conducted using trucks and shovels, draglines, and/or direct cast blasting. Most overburden and all coal would be drilled and blasted to facilitate efficient excavation. The design of the North Antelope/Rochelle Complex seeks to confine disturbance to the active mine blocks. As overburden is removed, most would be directly placed into areas where coal has already been removed. Once the overburden has been replaced it is sampled and verified to be suitable overburden material, then graded to approximate final contour, ripped and finally topsoiled. If necessary, material that is found to be unsuitable would be adequately covered with suitable overburden material prior to grading and topsoiling. Elevations consistent with an approved PMT plan would be established as quickly as possible. Under certain conditions, the PMT may not be immediately achievable. This occurs when there is an excess of material that may require temporary stockpiling, when there is insufficient material available from current overburden removal operations, or when future mining could redisturb an area already mined. Once a seedbed has been formed, vegetation would be reestablished that is consistent with the postmining land use.

Coal would be produced from two seams (Wyodak-Anderson 1 and Wyodak-Anderson 2) that total 60 to 80 ft thick at several working faces to enable blending of the coal to meet customer quality requirements, to comply with BLM lease requirements

for maximum economic recovery of the coal resource, and to optimize coal removal efficiency with available equipment. Coal would be loaded with electric-powered shovels into off-highway haul trucks for transport to crushing facilities. Coal haul roads would be temporary structures built within the mine areas. Mining efficiency and air quality protection are and would continue to be facilitated by extensive use of near-pit crushers and overland conveyors. There are three existing crushing facilities within the existing permit area. All transfer points on conveyor belts and the truck dump hopper at the processing plant are controlled by baghouse-type dust collectors, PECs, fogger/spray systems, or stilling sheds. There are five existing storage silos, each with a covered storage slot. While sufficient capacity exists, future changes in facilities may be constructed to improve operating efficiency and air quality protection. An additional near-pit crusher/conveyor, railroad loop, and two silos are planned whether or not PRCC acquires the NARO North or NARO South LBA Tracts. PRCC's recently approved (August 14, 2001) air quality permit from the WDEQ/AQD allows a maximum of 105 million tons of coal per year to be mined provided additional coal handling and processing facilities are constructed. The fourth crushing facility and two additional storage silos have been permitted for construction.

Current full-time employment at the North Antelope/Rochelle Complex is 877 but PRCC anticipates that employment will increase to 1,175

under the No Action Alternative. If both the NARO North and NARO South LBA tracts are acquired, PRCC anticipates that the average annual coal production would be approximately 90 million tons, the maximum annual coal production would be 105 million tons, and employment would be 1,185 persons at the maximum annual production rate of 105 million tons.

2.1.2 NARO North LBA Tract Alternative 1

Under the NARO North LBA Tract Alternative 1, the No-Action Alternative, the application to lease the coal included in the NARO North LBA Tract would be rejected, the tract would not be offered for competitive sale, and the coal included in the tract would not be mined. This would not affect permitted mining activities and employment on the existing leases at the North Antelope/Rochelle Complex and would not preclude an application to lease the coal included in the NARO North LBA Tract in the future. Portions of the surface of the NARO North LBA Tract could be disturbed due to overstripping to allow coal to be removed from the adjacent existing leases.

Approximately 14,895.5 acres of federal coal are currently leased at the North Antelope/Rochelle Complex and a total of about 20,410 acres of land will be affected in mining the current leases. If the NARO North and NARO South LBA Tracts are not leased, PRCC estimates that the average annual production at the North Antelope/Rochelle Complex after 2001 will be 75 million tons,

annual production will range from 8.7 million tons to 105 million tons, and employment will be approximately 1,175 persons at the maximum production rate.

In order to compare the economic and environmental consequences of mining these lands versus not mining them, this EIS was prepared under the assumption that an LBA tract would not be mined in the foreseeable future if the No Action Alternative for that tract is selected. However, selection of this alternative would not preclude leasing and mining of a rejected tract in the future, either as a maintenance tract for existing operations or as a new start mine.

2.2 Proposed Action and Alternatives for the NARO South LBA Tract

2.2.1 NARO South LBA Tract Proposed Action

PRCC has applied for two separate LBA tracts (NARO North and NARO South). Each tract will be evaluated separately and, if a decision is made to lease both of these tracts, a separate competitive lease sale will be held for each tract.

Under the Proposed Action for the NARO South LBA Tract, the tract as applied for by PRCC would be offered for lease at a separate, sealed-bid, competitive lease sale, subject to standard and special lease stipulations developed for the PRB (Appendix D). The boundaries of the tract would be consistent with the tract configuration proposed in the NARO South LBA Tract lease

2.0 Proposed Action and Alternatives

application (Figure 2-1). The Proposed Action assumes that PRCC will be the successful bidder on the NARO South LBA Tract if it is offered for sale.

The legal description of the proposed NARO South LBA Tract coal lease lands as applied for by PRCC under the Proposed Action is as follows:

T.41N., R.70W., 6th P.M., Campbell and Converse Counties, Wyoming

Section 19: Lots 6 through 11, 12(S½), 13 through 20;

584.555 acres

Section 20: Lots 5(S½), 6(S½), 7(S½), 8(S½), 9 through 16;

402.645 acres

Section 21: Lots 5(S½), 12, and 13;

99.695 acres

Section 28: Lots 3 through 6, 11, and NE¼ SW¼;

238.62 acres

Section 29: Lots 1 through 12;

484.08 acres

Section 30: Lots 5 through 12;

324.04 acres

Total surface area applied for:

2,133.635 acres

Land descriptions and acreage are based on the BLM Status of Public Domain Land and Mineral Titles approved Coal Plats as of July 26, 2000, May 9, 2001 and September 6, 2001.

As indicated in Chapter 1, Section 1.4, some of the above-described lands in the NARO South LBA Tract are unsuitable for mining due to the presence of the BNSF & UP railroad ROW and partially burned areas

where the coal is not recoverable. Although these lands would not be mined, they are included in the tract to allow maximum recovery of all the mineable coal outside of the railroad ROW and associated buffer zones and the partially burned areas, and to comply with the coal leasing regulations, which do not allow leasing of less than 10-acre aliquot parts. The NARO South Tract as applied for includes approximately 2,133.635 mineable acres. PRCC estimates that it includes approximately 241 million tons of in-place coal and that about 200 million tons of that coal would be recoverable. An average recovery factor of approximately 83 percent is therefore assumed, based largely upon PRCC's estimate of the unmineable reserves within the ROW and unrecoverable coal in partially burned areas.

BLM will independently evaluate the volume and average quality of the coal resources included in the NARO South LBA Tract as part of the fair market value determination process. The fact that the coal within the ROW and partially burned area cannot all be recovered would be considered by BLM in the fair market value determination for the LBA tract. BLM's estimate of the recoverable reserves and average quality of the coal included in the tracts will be published in the sale notice if the tract is offered for sale. Some coal quality information in the area of the NARO South LBA Tract is included in Section 3.3 of this document.

The approved North Antelope/Rochelle Complex Permit 569 Term

T5 includes monitoring and mitigation measures for the North Antelope/Rochelle Complex that are required by SMCRA and Wyoming State Law. If the NARO South LBA Tract is acquired by PRCC, these monitoring and mitigation measures would be extended to cover operations on the NARO South LBA Tract when the coal mining permit is revised to include the tract. This permit would have to be approved before mining operations could take place on the tract. These monitoring and mitigation measures are considered to be part of the Proposed Action and other action alternatives during the leasing process because they are regulatory requirements.

The NARO South LBA Tract would be mined as an integral part of the North Antelope/Rochelle Complex under the Proposed Action. The North Antelope/Rochelle Complex is already operating under both an approved state mining permit and MLA mining plan. Both the approved state mining permit and MLA mining plan would require amendment to include the LBA tract. Since the NARO South LBA Tract would be an extension of the existing North Antelope/Rochelle Complex, the facilities and infrastructure would be the same as those identified in the WDEQ/LQD Mine Permit 569 Term T5 approved December 1, 1999 and the BLM Resource Recovery and Protection Plan approved July 23, 2001 for the North Antelope/Rochelle Complex.

PRCC's currently approved air quality permit from the WDEQ/AQD allows up to 105 million tons of coal per year to be mined in years 2004 through

2006. The North Antelope/Rochelle Complex produced 68.9 million tons of coal in 1999, 70.8 million tons of coal in 2000, and 74.8 million tons of coal in 2001 (Wyoming State Inspector of Mines 1999, 2000, and 2001). Under the No Action Alternative, the North Antelope/Rochelle Complex would mine its remaining 952 million tons of in-place coal reserves in approximately 12 years at an average production rate of 75 mmtpy (the production rate ranges between 8.7 mmtpy to 105 mmtpy). Under the Proposed Action, PRCC estimates that average annual coal production would be 90 million tons (the production rate ranges between 26 mmtpy to 105 mmtpy), and the life of the mine would be extended by approximately four years.

If PRCC acquires both the NARO North and NARO South LBA Tracts as applied for, they estimate that a total of 1,411.3 million tons of coal would be mined after January 1, 2002, with an estimated 506.9 million tons coming from the two LBA tracts. As of December 31, 2001, 643 million tons of coal had been mined from within the current permitted area of the mine.

Topsoil removal with heavy equipment would proceed ahead of overburden removal. Whenever possible, direct haulage to a reclamation area would be done, but due to scheduling, some topsoil would be temporarily stockpiled. As required by the reclamation plan, heavy equipment again would be used to haul and distribute the stockpiled topsoil.

2.0 Proposed Action and Alternatives

The North Antelope/Rochelle Complex is one of several mines currently operating in the PRB where the coal seams are notably thick and the overburden is relatively thin. Mining would be conducted in semi-independent pits. Overburden removal has been and would continue to be conducted using trucks and shovels, draglines, and/or direct cast blasting. Most overburden and all coal would be drilled and blasted to facilitate efficient excavation. The design of the North Antelope/Rochelle Complex seeks to confine disturbance to the active mine blocks. As overburden is removed, most would be directly placed into areas where coal has already been removed. Once the overburden has been replaced it is sampled and verified to be suitable overburden material, then graded to approximate final contour, ripped and finally topsoiled. If necessary, material that is found to be unsuitable would be adequately covered with suitable overburden material prior to grading and topsoiling. Elevations consistent with an approved PMT plan would be established as quickly as possible. Under certain conditions, the PMT may not be immediately achievable. This occurs when there is an excess of material that may require temporary stockpiling, when there is insufficient material available from current overburden removal operations, or when future mining could redisturb an area already mined. Once a seedbed has been formed, vegetation would be reestablished that is consistent with the postmining land use.

Coal would be produced from two seams (Wyodak-Anderson 1 and Wyodak-Anderson 2) that total 60 to 80 ft thick at several working faces to enable blending of the coal to meet customer quality requirements, to comply with BLM lease requirements for maximum economic recovery of the coal resource, and to optimize coal removal efficiency with available equipment. Coal would be loaded with electric-powered shovels into off-highway haul trucks for transport to crushing facilities. Coal haul roads would be temporary structures built within the mine areas. Mining efficiency and air quality protection are and would continue to be facilitated by extensive use of near-pit crushers and overland conveyors. There are three existing crushing facilities within the existing permit area. All transfer points on conveyor belts and the truck dump hopper at the processing plant are controlled by baghouse-type dust collectors, PECs, fogger/spray systems, or stilling sheds. There are five existing storage silos, each with a covered storage slot. While sufficient capacity exists, future changes in facilities may be constructed to improve operating efficiency and air quality protection. An additional near-pit crusher/conveyor, railroad loop, and two silos are planned whether or not PRCC acquires the NARO North or NARO South LBA Tracts. PRCC's recently approved (August 14, 2001) air quality permit from the WDEQ/AQD allows a maximum of 105 million tons of coal per year to be mined provided additional coal handling and processing facilities are constructed. The fourth crushing facility and two additional storage

silos have been permitted for construction.

Current full-time employment at the North Antelope/Rochelle Complex is 877, but PRCC anticipates that employment will increase to 1,175 under the No Action Alternative. If both the NARO North and NARO South LBA Tracts are acquired, PRCC anticipates that the average annual coal production would be approximately 90 million tons, the maximum annual coal production would be 105 million tons, and employment would be 1,185 persons at the maximum annual production rate of 105 million tons.

The NARO South LBA Tract was applied for by PRCC, but it is also located adjacent to the Antelope Mine, operated by ACC. ACC may also be in a position to mine the NARO South LBA Tract under the Proposed Action or Alternative 2 as a maintenance lease. If ACC acquires the tract, the rate of coal production, mining sequence, equipment, and facilities would be different than if PRCC acquired the tract as a maintenance lease, as described above. However, the area of disturbance and the impacts of removing the coal would not be substantially different from the area of disturbance and the impacts of PRCC mining the tract.

2.2.2 NARO South LBA Tract Alternative 1

Under the NARO South LBA Tract Alternative 1, the No-Action Alternative, the application to lease the coal included in the NARO South LBA Tract would be rejected, the tract

would not be offered for competitive sale, and the coal included in the tract would not be mined. This would not affect permitted mining activities and employment on the existing leases at the North Antelope/Rochelle Complex and would not preclude an application to lease the coal included in the NARO South LBA Tract in the future. Portions of the surface of the NARO South LBA Tract could be disturbed due to overstripping to allow coal to be removed from the adjacent existing leases.

Approximately 14,895.5 acres of federal coal are currently leased at the North Antelope/Rochelle Complex and a total of about 20,410 acres of land will be affected in mining the current leases. If the NARO North and NARO South LBA Tracts are not leased, PRCC estimates that the average annual production at the North Antelope/Rochelle Complex after 2001 will be 75 million tons, annual production will range from 8.7 million tons to 105 million tons, and employment will be approximately 1,175 persons at the maximum production rate.

In order to compare the economic and environmental consequences of mining these lands versus not mining them, this EIS was prepared under the assumption that an LBA tract would not be mined in the foreseeable future if the No Action Alternative for that tract is selected. However, selection of this alternative would not preclude leasing and mining of a rejected tract in the future, either as a maintenance tract for existing operations or as a new start mine.

2.0 Proposed Action and Alternatives

2.2.3 NARO South LBA Tract Alternative 2

Under Alternative 2 for the NARO South LBA Tract, BLM would reconfigure the tract and hold a competitive coal sale for the lands included in the reconfigured tract and issue a lease to the successful bidder. The modified tract would be subject to standard and special lease stipulations developed for the PRB and this tract if it is offered for sale (Appendix D). Alternative 2 for the NARO South LBA Tract assumes that PRCC would be the successful bidder on the tract if a lease sale is held and that the tract would be mined as a maintenance lease for the North Antelope/Rochelle Complex. Other assumptions are the same as for the Proposed Action.

BLM is considering an alternate tract configuration for the NARO South LBA Tract to potentially increase competitive interest in the tract and to maintain the fair market value of the remaining unleased federal coal in this area. Under this alternative, the BLM is considering adding additional lands to the NARO South LBA Tract as applied for. The lands that BLM is considering adding lie between the western edge of the tract as applied for and the BNSF & UP railroad ROW (Figure 2-1). Under Alternative 2 for the NARO South LBA Tract, BLM is considering adding all or part of the following lands to the NARO South LBA Tract:

T.41N., R.71W., 6th P.M., Campbell County, Wyoming

Section 23: Lots 1, 8, and 9;

120.88 acres
Section 24: Lots 1 through 16;
678.65 acres
Section 25: Lots 1 through 4, 9, 10,
and 12(N½)
268.64 acres
Total: 1,068.17 acres

PRCC estimates that these 1,068.17 acres contain approximately 146 million tons of mineable coal. If all of these lands are added to the NARO South LBA Tract, it would include approximately 3,201.81 mineable acres. PRCC estimates that the reconfigured tract includes approximately 387 million tons of in-place coal. Using PRCC's projected recovery factor of 79 percent, the reconfigured tract would contain about 307 million tons of recoverable coal. PRCC estimates that the average recovery factor for this reconfigured tract would be 79 percent because the 1,068.17 acres added in this alternative include areas that lie within the BNSF & UP railroad ROW and are therefore unsuitable for mining according to the coal leasing unsuitability criteria (43 CFR 3461). Although the coal included in these lands could not be mined, these lands have been included in this alternative tract configuration to allow maximum recovery of all the mineable coal outside of the ROW and to comply with the coal leasing regulations, which do not allow leasing of less than 10-acre aliquot parts.

BLM will independently evaluate the volume and average quality of the coal resources included in each tract offered for sale as part of the fair

market value determination process. The fact that the coal within the ROW and partially burned area cannot all be recovered would be considered by BLM in the fair market value determination for the LBA tract. BLM's estimate of the recoverable federal coal reserves and average quality of the coal included in each tract will be published in the sale notice for each tract that is offered for sale. Some general coal quality information in the area of the LBA tracts considered in this EIS is included in Section 3.3 of this document.

2.2.4 NARO South LBA Tract Alternative 3

Under Alternative 3 for the NARO South LBA Tract, BLM is considering a different tract configuration. As under Alternative 2, if this tract configuration is selected BLM would hold a competitive coal sale and issue a lease to the successful bidder. The modified tract would be subject to standard and special lease stipulations developed for the PRB and this tract if it is offered for sale (Appendix D). Alternative 3 for the NARO South LBA Tract assumes that PRCC would be the successful bidder on the tract if a lease sale is held and that the tract would be mined as a maintenance lease for the North Antelope/Rochelle Complex. Other assumptions would be the same as for the Proposed Action.

Under this alternative for the NARO South LBA Tract, BLM is considering removing some of the lands applied for in the western portion of the NARO South LBA Tract from

consideration for leasing at this time and offering a smaller tract for competitive sale (Figure 2-1). The coal that BLM is considering removing from the tract as applied for could be combined with the unleased federal coal between the reconfigured NARO South LBA Tract and the BNSF & UP railroad ROW to create a tract which could potentially have more competitive interest and a higher fair market value if it is leased in the future. The lands that BLM is considering removing from the tract are:

T.41N., R.70W., 6th P.M., Campbell County, Wyoming

Section 19: Lots 6 through 11 and 14 through 19;

483.74 acres

Section 30: Lots 6 through 11;

243.01 acres

Total:

726.75 acres

PRCC estimates that these 726.75 acres contain approximately 99.7 million tons of mineable coal. The Alternative 3 reconfiguration of the NARO South LBA Tract, therefore, results in a tract comprising approximately 1,406.89 mineable acres. PRCC estimates that the reconfigured tract includes approximately 141.4 million tons of in-place coal and that about 128 million tons of that coal would be recoverable. PRCC estimates that the average recovery factor for this reconfigured tract would be 91 percent because these 726.75 acres include lands unsuitable for mining due to the presence of partially

2.0 Proposed Action and Alternatives

burned areas where the coal is not recoverable.

BLM will independently evaluate the volume and average quality of the coal resources included in each tract offered for sale as part of the fair market value determination process. The fact that the coal within the partially burned area cannot all be recovered would be considered by BLM in the fair market value determination for the LBA tract. BLM's estimate of the recoverable federal coal reserves and average quality of the coal included in each tract will be published in the sale notice for each tract that is offered for sale. Some general coal quality information in the area of the LBA tracts considered in this EIS is included in Section 3.3 of this document.

successful bidder on the Little Thunder LBA Tract if it is offered for sale.

The legal description of the proposed Little Thunder LBA Tract coal lease lands as applied for by ALC under the Proposed Action is as follows:

T.43N., R.71W., 6th P.M., Campbell County, Wyoming

Section 2: Lots 5, 6, 11 through 14, 19 and 20;

320.93 acres

Section 11: Lots 1, 2, 7 through 10, 15 and 16;

302.42 acres

Section 12: Lots 2(W¹/₂ and SE¹/₄), 3 through 16;

602.60 acres

Section 13: Lots 1 through 16;

648.28 acres

2.3 Proposed Action and Alternatives for the Little Thunder LBA Tract

2.3.1 Little Thunder LBA Tract Proposed Action

Under the Proposed Action for the Little Thunder LBA Tract, the tract as applied for by ALC would be offered for lease at a separate, sealed-bid, competitive lease sale, subject to standard and special lease stipulations developed for the PRB and this tract (Appendix D). The boundaries of the tract would be consistent with the tract configurations proposed in the Little Thunder LBA Tract lease application (Figure 2-2). The Proposed Action assumes that ALC will be the

Figure 2-2

2.0 Proposed Action and Alternatives

Section 14: Lots 1, 2, 6 through 9, 14 and 15;

299.87 acres

Section 24: Lots 1 through 16;

630.52 acres

Section 25: Lots 1, 2, 7 through 10, 15 and 16;

315.78 acres

T.44N., R.71W., 6th P.M., Campbell County, Wyoming

Section 35: Lots 1, 2, 7 through 10, 15 and 16;

328.92 acres

Total surface area applied for:

3,449.32 acres

Land descriptions and acreage are based on the BLM Status of Public Domain Land and Mineral Titles approved Coal Plats as of August 23, 2001 and August 24, 2001.

As indicated in Chapter 1, Section 1.4, some of the above described lands in the Little Thunder LBA Tract are unsuitable for mining due to the presence of the BNSF & UP railroad and Wyoming Highway 450 ROWs. Although these lands would not be mined, they are included in the tract to allow maximum recovery of all the mineable coal outside of the railroad and highway rights-of-way and associated buffer zones and to comply with the coal leasing regulations, which do not allow leasing of less than 10-acre aliquot parts. The tract as applied for includes approximately 3,449.32 mineable acres. TBCC estimates that it includes approximately 479.3 million tons of in-place coal, and that about 440 million tons of that coal would be

recoverable. An average recovery factor of approximately 92 percent is therefore assumed, based largely upon TBCC's estimate of the unmineable reserves within the ROWs.

BLM will independently evaluate the volume and average quality of the mineable coal resources included in the tract as part of the fair market value determination process. The fact that the coal within the ROWs cannot all be recovered would be considered by BLM in the fair market value determination for the LBA tract. BLM's estimate of the mineable reserves and average quality of the coal included in the tract will be published in the sale notice if the tract is offered for sale. Some coal quality information in the area of the Little Thunder LBA Tract is included in Section 3.3 of this document.

The approved Black Thunder Mine Permit 233 Term T6 includes monitoring and mitigation measures for the Black Thunder Mine that are required by SMCRA and Wyoming State Law. If the Little Thunder LBA Tract is acquired by ALC, these monitoring and mitigation measures would be extended to cover operations on the LBA tract when the coal mining permit is revised to include the tract. This permit would have to be approved before mining operations could take place on the tract. These monitoring and mitigation measures are considered to be part of the Proposed Action and other action alternatives during the leasing process because they are regulatory requirements.

The Little Thunder LBA Tract would be mined as an integral part of the Black Thunder Mine under the Proposed Action. The Black Thunder Mine is already operating under both an approved state mining permit and MLA mining plan. Both the approved state mining permit and MLA mining plan would require amendment to include the LBA tract. Since the Little Thunder LBA Tract would be an extension of the existing Black Thunder Mine, the facilities and infrastructure would be the same as those identified in the WDEQ/LQD Mine Permit 233 Term T6 approved June 29, 2000 and the BLM Resource Recovery and Protection Plan approved October 5, 1999 for the Black Thunder Mine.

TBCC's currently approved air quality permit from the WDEQ/AQD allows up to 100 million tons of coal per year to be mined through year 2027. The Black Thunder Mine produced 48.7 million tons of coal in 1999, 60.1 million tons in 2000, and 67.6 million tons in 2001 (Wyoming State Inspector of Mines 1999, 2000, and 2001). Under the No Action Alternative, TBCC estimates that the Black Thunder Mine will produce 68.5 million tons per year for five years. Production will decrease when the West Pit of the mine reaches the existing West Black Thunder Lease boundary in 2008. The production rate will drop after 2008 because the configuration of the remaining reserves will cause the mine to relocate and retire mining equipment. Due to the mining conditions, the mine will produce an average of 23.3 million tons per year during the last 15 years. TBCC estimates that,

under the No Action Alternative, the mine will produce its remaining 919.4 million tons or recoverable coal reserves over a 24-year time-period at an average annual production rate of 38.3 million tons.

Under the Proposed Action, TBCC estimates that the Black Thunder mine would produce between 66 and 68.5 million tons per year for the next 13 years, then production would decrease when the mining conditions and pit configurations change once the West Pit reaches the Little Thunder Lease Boundary. Acquisition of the Little Thunder LBA Tract would allow the Black Thunder Mine to maintain peak production rates between 66 and 68.5 million tons per year for eight additional years. Under the Proposed Action, the mine would produce 1,359.4 million tons of recoverable coal reserves over a 32-year time-period at an average annual production rate of 42.5 million tons.

If ALC acquires the Little Thunder LBA Tract as applied for, they estimate that a total of 1,359.4 million tons of recoverable coal would be mined after January 1, 2002, with an estimated 440 million tons coming from the LBA tract. This estimate of recoverable reserves equates to about an eight percent loss of coal under normal mining practices. As of December 31, 2001, 699.9 million tons of coal have been mined from within the current permitted area of the mine.

Topsoil removal with heavy equipment would proceed ahead of overburden removal. Whenever

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possible, direct haulage to a reclamation area would be done, but due to scheduling, some topsoil would be temporarily stockpiled. As required by the reclamation plan, heavy equipment again would be used to haul and distribute the stockpiled topsoil.

The Black Thunder Mine is one of several mines currently operating in the PRB where the coal seams are notably thick and the overburden is relatively thin. Mining would be conducted in three separate pits identified as the West Pit, South Pit and North Pit. Overburden removal has been and would continue to be conducted using trucks and shovels, draglines, and/or direct cast blasting. Other equipment used during overburden removal and backfilling includes dozers, scrapers, excavators, front-end loaders, graders and water trucks. Most overburden and all coal is drilled and blasted to facilitate efficient excavation. The design of the Black Thunder Mine seeks to confine disturbance to the active mine blocks. As overburden is removed, most is directly placed into areas where coal has already been removed. Once the overburden has been replaced it is sampled and verified to be suitable overburden material, then graded to approximate final contour, ripped and finally topsoiled. If necessary, material that is found to be unsuitable would be adequately covered with suitable material prior to grading and topsoiling. Elevations consistent with an approved PMT plan would be established as quickly as possible. Under certain conditions, the PMT may not be immediately achievable. This occurs

when there is an excess of material that may require temporary stockpiling, when there is insufficient material available from current overburden removal operations, or when future mining could redisturb an area already mined. Once a seedbed has been formed, vegetation would be reestablished that is consistent with the postmining land use.

Coal would be produced from three seams, the Upper, Middle, and Lower Wyodak, at several working faces to enable blending of the coal to meet customer quality requirements, to comply with BLM lease requirements for maximum economic recovery of the coal resource, and to optimize coal removal efficiency with available equipment. Mining efficiency and air quality protection are and would continue to be facilitated by extensive use of near-pit crushers and overland conveyors. Coal would be loaded with electric-powered shovels or hydraulic excavators into off-highway haul trucks for transport to crushing facilities. Coal haul roads would be temporary structures built within the mine areas. All coal transfer location points and crushing operations are controlled by baghouse-type dust collectors or PECs. The truck dumping operations use stilling sheds to control fugitive dust and the overland conveyor is covered by a dust hood. There are two existing crushing facilities, two silos, and a slot storage facility within the permit area that provide capacity to produce at the permitted level. While sufficient capacity exists, future changes in facilities may be constructed to improve operating

efficiency and air quality protection. The existing near-pit crusher/conveyor systems would probably be relocated if ALC acquires the Little Thunder LBA Tract as applied for.

Current full-time employment at the Black Thunder Mine is approximately 600. If the LBA tract is acquired, TBCC anticipates that the average annual coal production would be approximately 42.5 million tons and no employment changes would be expected.

2.3.2 Little Thunder LBA Tract Alternative 1

Under the Little Thunder LBA Tract Alternative 1, the No-Action Alternative, the application to lease the coal included in the Little Thunder LBA Tract would be rejected, the tract would not be offered for competitive sale, and the coal included in the tract would not be mined. This would not affect permitted mining activities and employment on the existing leases at the Black Thunder Mine and would not preclude an application to lease the coal included in the Little Thunder LBA Tract in the future. Portions of the surface of the Little Thunder LBA Tract could be disturbed due to overstripping to allow coal to be removed from the adjacent existing leases.

Approximately 12,772.9 acres of federal coal are currently leased at the Black Thunder Mine and a total of about 18,476 acres of land will be affected in mining the current leases. Under the No Action Alternative,

TBCC estimates that the average annual production at the Black Thunder Mine after 2001 will be 38.3 million tons, and average employment will be approximately 600 persons.

In order to compare the economic and environmental consequences of mining these lands versus not mining them, this EIS was prepared under the assumption that an LBA tract would not be mined in the foreseeable future if the No Action Alternative for that tract is selected. However, selection of this alternative would not preclude leasing and mining of a rejected tract in the future, either as a maintenance tract for existing operations or as a new start mine.

2.3.3 Little Thunder LBA Tract Alternative 2

Under Alternative 2 for the Little Thunder LBA Tract, BLM would reconfigure the tract and hold a competitive coal sale for the lands included in the reconfigured tract and issue a lease to the successful bidder. The modified tract would be subject to standard and special lease stipulations developed for the PRB and this tract if it is offered for sale (Appendix D). Alternative 2 for the Little Thunder LBA Tract assumes that ALC would be the successful bidder on the tract if a lease sale is held and that the tract would be mined as a maintenance lease for the Black Thunder Mine. Other assumptions are the same as for the Proposed Action.

BLM is considering an alternate tract configuration for the Little Thunder LBA Tract in order to avoid creating a

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potential bypass situation and to enhance the fair market value of the remaining unleased coal in this area. Under this alternative, BLM is considering adding lands to the Little Thunder LBA Tract as applied for Figure 2-2). The lands that BLM is considering adding to the tract are:

T.43N., R.71W., 6th P.M., Campbell County, Wyoming

Section 1: Lot 16 (S½);

19.81 acres

Section 2: Lots 7 through 10 and 15 through 18;

321.18 acres

Section 11: Lots 3 through 6 and 11 through 14;

318.93 acres

Section 14: NW¼ NW¼, Lots 3 through 5 and 10 through 13;

324.79 acres

Section 25: Lots 3 through 6 and 11 through 14;

316.37 acres

T.44N., R.71W., 6th P.M., Campbell County, Wyoming

Section 35: Lots 3 through 6 and 11 through 14;

333.10 acres

Total: 1,634.18 acres

TBCC estimates that these 1,634.18 acres contain approximately 216 million tons of in-place coal. The Alternative 2 reconfiguration of the Little Thunder LBA Tract, therefore, results in a tract comprising approximately 5,083.50 acres containing approximately 695.3 million tons of in-place coal. Not all of the coal included in this tract

would be mineable, however. Some of the coal added by BLM under Alternative 2 is located within the BNSF & UP railroad ROW. This coal will not be mined because it has been determined to be unsuitable for mining according to the coal leasing unsuitability criteria (43 CFR 3461). Although the coal included in these lands within the ROW could not be mined, these lands would be included in this alternative tract configuration to allow maximum recovery of all the mineable reserves adjacent to the ROW and to comply with the coal leasing regulations, which do not allow leasing of less than 10-acre aliquot parts. TBCC estimates that approximately 113 million tons of coal would be produced from these additional 1,634.18 acres. The reconfigured tract would contain about 553 million tons of recoverable coal.

BLM will independently evaluate the volume and average quality of the coal resources included in each tract offered for sale as part of the fair market value determination process. The fact that the coal within the ROW cannot all be recovered would be considered by BLM in the fair market value determination for the LBA tract. BLM's estimate of the recoverable federal coal reserves and average quality of the coal included in each tract will be published in the sale notice for each tract that is offered for sale. Some general coal quality information in the area of the LBA tracts considered in this EIS is included in Section 3.3 of this document.

2.3.4 Little Thunder LBA Tract
Alternative 3

Under Alternative 3 for the Little Thunder LBA Tract, BLM is considering splitting the tract described under Alternative 2 and offering two tracts for competitive sale. The two tracts would each be subject to standard and special lease stipulations developed for the PRB and each tract if they are offered for sale (Appendix D). Alternative 3 for the Little Thunder LBA Tract assumes that ALC would be the successful bidder on the two tracts if lease sales are held and that the tracts would be mined as maintenance leases for the Black Thunder Mine. Other assumptions would be the same as for the Little Thunder LBA Tract Proposed Action.

Under Alternative 3, BLM is considering a division of the tract described in Alternative 2 into a north tract and a south tract in order to increase competitive interest in the federal coal. The tract described in Alternative 2 would be split into two tracts roughly along State Highway 450 and the BNSF & UP railroad spur to the Jacobs Ranch and Black Thunder Mines (Figure 2-2). The two tracts would be offered for sale at separate, competitive sealed bid sales. Both the north and south tracts could be offered for sale at this time, or the south tract could be offered for sale at this time and the north tract could potentially be combined with other unleased federal coal to create a larger tract. This north tract would potentially be of competitive interest to more than one mine.

The lands that BLM is considering including in the north tract are:

T.44N., R.71W., 6th P.M., Campbell County, Wyoming

Section 35: Lots 1 through 16;
662.02 acres

T.43N., R.71W., 6th P.M., Campbell County, Wyoming

Section 2: Lots 5 through 14;
403.47 acres

Total: 1,065.49 acres

The lands that BLM is considering including in the south tract are:

T.43N., R.71W., 6th P.M., Campbell County, Wyoming

Section 1: Lot 16(S½);
19.81 acres

Section 2: Lots 15 through 20;
238.64 acres

Section 11: Lots 1 through 16;
621.35 acres

Section 12: Lots 2(W½, SE¼), 3 through 16;
602.60 acres

Section 13: Lots 1 through 16;
648.28 acres

Section 14: NW¼ NW¼, Lots 1 through 15;
624.66 acres

Section 24: Lots 1 through 16;
630.52 acres

Section 25: Lots 1 through 16;
632.15 acres

Total: 4,018.01 acres

The Alternative 3 reconfiguration of the Little Thunder LBA Tract,

therefore, results in a north tract comprising 1,065.49 acres containing approximately 155.7 million tons of in-place coal, and a south tract comprising 4,018.01 acres containing approximately 539.6 million tons of in-place coal, according to information provided by the applicant. As discussed under Alternative 2, not all of the coal included in the north and south tracts would be mineable. Some of the coal included in the two tracts is located within the BNSF & UP railroad ROW. This coal would not be mined because it has been determined to be unsuitable for mining according to the coal leasing unsuitability criteria (43 CFR 3461). Although the coal included in these lands could not be mined, the lands would be included in the Alternative 3 tract configuration to allow maximum recovery of all the mineable reserves adjacent to the ROW and to comply with the coal leasing regulations, which do not allow leasing of less than 10-acre aliquot parts. TBCC estimates that approximately 111.9 million tons of coal would be produced from the 1,065.49-acre north tract and approximately 441.1 million tons of coal would be produced from the 4,018.01-acre south tract.

BLM will independently evaluate the volume and average quality of the coal resources included in each tract offered for sale as part of the fair market value determination process. The fact that the coal within the ROW cannot all be recovered would be considered by BLM in the fair market value determination for the LBA tracts. BLM's estimate of the

recoverable federal coal reserves and average quality of the coal included in each tract will be published in the sale notice for each tract that is offered for sale. Some general coal quality information in the area of the LBA tracts considered in this EIS is included in Section 3.3 of this document.

2.4 Proposed Action and Alternatives for the West Roundup LBA Tract

2.4.1 West Roundup LBA Tract Proposed Action

Under the Proposed Action for the West Roundup LBA Tract, the tract as applied for by TCC would be offered for lease at a separate, sealed-bid, competitive lease sale, subject to standard and special lease stipulations developed for the PRB (Appendix D). The boundaries of the tract would be consistent with the tract configuration proposed in the West Roundup LBA Tract lease application (Figure 2-3). As applied for, the West Roundup LBA Tract consists of two tracts separated by the North Rochelle Mine railroad spur

Figure 2-3

2.0 Proposed Action and Alternatives

and facilities and a county road (Reno Road). The Proposed Action assumes that TCC will be the successful bidder on the West Roundup LBA Tract if it is offered for sale.

The legal description of the proposed West Roundup LBA Tract coal lease lands as applied for by TCC under the Proposed Action is as follows:

T.42N., R.70W., 6th P.M., Campbell County, Wyoming

Section 6: Lots 8 through 19, 20(N½), 21(N½), 22(N½), and 23(N½);
539.28 acres

Section 7: Lots 5(S½), 6(S½), 7(S½), 8(S½), 9 through 14;
303.15 acres

Section 8: Lots 1(SW¼), 2(S½), 3(S½), 4(S½), 5 through 12;
384.09 acres

Section 9: Lots 5(SW¼), 11, 12, and 14;
130.39 acres

T.43N., R.70W., 6th P.M., Campbell County, Wyoming

Section 31: Lots 13 through 20;
314.23 acres

T.42N., R.71W., 6th P.M., Campbell County, Wyoming

Section 1: Lots 5, 6, and 11 through 13;
199.51 acres

Total surface area applied for:
1,870.65 acres

Land descriptions and acreage are based on the BLM Status of Public Domain Land and Mineral Titles

approved Coal Plats as of July 26, 2000, January 9, 2001 and May 9, 2001.

As indicated in Chapter 1, Section 1.4, no lands in the West Roundup LBA Tract as applied for were found to be unsuitable for mining. The tract as applied for includes approximately 1,870.65 mineable acres. TCC estimates that it includes approximately 173.2 million tons of in-place coal reserves and that about 155.9 million tons of that coal would be recoverable assuming a recovery factor of 90 percent.

BLM will independently evaluate the volume and average quality of the coal resources included in the tract as part of the fair market value determination process. BLM's estimate of the mineable reserves and average quality of the coal included in the tract will be published in the sale notice if the tract is offered for sale. Some coal quality information in the area of the West Roundup LBA Tract is included in Section 3.3 of this document.

The approved North Rochelle Mine Permit 550 Term T5 includes monitoring and mitigation measures for the North Rochelle Mine that are required by SMCRA and Wyoming State Law. If the West Roundup LBA Tract is acquired by TCC, these monitoring and mitigation measures would be extended to cover operations on the LBA tract when the coal mining permit is revised to include the tract. This permit would have to be approved before mining operations could take place on the tract. These monitoring and

mitigation measures are considered to be part of the Proposed Action and other action alternatives during the leasing process because they are regulatory requirements.

The West Roundup LBA Tract would be mined as an integral part of the North Rochelle Mine under the Proposed Action. The North Rochelle Mine is already operating under both an approved state mining permit and MLA mining plan. Both the approved state mining permit and MLA mining plan would require amendment to include the LBA tract. Since the West Roundup LBA Tract would be an extension of the existing North Rochelle Mine, the facilities and infrastructure would be the same as those identified in the WDEQ/LQD Mine Permit 550 Term T5 approved August 29, 2000 and the BLM Resource Recovery and Protection Plan approved July 12, 2000 for the North Rochelle Mine.

TCC's currently approved air quality permit allows up to 35 million tons of coal per year to be mined through year 2018. The North Rochelle Mine produced 8.2 million tons of coal in 1999, 17.2 million tons of coal in 2000, and 23.9 million tons of coal in 2001 (Wyoming State Inspector of Mines 1999, 2000, and 2001). Under the No Action Alternative, the North Rochelle Mine would mine its remaining 283 million tons of in-place coal reserves in approximately 7.3 years at an average production rate of 35 mmtpy. Under the Proposed Action, TCC currently estimates that average annual production would be 35 million tons and the life of the

mine would be extended by approximately 4.5 years.

If TCC acquires the West Roundup LBA Tract as applied for, they estimate that a total of 410.9 million tons of coal would be mined after January 1, 2002, with an estimated 155.9 million tons coming from the LBA tract. This estimate of recoverable reserves assumes that about 10 percent of the coal would be lost under normal mining practices, based on historical recovery factors at the North Rochelle Mine. As of December 31, 2001, 49.3 million tons of coal had been mined from within the current permitted area of the mine.

Topsoil removal with heavy equipment would proceed ahead of overburden removal. Whenever possible, direct haulage to a reclamation area would be done, but due to scheduling, some topsoil would be temporarily stockpiled. As required by the reclamation plan, heavy equipment again would be used to haul and distribute the stockpiled topsoil.

The North Rochelle Mine is one of several mines currently operating in the PRB where the coal seams are notably thick and the overburden is relatively thin. Overburden removal has been and would continue to be by truck/shovel operation and the combination of cast-blasting and dragline. Most overburden and all coal is drilled and blasted to facilitate efficient excavation. The design of the North Rochelle Mine seeks to confine disturbance to the active mine blocks. As overburden is removed, most is

directly placed into areas where coal has already been removed. Once the overburden has been replaced it is sampled and verified to be suitable overburden material, then graded to approximate final contour, ripped and finally topsoiled. If necessary, material that is found to be unsuitable would be adequately covered with suitable overburden material prior to grading and topsoiling. Elevations consistent with an approved PMT plan would be established as quickly as possible. Under certain conditions, the PMT may not be immediately achievable. This occurs when there is an excess of material that may require temporary stockpiling, when there is insufficient material available from current overburden removal operations, or when future mining could redisturb an area already mined. Once a seedbed has been formed, vegetation would be reestablished that is consistent with the postmining land use.

Coal would be produced from two seams of the Wyodak bed, a thin, discontinuous rider seam (referred to as the “D” seam or Upper Wyodak) and a uniformly thick main seam (referred to as the “E” seam or Middle Wyodak), at several working faces to enable blending of the coal to meet customer quality requirements, to comply with BLM lease requirements for maximum economic recovery of the coal resource, and to optimize coal removal efficiency with available equipment. The “D” seam (Upper Wyodak) fluctuates greatly in thickness and quality throughout the mine area. Therefore, the recoverable portion of the “D” seam is highly

variable, thus reducing the overall recovery factor for the coal reserves to approximately 90 percent. Mining efficiency and air quality protection are and would continue to be facilitated by extensive use of near-pit crushers and overland conveyors. Coal would be loaded with electric-powered shovels or hydraulic front-end loaders into off-highway haul trucks for transport to crushing facilities. Coal haul roads, crushing facilities and conveyors would be temporary structures built within the mine area. All coal transfer location points and crushing operations are controlled by baghouse-type dust collectors, and dry mist foggers are being reviewed for permitting at several locations throughout the mine. Truck dumping operations use stilling sheds to control fugitive dust. While sufficient capacity exists, future changes in facilities may be constructed to improve operating efficiency and air quality protection. Additional near-pit crusher/conveyor systems would be constructed and moved as the mining operation progresses. A new truck dump/crusher and conveyor system was added in 2001.

Current full-time employment at the North Rochelle Mine is approximately 224. If the LBA tract is acquired, TCC anticipates that the average annual coal production would be approximately 35 million tons with employment increasing to 400 persons.

The West Roundup LBA Tract was applied for by TCC, but it is also located adjacent to the Black Thunder Mine, operated by TBCC. TBCC may

also be in a position to mine the West Roundup LBA Tract as a maintenance lease under the Proposed Action and Alternatives 2 and 3. If ALC acquires the tract, the rate of coal production, mining sequence, equipment, and facilities would be different than if TCC acquired the tract as a maintenance lease, as described above. However, the area of disturbance and the impacts of removing the coal would not be substantially different from the area of disturbance and the impacts of TCC mining the tract.

2.4.2 West Roundup LBA Tract Alternative 1

Under the West Roundup LBA Tract Alternative 1, the No-Action Alternative, the application to lease the coal included in the West Roundup LBA Tract would be rejected, the tract would not be offered for competitive sale, and the coal included in the tract would not be mined. This would not affect permitted mining activities and employment on the existing leases at the North Rochelle Mine and would not preclude an application to lease the coal included in the West Roundup LBA Tract in the future. Portions of the surface of the West Roundup LBA Tract could be disturbed due to overstripping to allow coal to be removed from the adjacent existing leases.

Approximately 3,443.5 acres of federal coal are currently leased at the North Rochelle Mine and a total of about 5,288 acres of land will be affected in mining the current leases. Under the No Action Alternative, TCC

estimates that the average annual production at the North Rochelle Mine after 2001 will be 35 million tons, and average employment will be 224 persons.

In order to compare the economic and environmental consequences of mining these lands versus not mining them, this EIS was prepared under the assumption that an LBA tract would not be mined in the foreseeable future if the No Action Alternative for that tract is selected. However, selection of this alternative would not preclude leasing and mining of a rejected tract in the future, either as a maintenance tract for existing operations or as a new start mine.

2.4.3 West Roundup LBA Tract Alternative 2

Under Alternative 2 for the West Roundup LBA Tract, BLM would reconfigure the tract and hold a competitive coal sale for the lands included in the reconfigured tract and issue a lease to the successful bidder. The modified tract would be subject to standard and special lease stipulations developed for the PRB and this tract if it is offered for sale (Appendix D). Alternative 2 for the West Roundup LBA Tract assumes that TCC would be the successful bidder on the tract if a lease sale is held and that the tract would be mined as a maintenance lease for the North Rochelle Mine. Other assumptions are the same as for the Proposed Action.

As applied for, the West Roundup LBA Tract consists of two non-contiguous tracts of federal coal

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separated by the North Rochelle Mine railroad spur, the North Rochelle Mine facilities, and a county road known as Reno Road (Figure 1-4). Under Alternative 2 for the West Roundup LBA Tract, the size of the tract as applied for would be increased to include the area between the two tracts as applied for (Figure 2-3). BLM is considering including this coal to prevent some or all of the coal in this area from being bypassed. As discussed in Section 1.4, USFS has determined that lands under a USFS special use permit for ancillary facilities at the North Rochelle Mine are unsuitable for mining under Unsuitability Criterion 2. The area that would be added under this alternative is included in the USFS special use permit. It would not be economically feasible to move the railroad spur, county road, and mine facilities to recover all the coal at this time. However, BLM is considering including this area in the tract because it may be possible to recover portions of the coal reserves in this area when the rest of the tract is mined if it is leased at this time. It may also be economically feasible at some point in the future to move the road and railroad spur and recover the coal if it is leased. The lands that BLM is considering adding to the tract are:

T.42N., R.70W., 6th P.M., Campbell County, Wyoming

Section 4: Lots 17(S½ S½) and 18(S½ S½);

19.53 acres

Section 5: Lots 17(S½), 18(S½), 19(S½ S½), and 20(S½ S½);

58.33 acres

Section 6: Lots 20(S½), 21(S½), 22(S½), and 23(S½);

77.35 acres

Section 7: Lots 5(N½), 6(N½), 7(N½), and 8(N½);

77.18 acres

Section 8: Lots 1(N½, SE¼), 2(N½), 3(N½), and 4(N½);

87.86 acres

Section 9: Lots 1 through 4, 5(N½ SE¼), 6 through 8;

305.89 acres

Total: 626.14 acres

TCC estimates that these 626.14 acres contain approximately 51.4 million tons of mineable coal. The Alternative 2 reconfiguration of the West Roundup LBA Tract, therefore, results in a tract comprising approximately 2,496.79 acres containing approximately 224.6 million tons of in-place coal. Using TCC's projected recovery factor of 90 percent, the reconfigured tract would contain about 202.1 million tons of recoverable coal, assuming that the coal underlying the railroad spur and facilities would be economically recoverable at some point in the future.

BLM will independently evaluate the volume and average quality of the coal resources included in the tract as part of the fair market value determination process. The fact that the coal underlying the railroad spur, county road, and mine facilities cannot be economically recovered at this time would be considered by BLM in the fair market value determination for the LBA tract. BLM's estimate of the recoverable reserves and average quality of the coal included in the

tract will be published in the sale notice if the tract is offered for sale. Some coal quality information in the area of the West Roundup LBA Tract is included in Section 3.3 of this document.

On February 9, 2001, TCC filed an application to modify an existing federal coal lease (WYW-127221) at the North Rochelle Mine by adding 155.90 acres to the southern end of that lease. BLM is processing that lease modification application. In the event that the lands included in the lease modification application are not added to federal coal lease WYW-127221 as proposed, BLM will consider offering them, as well as the 616.35 acres described above, in West Roundup LBA Tract Alternative 2. The additional lands that would be added to the tract as applied for under Alternative 2 if lease WYW-127221 is not modified are:

T.42N., R.70W., 6th P.M., Campbell County, Wyoming

Section 4: Lots 17(N½, N½ S½), and 18(N½, N½ S½);

58.58 acres

Section 5: Lots 17(N½), 18(N½), 19 (N½, N½ S½), and 20 (N½, N½ S½);

97.32 acres

Total: 155.90 acres

TCC estimates that these 155.90 acres contain approximately 13 million tons of mineable coal. Therefore, if lease WYW-127221 is not modified, the Alternative 2 reconfiguration of the West Roundup LBA Tract results in a tract comprising approximately 2,652.69

acres containing approximately 237.6 million tons of in-place coal. Using TCC's projected recovery factor of 90 percent, the reconfigured tract would contain about 213.8 million tons of recoverable coal, assuming that the coal underlying the railroad spur and facilities would be economically recoverable at some point in the future.

2.4.4 West Roundup LBA Tract Alternative 3

Under Alternative 3 for the West Roundup LBA Tract, BLM would reconfigure the tract and hold a competitive coal sale for the lands included in the reconfigured tract and issue a lease to the successful bidder. The modified tract would be subject to standard and special lease stipulations developed for the PRB and this tract if it is offered for sale (Appendix D). Alternative 3 for the West Roundup LBA Tract assumes that TCC would be the successful bidder on the tract if a lease sale is held and that the tract would be mined as a maintenance lease for the North Rochelle Mine. Other assumptions are the same as for the Proposed Action.

Under Alternative 3 for the West Roundup LBA Tract, the size of the tract as applied for would be increased. The area between the two tracts as applied for would be added as under Alternative 2, along with additional lands to the west and south of the tract as applied for (Figure 2-3). The BLM is considering adding additional lands to the south and west to enhance the value of the remaining unleased federal coal in

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this area. As Under Alternative 2, the area between the two tracts that would be added under this alternative is included in the USFS special use permit, which USFS has determined to be unsuitable for mining. However, it may be possible to recover portions of coal that would be added under the North Rochelle Mine railroad spur, North Rochelle Mine facilities, and Reno Road when the rest of the tract is mined. The additional lands that BLM is considering adding to the tract under this alternative are:

T.42N., R.70W., 6th P.M., Campbell County, Wyoming

Section 4: Lots 17(S½ S½), and 18(S½ S½);

19.53 acres

Section 5: Lots 17(S½), 18(S½), 19(S½ S½), and 20(S½ S½);

58.33 acres

Section 6: Lots 20(S½), 21(S½), 22(S½), and 23(S½);

77.35 acres

Section 7: Lots 5(N½), 6(N½), 7(N½), and 8(N½);

77.18 acres

Section 8: Lots 1(N½, SE¼), 2(N½), 3(N½), 4(N½), and 16;

127.87 acres

Section 9: Lots 1 through 4, 5(N½, SE¼), 6 through 8, and 13;

346.09 acres

T.42N., R.71W., 6th P.M., Campbell County, Wyoming

Section 1: Lots 7 through 10, 14, 15, 19, and 20;

317.03 acres

Total: 1,023.38 acres

TCC estimates that these 1,023.38 acres contain approximately 101 million tons of in-place coal. The Alternative 3 reconfiguration of the West Roundup LBA Tract, therefore, results in a tract comprising approximately 2,894.03 acres containing approximately 274.2 million tons of in-place coal. Using TCC's projected recovery factor of 90 percent, the reconfigured tract would contain about 246.8 million tons of recoverable coal, assuming that the coal underlying the railroad spur and facilities would be economically recoverable at some point in the future.

BLM will independently evaluate the volume and average quality of the coal resources included in the tract as part of the fair market value determination process. The fact that the coal underlying the railroad spur, county road, and mine facilities cannot be economically recovered would be considered by BLM in the fair market value determination for the LBA tract. BLM's estimate of the recoverable reserves and average quality of the coal included in the tract will be published in the sale notice if the tract is offered for sale. Some coal quality information in the area of the West Roundup LBA Tract is included in Section 3.3 of this document.

Alternative 3 for the West Roundup LBA Tract also would include the lease modification area discussed in Section 2.4.3 in the tract that would be offered for lease. On February 9, 2001, TCC filed an application to modify an existing federal coal lease (WYW-127221) at the North Rochelle

Mine by adding 155.90 acres to the southern end of that lease. BLM is processing that lease modification application. In the event that the lands included in the lease modification application are not added to federal coal lease WYW-127221 as proposed, BLM will consider offering them, as well as the 1,023.38 acres described above, in West Roundup LBA Tract Alternative 3. The additional lands that would be added to the tract as applied for under Alternative 3 if lease WYW-127221 is not modified:

T.42N., R.70W., 6th P.M., Campbell County, Wyoming

Section 4: Lots 17(N½, N½ S½), and 18 (N½, N½ S½);

58.58 acres

Section 5: Lots 17(N½), 18(N½), 19 (N½, N½ S½), and 20 (N½, N½ S½);

97.32 acres

Total: 155.90 acres

TCC estimates that these 155.90 acres contain approximately 13 million tons of mineable coal. Therefore, if lease WYW-127221 is not modified, the Alternative 3 reconfiguration of the West Roundup LBA Tract results in a tract comprising approximately 3,049.93 acres containing approximately 287.2 million tons of in-place coal. Using TCC's projected recovery factor of 90 percent, the reconfigured tract would contain about 258.5 million tons of recoverable coal, assuming that the coal underlying the railroad spur and facilities would be economically recoverable at some point in the future.

2.5 Proposed Action and Alternatives for the West Antelope LBA Tract

2.5.1 West Antelope LBA Tract Proposed Action

Under the Proposed Action for the West Antelope LBA Tract, the tract as applied for by ACC would be offered for lease at a separate, sealed-bid, competitive lease sale, subject to standard and special lease stipulations developed for the PRB (Appendix D). The boundaries of the tract would be consistent with the tract configuration proposed in the West Antelope LBA Tract lease application (Figure 2-4). The Proposed Action assumes that ACC will be the successful bidder on the West Antelope LBA Tract if it is offered for sale.

The legal description of the proposed West Antelope LBA Tract coal lease lands as applied for by ACC under the Proposed Action is as follows:

Figure 2-4

T.40N., R.71W., 6th P.M., Converse County, Wyoming

Section 3: Lots 15 through 18;
159.78 acres

Section 4: Lots 5 through 20;
487.25 acres

Section 5: Lots 5 through 7, 10 through 15, 19, and 20;
320.84 acres

Section 9: Lot 1;
40.14 acres

Section 10: Lots 3 and 4;
80.65 acres

T.41N., R.71W., 6th P.M., Converse and Campbell Counties, Wyoming

Section 28: Lots 1 through 16;
649.21 acres

Section 29: Lots 1 through 16;
659.81 acres

Section 32: Lots 1 through 3, 6 through 11, 14 through 16;
486.16 acres

Section 33: Lots 1 through 16;
658.35 acres

Total surface area applied for:
3,542.19 acres

Land descriptions and acreage are based on the BLM Status of Public Domain Land and Mineral Titles approved Coal Plats as of July 26, 2000, May 9, 2001 and September 6, 2001.

As indicated in Chapter 1, Section 1.4, no lands in the West Antelope LBA Tract were found to be unsuitable for mining. ACC's approved mining plan avoids disturbing Antelope Creek and an adjacent buffer zone, so it is assumed that any coal resources included in

the above described lands that are beneath Antelope Creek would not be recovered. ACC estimates that the tract as applied for includes approximately 2,755.16 mineable acres with approximately 293.9 million tons of in-place coal, 245.6 million tons of mineable coal, and that about 228.4 million tons of that coal would be recoverable assuming a recovery factor of 93 percent.

BLM will independently evaluate the volume and average quality of the coal resources included in the tract as part of the fair market value determination process. The fact that the coal underlying Antelope Creek and the adjacent buffer zone will not be mined would be considered by BLM in the fair market value determination for the LBA tract. BLM's estimate of the recoverable reserves and average quality of the coal included in the tract will be published in the sale notice if the tract is offered for sale. Some coal quality information in the area of the West Antelope LBA Tract is included in Section 3.3 of this document.

The approved Antelope Mine Permit 525 Term T6 includes monitoring and mitigation measures for the Antelope Mine that are required by SMCRA and Wyoming State Law. If the West Antelope LBA Tract is acquired by ACC, these monitoring and mitigation measures would be extended to cover operations on the LBA tract when the coal mining permit is revised to include the tract. This permit would have to be approved before mining operations could take place on the tract. These monitoring and mitigation measures are considered to

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be part of the Proposed Action and other action alternatives during the leasing process because they are regulatory requirements.

The West Antelope LBA Tract would be mined as an integral part of the Antelope Mine under the Proposed Action. The Antelope Mine is already operating under both an approved state mining permit and MLA mining plan. Both the approved state mining permit and MLA mining plan would require amendment to include the LBA tract. Since the West Antelope LBA Tract would be an extension of the Antelope Mine, the facilities and infrastructure would be the same as those identified in the WDEQ/LQD Mine Permit 525 Term T6 approved November 3, 1998 and the BLM Resource Recovery and Protection Plan approved August 27, 2001 for the Antelope Mine.

ACC's currently approved air quality permit allows up to 32 million tons of coal per year to be mined through year 2017. The Antelope Mine produced 22.7 million tons of coal in 1999, 23 million tons of coal in 2000, and 24.6 million tons of coal in 2001 (Wyoming State Inspector of Mines 1999, 2000, and 2001). Under the No Action Alternative, the Antelope Mine would mine its remaining 347.3 million tons of recoverable coal reserves in approximately 25 years at an average annual production rate of 13.9 million tons and at a maximum production rate of 32 mmtpy. Under the Proposed Action, ACC currently estimates that average annual coal production would be 23 million tons, the maximum annual production would be 32 million tons, and the life

of the mine is expected to remain at 25 years.

If ACC acquires the West Antelope LBA Tract as applied for, they estimate that a total of 575.7 million tons of coal would be mined after January 1, 2002, with an estimated 228.4 million tons coming from the LBA tract. This estimate of recoverable reserves assumes that about seven percent of the coal would be lost under normal mining practices, based on historical recovery factors at the Antelope Mine. As of December 31, 2001, 169 million tons of coal had been mined from within the current permitted area of the mine.

Topsoil removal with heavy equipment would proceed ahead of overburden removal. Whenever possible, direct haulage to a reclamation area would be done, but due to scheduling, some topsoil would be temporarily stockpiled. As required by the reclamation plan, heavy equipment again would be used to haul and distribute the stockpiled topsoil.

Overburden has been and would continue to be removed by dragline and truck and shovel operations. Most overburden and all coal is drilled and blasted to facilitate efficient excavation. The design of the Antelope Mine seeks to confine disturbance to the active mine blocks. As overburden is removed, most would be directly placed into areas where coal has already been removed. Once the overburden has been replaced it is sampled and verified to be suitable overburden material, then

graded to approximate final contour, ripped and finally topsoiled. If necessary, material that is found to be unsuitable would be adequately covered with suitable overburden material prior to grading and topsoiling. Elevations consistent with an approved PMT plan would be established as quickly as possible. Under certain conditions, the PMT may not be immediately achievable. This occurs when there is an excess of material that may require temporary stockpiling, when there is insufficient material available from current overburden removal operations, or when future mining could redisturb an area already mined. Once a seedbed has been formed, vegetation would be reestablished that is consistent with the postmining land use.

Coal would be produced from as many as four seams of the primary Anderson and Canyon beds at several working faces to enable blending of the coal to meet customer quality requirements, to comply with BLM lease requirements for maximum economic recovery of the coal resource, and to optimize coal removal efficiency with available equipment. Mining efficiency and air quality protection are and would continue to be facilitated by extensive use of near-pit crushers and overland conveyors from the crushers to the storage and loadout facilities. Coal would be loaded with electric-powered shovels or hydraulic excavators into off-highway haul trucks for transport to crushing facilities. Coal haul roads, crushing facilities and conveyors would be temporary structures built within the mine area.

All coal transfer location points and crushing operations are controlled by baghouse-type dust collectors or PECs. The truck dumping operations use stilling sheds to control fugitive dust and the overland conveyors are covered by dust hoods. While sufficient capacity exists, future changes in facilities may be constructed to improve operating efficiency and air quality protection. The conveyor systems would be extended to reach each of the various mine areas if ACC acquires the West Antelope LBA Tract.

Current full-time employment at the Antelope Mine is 215. If the LBA tract is acquired, ACC anticipates that the average annual coal production would be approximately 23 million tons, and no additional employment would be expected.

2.5.2 West Antelope LBA Tract Alternative 1

Under the West Antelope LBA Tract Alternative 1, the No-Action Alternative, the application to lease the coal included in the West Antelope LBA Tract would be rejected, the tract would not be offered for competitive sale, and the coal included in the tract would not be mined. This would not affect permitted mining activities and employment on the existing leases at the Antelope Mine and would not preclude an application to lease the coal included in the West Antelope LBA Tract in the future. Portions of the surface of the West Antelope LBA Tract could be disturbed due to overstripping to allow coal to be

2.0 Proposed Action and Alternatives

removed from the adjacent existing leases.

Approximately 8,019.2 acres of federal coal are currently leased at the Antelope Mine and a total of about 8,821 acres of land will be affected in mining the current leases. Under the No Action Alternative, ACC estimates that the average annual production at the Antelope Mine after 2001 will be 13.9 million tons, and average employment will be 215 persons.

In order to compare the economic and environmental consequences of mining these lands versus not mining them, this EIS was prepared under the assumption that an LBA tract would not be mined in the foreseeable future if the No Action Alternative for that tract is selected. However, selection of this alternative would not preclude leasing and mining of a rejected tract in the future, either as a maintenance tract for existing operations or as a new start mine.

2.5.3 West Antelope LBA Tract Alternative 2

Under Alternative 2 for the West Antelope LBA Tract, BLM would reconfigure the tract and hold a competitive coal sale for the lands included in the reconfigured tract and issue a lease to the successful bidder. The modified tract would be subject to standard and special lease stipulations developed for the PRB and that tract if it is offered for sale (Appendix D). Alternative 2 for the West Antelope LBA Tract assumes that ACC would be the successful bidder on the tract if a lease sale is

held and that the tract would be mined as a maintenance lease for the Antelope Mine. Other assumptions are the same as for the Proposed Action.

BLM is considering an alternate tract configuration for the West Antelope LBA Tract in order to avoid creating a potential bypass situation (Figure 2-4). Adding the area between the West Antelope LBA Tract as applied for and the existing Horse Creek lease (WYW 141435, issued effective December 1, 2000) would enlarge the original configuration of the West Antelope LBA Tract. The lands that BLM is considering adding to the tract are:

T.41N., R.71W., 6th P.M., Campbell County, Wyoming

Section 22: Lots 2 and 16;	
	85.20 acres
Section 27: Lots 6 through 11;	
	250.51 acres
Total:	<u>335.71 acres</u>

The increase to the West Antelope LBA Tract would be 335.71 acres containing approximately 27.9 million tons of in-place coal. The Alternative 2 reconfiguration, therefore, results in a tract comprising approximately 3,877.90 acres containing approximately 321.8 million tons of in-place coal. After eliminating coal that would not be mined beneath Antelope Creek and the adjacent buffer zone, ACC estimates that the reconfigured tract includes approximately 3,091 mineable acres with approximately 273.4 million tons of mineable coal. Using ACC's projected recovery factor of 93

percent, the reconfigured tract would contain about 254.3 million tons of recoverable coal.

BLM will independently evaluate the volume and average quality of the coal resources included in the tract as part of the fair market value determination process. The fact that the coal underlying Antelope Creek and the adjacent buffer zone will not be mined would be considered by BLM in the fair market value determination for the LBA tract. BLM's estimate of the recoverable reserves and average quality of the coal included in the tract will be published in the sale notice if the tract is offered for sale. Some coal quality information in the area of the West Antelope LBA Tract is included in Section 3.3 of this document.

2.5.4 West Antelope LBA Tract Alternative 3

Under Alternative 3 for the West Antelope LBA Tract, BLM is considering a different tract configuration. As under Alternative 2, if this tract configuration is selected BLM would hold a competitive coal sale and issue a lease to the successful bidder. The modified tract would be subject to standard and special lease stipulations developed for the PRB and that tract if it is offered for sale (Appendix D). Alternative 3 for the West Antelope LBA Tract assumes that ACC would be the successful bidder on the tract if a lease sale is held and that the tract would be mined as a maintenance lease for the Antelope Mine. Other assumptions

would be the same as for the Proposed Action.

Under this alternative for the West Antelope LBA Tract, BLM is considering removing some of the lands applied for in the northern portion of the West Antelope LBA Tract from consideration for leasing at this time and offering a smaller tract for competitive sale (Figure 2-4). The coal that BLM is considering removing from the tract as applied for could be combined with the unleased federal coal in this area to create a tract which could potentially have more competitive interest and a higher fair market value if it is leased in the future. The lands that BLM is considering removing from the tract are:

T.41N., R.71W., 6th P.M., Campbell County, Wyoming

Section 28: Lots 1 through 8;	332.50 acres
Section 29: Lots 1 through 8, 12, and 13:	410.56 acres
Total:	<u>733.06 acres</u>

ACC estimates that these 733.06 acres contain approximately 91.6 million tons of in-place coal. The Alternative 3 reconfiguration of the West Antelope LBA Tract, therefore, results in a tract comprising approximately 2,809.13 acres containing approximately 202.3 million tons of in-place coal, according to information provided by the applicant. After eliminating coal that would not be mined beneath Antelope Creek and the adjacent

buffer zone, ACC estimates that the reconfigured tract includes approximately 2,022.1 mineable acres with approximately 183.2 million tons of mineable coal. Using ACC's projected recovery factor of 93 percent, the reconfigured tract would contain about 170.4 million tons of recoverable coal.

BLM will independently evaluate the volume and average quality of the coal resources included in each tract offered for sale as part of the fair market value determination process. The fact that the coal underlying Antelope Creek and the adjacent buffer zone will not be mined would be considered by BLM in the fair market value determination for the LBA tract. BLM's estimate of the recoverable federal coal reserves and average quality of the coal included in each tract will be published in the sale notice for each tract that is offered for sale. Some general coal quality information in the area of the LBA tracts considered in this EIS is included in Section 3.3 of this document.

2.6 Alternatives Considered but Not Analyzed in Detail

2.6.1 Alternative 4

Under this alternative, as under the Proposed Action and Alternatives 2 and 3, the BLM would hold a separate, competitive, sealed-bid sale

for the lands included in one or more of the LBA tracts. Alternative 4 assumes, however, that the successful qualified bidder would be someone other than the applicant and that this bidder would plan to open a new mine to develop the coal resources in one or more of the LBA tracts (NARO North, NARO South, Little Thunder, West Roundup, and West Antelope).

A company or companies acquiring this coal for one or more new stand-alone mines would require considerable initial capital expenses, including the construction of new surface facilities (i.e., offices, shops, warehouses, coal processing facilities, coal loadout facilities, and rail spur), extensive baseline data collection, and development of new mining and reclamation plans. In addition, a company or companies acquiring this coal for one or more new start mines would have to compete for customers with established mines in a competitive market.

BLM currently estimates that a tract would potentially need to include as much as 500 to 600 million tons of coal in order to attract a buyer interested in opening a new mine in the Wyoming PRB. This is based on the assumptions that an operator would construct facilities capable of producing 30 mmtpy to take advantage of the economies of scale offered by the coal deposits in the PRB and that 20 to 30 years of coal reserves would be needed to justify the expense of building the facilities described above. Given these assumptions, it is questionable whether most of the tracts under the

Proposed Action or Alternatives 2 or 3 potentially include sufficient coal resources to support a new mine.

The potential difficulty in obtaining an air quality permit is another issue which could discourage new mine starts in the PRB. A new mine would create a new source of air quality impacts. As discussed in Chapter 3, the WDEQ/AQD administers a permitting program to assist the agency in managing the State's air resources. Under this program, anyone planning to construct, modify, or use a facility capable of emitting designated pollutants into the atmosphere must obtain an air quality permit to construct. Coal mines fall into this category.

In order to obtain a construction permit, an operator may be required to demonstrate that the proposed activities will not increase air pollutant levels above annual standards established by the Wyoming Air Quality Standards and Regulations (WDEQ/AQD 2000). Due to the current levels of mineral development (coal and oil and gas) in the Wyoming PRB, the Wyoming air quality standards have been exceeded several times recently in the southern PRB. Therefore, it may be difficult for an operator planning on opening a new mine to demonstrate that new operations would not result in air pollution levels that are above annual Wyoming standards.

In view of the issues discussed above, development of new mines on one or more of the LBA tracts included in this EIS is considered unlikely and

this alternative is not analyzed in detail.

The environmental impacts of developing one or more new mines to recover the coal resources in one or more of these LBA tracts would be greater than under the Proposed Action, the No Action Alternative, or Alternatives 2 or 3 because of the need for new facilities, new rail lines, new employment, and the creation of additional sources of particulates (dust). In the event that one or more lease sales are held and the applicants are not the successful bidders, the successful bidder or bidders would be required to submit detailed mining and reclamation plans for approval before any of the tracts could be mined, and this NEPA analysis would be reviewed and supplemented as necessary prior to approval of those mining and reclamation plans.

2.6.2 Alternative 5

Under Alternative 5, the BLM would delay the sale of one or more of the LBA tracts as applied for. Delaying the sale of one or more of the tracts would allow CBM resources to be more completely recovered prior to mining. Also, the prices received for coal from the PRB have generally been decreasing in recent years. If coal lease sales are delayed until prices increase, the bonus and royalty payments to the government might be higher. Under this alternative, it is assumed that one or more of the tracts could be developed later as maintenance tracts or new start mines, depending on how long the sales were delayed.

CBM wells presently exist or are proposed on oil and gas leases inside or adjacent to the NARO North, NARO South, Little Thunder, West Roundup, and West Antelope LBA Tracts as proposed. If one or more of the LBA tracts included in this EIS are leased, mining cannot occur until the lessees have approved mining and reclamation permits and MLA mining plans, which generally takes several years. This would allow time for a large portion of the CBM resources to be recovered from the tracts.

There are two major sources of revenue to state and federal governments from the leasing and mining of federal coal: 1) the competitive bonus bid paid at the time the coal is leased, and 2) federal and state royalties and taxes collected when the coal is sold. This alternative could potentially increase the fair market value of the coal resources in one or more of the LBA tracts, which could increase the bonus bid when the coal is leased. The price paid for coal from northeastern Wyoming decreased by more than \$1.00 per ton from 1992 to 2000, while production of low sulfur PRB coal increased annually. Prices for PRB coal increased slightly in 2000 and 2001, and are projected to remain stable or increase slightly from 2002 through 2007 (WSGS 2002a). There is no assurance that delaying one or more of the sales would result in a higher coal price or a higher bonus bid.

The fair market value of these tracts and the resulting bonus payment to the government could increase if one

or more lease sales are postponed and if PRB coal prices increase, but the postponement would not necessarily lead to higher royalty or tax income to the state or federal governments. Royalty and tax payments increase automatically when coal prices increase because they are collected at the time the coal is sold, but they cannot be collected until the coal is leased and permitted and that takes several years. If leasing is delayed, then by the time the coal is mined, the higher coal prices may or may not persist. If the higher coal prices do persist, they may enable the coal lessee to negotiate longer term contracts at higher prices, which would result in longer term, higher royalty and tax revenues. On the other hand, if the existing mining operations run out of coal reserves before prices rise, they may have to shut down their operations before additional coal can be leased and permitted for mining. In that case, the fair market value of the coal may actually drop because the added expense of reopening a mine or starting a new mine would have to be factored into the fair market value.

Other considerations include the value of leaving the mineable coal for future development versus the value of making low-sulfur coal available now, in anticipation of cleaner fuel sources being developed in the future. Continued leasing of PRB coal enables coal-fired power plants to meet Clean Air Act requirements without constructing new plants, revamping existing plants, or switching to existing alternative fuels, which would probably significantly

increase power costs for individuals and businesses. If cleaner fuel sources are developed in the future, they could be phased in with less economic impact to the public.

A range of the potential future economic benefits of delaying leasing until coal prices rise could be quantified in an economic analysis, but the benefits would have to be discounted to the present, which would make them similar to the Proposed Action and Alternatives 2 and 3.

The environmental impacts of mining the coal at a later time as part of one or more existing mines would be expected to be similar and about equal to the Proposed Action, Alternative 2 or Alternative 3. If new mine starts are required to mine the coal in these tracts, the environmental impacts would be expected to be greater than if the tracts were mined as extensions of existing mines.

Thunder, West Roundup, and West Antelope LBA Tracts are the presented in Tables 2-1 through 2-4, respectively.

Table 2-5 presents a comparative summary of the direct and indirect environmental impacts of implementing each alternative as compared to the No Action Alternative for all five LBA tracts. The No Action Alternative assumes completion of currently permitted mining at the North Antelope/Rochelle Complex for comparison to the NARO North and NARO South LBA Tracts, the currently permitted mining at the Black Thunder Mine for comparison to the Little Thunder LBA Tract, the currently permitted mining at the North Rochelle Mine for comparison to the West Roundup LBA Tract, and the currently permitted mining at the Antelope Mine for comparison to the West Antelope LBA Tract. Table 2-6 presents a comparative summary of cumulative environmental impacts of implementing each alternative for all five LBA tracts. The environmental consequences of the Proposed Action

2.7 Comparison of Alternatives

The locations of the Proposed Action and Alternatives 2 and 3 for the NARO North and NARO South, Little Thunder, West Roundup, and West Antelope LBA Tracts are shown on Figures 2-1 through 2-4, respectively. A summary comparison of projected coal production, surface disturbance, mine life, and federal and state revenues for the Proposed Action and Alternatives 1, 2, and 3 for NARO North and NARO South, Little

Table 2-1. Summary Comparison of Coal Production, Surface Disturbance, and Mine Life for NARO North and NARO South LBA Tracts and North Antelope/Rochelle Complex.

Item	No Action Alternative (Existing North Antelope/Rochelle Complex)	Added by Proposed Action	Added by Alternative 2	Added by Alternative 3
In-Place Coal (as of 1/1/02)	952 mmt	564 mmt	710 mmt	464.4 mmt
Recoverable Coal (as of 1/1/02) ¹	904.4 mmt	506.9 mmt	613.9 mmt	434.9 mmt
Coal Mined Through 2001	643 mmt	—	—	—
Lease Area ²	14,895.5 ac	4,503.02 ac	5,571.19 ac	3,776.27 ac
Total Area To Be Disturbed ²	20,410 ac	5,590 ac	6,275 ac	4,863 ac
Permit Area ²	27,187 ac	21,035 ac	21,835 ac	21,035 ac
Average Annual Post-2001 Coal Production	75 mmt	15 mmt	15 mmt	15 mmt
Maximum Annual Post-2001 Coal Production (years 2004-2006)	105 mmt	0 mmt	0 mmt	0 mmt
Remaining Life Of Mine (post-2001)	12 yrs	4 yrs	5.5 yrs	3 yrs
Average No. of Employees (at maximum production rate)	1,175	10	10	10
Total Projected State Revenues (post-2001) ³	\$ 994.8 million	\$ 557.6 million	\$ 675.3 million	\$ 478.4 million
Total Projected Federal Revenues (post-2001) ⁴	\$ 745.5 million	\$ 421.8 million	\$ 514.4 million	\$ 359.4 million

¹ Assumes 95 percent recovery of leased coal (with the exception of the NARO South Tract as proposed, which is estimated to be 83 percent recovery of leased coal; the NARO South Alternative 2 Tract, which is estimated to be 79 percent recovery of leased coal; and NARO South Alternative 3 Tract, which is estimated to be 91 percent recovery of leased coal).

² For the Proposed Action and Alternatives 2 and 3, the disturbed acreage exceeds the leased acreage because of the need for highwall reduction, topsoil removal and other activities outside the lease boundaries. When added to the existing mine, the permit area is larger than leased or disturbed areas to assure that all disturbed lands are within the permit boundary and to allow easily defined legal land description. Permit areas under Proposed Action and Alternatives 2 and 3 are the anticipated permit amendment baseline study areas.

³ Projected revenue to the State of Wyoming is \$1.10 per ton of coal sold and includes income from severance tax, property and production taxes, sales and use taxes, and Wyoming's share of federal royalty payments and bonus bids (University of Wyoming 1994).

⁴ Federal revenues are based on \$5.00 per ton price × amount of recoverable coal × federal royalty of 12.5 percent minus State's 50 percent share, plus \$0.35 per ton for AML fees × amount of recoverable coal minus State's 50 percent share, plus \$5.00 per ton price × amount of recoverable coal × black lung tax of 4.0 percent, plus bonus payment on LBA leased coal of \$0.26 per ton (based on average of last 11 LBAs) × amount of in-place coal minus State's 50 percent share.

Table 2-2. Summary Comparison of Coal Production, Surface Disturbance, and Mine Life for Little Thunder LBA Tract and Black Thunder Mine.

Item	No Action Alternative (Existing Black Thunder Mine)	Added by Proposed Action	Added by Alternative 2	Added by Alternative 3 (North Tract)	Added by Alternative 3 (South Tract)
In-Place Coal (as of 1/1/02)	968.7 mmt	479.3 mmt	695.3 mmt	155.7 mmt	539.6 mmt
Recoverable Coal (as of 1/1/02) ¹	920.3 mmt	440 mmt	553 mmt	111.9 mmt	441.1 mmt
Coal Mined Through 2001	699.9 mmt	—	—	—	—
Lease Area ²	12,772.9 ac	3,449.32 ac	5,083.5 ac	1,065.49 ac	4,018.01 ac
Total Area To Be Disturbed ²	18,476 ac	5,424 ac	6,577 ac	1,382 ac	5,195 ac
Permit Area ²	21,238 ac	7,678 ac	7,678 ac	1,612.4 ac	6,065.6 ac
Average Annual Post-2001 Coal Production	38.3 mmt	4.2 mmt	4.2 mmt	4.2 mmt	4.2 mmt
Remaining Life Of Mine (post- 2001)	24 yrs	8 yrs	10.7 yrs	0.3 yrs	8 yrs
Average No. of Employees	600	0	0	0	0
Total Projected State Revenues (post-2001) ³	\$ 1,012.3 million	\$ 484.0 million	\$ 608.3 million	\$ 123.1 million	\$ 485.2 million
Total Projected Federal Revenues (post-2001) ⁴	\$ 758.6 million	\$ 364.8 million	\$ 470.6 million	\$ 97.2 million	\$ 373.6 million

¹ Assumes 95 percent recovery of leased coal for the No Action Alternative, 92 percent recovery of leased coal for Proposed Action; 79.5 percent recovery of leased coal for Alternative 2; 71.9 percent recovery of leased coal for Alternative 3, North Tract; and 81.8 percent recovery of leased coal for Alternative 3, South Tract.

² For the Proposed Action and Alternatives 2 and 3, the disturbed acreage exceeds the leased acreage because of the need for highwall reduction, topsoil removal and other activities outside the lease boundaries. When added to the existing mine, the permit area is larger than leased or disturbed areas to assure that all disturbed lands are within the permit boundary and to allow easily defined legal land description. Permit areas under Proposed Action and Alternatives 2 and 3 are the anticipated permit amendment baseline study areas.

³ Projected revenue to the State of Wyoming is \$1.10 per ton of coal sold and includes income from severance tax, property and production taxes, sales and use taxes, and Wyoming's share of federal royalty payments and bonus bids (University of Wyoming 1994).

⁴ Federal revenues are based on \$5.00 per ton price × amount of recoverable coal × federal royalty of 12.5 percent minus State's 50 percent share, plus \$0.35 per ton for AML fees × amount of recoverable coal minus State's 50 percent share, plus \$5.00 per ton price × amount of recoverable coal × black lung tax of 4.0 percent, plus bonus payment on LBA leased coal of \$0.26 per ton (based on average of last 11 LBAs) × amount of in-place coal minus State's 50 percent share.

Table 2-3. Summary Comparison of Coal Production, Surface Disturbance, and Mine Life for West Roundup LBA Tract and North Rochelle Mine.

Item	No Action Alternative e (Existing North Rochelle Mine)	Added by Proposed Action	Added by Alternative e 2	Added by Alternative 2 Plus Lease WYW- 127221 Modification n	Added by Alternative 3	Added by Alternative 3 Plus Lease WYW- 127221 Modification n
In-Place Coal (as of 1/1/02)	283 mmt	173.2 mmt	224.6 mmt	237.6 mmt	274.2 mmt	287.2 mmt
Recoverable Coal (as of 1/1/02) ¹	255 mmt	155.9 mmt	202.1 mmt	213.8 mmt	246.8 mmt	258.5 mmt
Coal Mined Through 2001	49.3 mmt	—	—	—	—	—
Lease Area ²	3,443.50 ac	1,870.65 ac	2,496.79 ac	2,652.69 ac	2,894.03 ac	3,049.93 ac
Total Area To Be Disturbed ²	5,288 ac	3,161 ac	3,161 ac	3,161 ac	3,591 ac	3,591 ac
Permit Area ²	7,042 ac	3,228.5 ac	3,228.5 ac	3,228.5 ac	3,228.5 ac	3,228.5 ac
Average Annual Post-2001 Coal Production	35 mmt	0 mmt	0 mmt	0 mmt	0 mmt	0 mmt
Remaining Life Of Mine (post-2001)	7.3 yrs	4.5 yrs	5.8 yrs	6.1 yrs	6.7 yrs	7.1 yrs
Average No. of Employees	224	176	176	176	176	176
Total Projected State Revenues (post-2001) ³	\$ 280.5 million	\$ 171.5 million	\$ 222.3 million	\$ 235.2 million	\$ 271.5 million	\$ 284.4 million
Total Projected Federal Revenues (post-2001) ⁴	\$ 212.1 million	\$ 129.7 million	\$ 168.1 million	\$ 177.9 million	\$ 205.3 million	\$ 215.1 million

¹ Assumes 90 percent recovery of leased coal.

² For the Proposed Action and Alternatives 2 and 3, the disturbed acreage exceeds the leased acreage because of the need for highwall reduction, topsoil removal and other activities outside the lease boundaries. When added to the existing mine, the permit area is larger than leased or disturbed areas to assure that all disturbed lands are within the permit boundary and to allow easily defined legal land description. Permit areas under Proposed Action and Alternatives 2 and 3 are the anticipated permit amendment baseline study areas.

³ Projected revenue to the State of Wyoming is \$1.10 per ton of coal sold and includes income from severance tax, property and production taxes, sales and use taxes, and Wyoming's share of federal royalty payments and bonus bids (University of Wyoming 1994).

⁴ Federal revenues are based on \$5.00 per ton price × amount of recoverable coal × federal royalty of 12.5 percent minus State's 50 percent share, plus \$0.35 per ton for AML fees × amount of recoverable coal minus State's 50 percent share, plus \$5.00 per ton price × amount of recoverable coal × black lung tax of 4.0 percent, plus bonus payment on LBA leased coal of \$0.26 per ton (based on average of last 11 LBAs) × amount of in-place coal minus State's 50 percent share.

Table 2-4. Summary Comparison of Coal Production, Surface Disturbance, and Mine Life for West Antelope LBA Tract and Antelope Mine.

Item	No Action Alternative (Existing Antelope Mine)	Added by Proposed Action	Added by Alternative 2	Added by Alternative 3
In-Place Coal (as of 1/1/02)	553.5 mmt	293.9 mmt	321.8 mmt	202.3 mmt
Mineable Coal (as of 1/1/02)	373.4 mmt	245.6 mmt	273.4 mmt	183.2 mmt
Recoverable Coal (as of 1/1/02) ¹	347.3 mmt	228.4 mmt	254.3 mmt	170.4 mmt
Coal Mined Through 2001	168.7 mmt	—	—	—
Lease Area ²	8,019.2 ac	3,542.19 ac	3,877.90 ac	2,809.13 ac
Total Area To Be Disturbed ²	8,821.1 ac	3,200 ac	3,500 ac	2,467 ac
Permit Area ²	10,848.6 ac	4,328.4 ac	4,328.4 ac	3,448.4 ac
Average Annual Post-2001 Coal Production	13.9 mmt	9.1 mmt	10.2 mmt	6.8 mmt
Remaining Life Of Mine (Post-2001)	25 yrs	0 yr	0 yr	0 yr
Average No. of Employees	215	0	0	0
Total Projected State Revenues (post-2001) ³	\$ 382.0 million	\$ 251.2 million	\$ 279.7 million	\$ 187.4 million
Total Projected Federal Revenues (post-2001) ⁴	\$ 238.8 million	\$ 195.2 million	\$ 216.7 million	\$ 143.4 million

¹ Assumes 93 percent recovery of leased coal remaining after eliminating coal that won't be mined beneath Antelope Creek and adjacent buffer zone.

² For the Proposed Action and Alternatives 2 and 3, the disturbed acreage is less than leased acreage because some of the coal is beneath Antelope Creek and the adjacent buffer zone and would not be mined. When added to the exiting mine, the permit area is larger than leased or disturbed areas to assure that all disturbed lands are within the permit boundary and to allow easily defined legal land description. Permit areas under Proposed Action and Alternatives 2 and 3 are anticipated permit amendment baseline study areas.

³ Projected revenue to the State of Wyoming is \$1.10 per ton of coal sold and includes income from severance tax, property and production taxes, sales and use taxes, and Wyoming's share of federal royalty payments and bonus bids (University of Wyoming 1994).

⁴ Federal revenues are based on \$5.00 per ton price × amount of recoverable coal × federal royalty of 12.5 percent minus State's 50 percent share, plus \$0.35 per ton for AML fees × amount of recoverable coal minus State's 50 percent share, plus \$5.00 per ton price × amount of recoverable coal × black lung tax of 4.0 percent, plus bonus payment on LBA leased coal of \$0.26 per ton (based on average of last 11 LBAs) × amount of in-place coal minus State's 50 percent share.

Table 2-5. Summary Comparison of Magnitude¹ and Duration of Direct and Indirect Impacts for the Proposed Action, Alternative 2, Alternative 3, and the No Action Alternative for the NARO North, NARO South, Little Thunder, West Roundup, and West Antelope LBA Tracts².

DESCRIPTION OF POTENTIAL IMPACT BY RESOURCE		MAGNITUDE AND DURATION OF IMPACT	
RESOURCE NAME	NO ACTION ALTERNATIVE	PROPOSED ACTION, ALTERNATIVE 2, & ALTERNATIVE 3	
TOPOGRAPHY & PHYSIOGRAPHY (Applicable to all five tracts)			
PERMANENT TOPOGRAPHIC MODERATION could result in:			
Microhabitat reduction	Moderate, long term on existing mine areas	Same as No Action on expanded mine areas	
Habitat diversity reduction	Moderate, long term on existing mine areas	Same as No Action on expanded mine areas	
Reduction in water runoff and peak flows	Moderate, long term on existing mine areas	Same as No Action on expanded mine areas	
Increased precipitation infiltration	Moderate, long term on existing mine areas	Same as No Action on expanded mine areas	
Wildlife carrying capacity reduction	Moderate, possibly short term on existing mine areas	Same as No Action on expanded mine areas	
Reduction in erosion	Moderate, long term on existing mine areas	Same as No Action on expanded mine areas	
Enhanced vegetative productivity	Moderate, beneficial, long term on existing mine areas	Same as No Action on expanded mine areas	
Potential acceleration of groundwater recharge	Moderate, long term on existing mine areas	Same as No Action on expanded mine areas	
GEOLOGY AND MINERALS (Applicable to all five tracts)			
SUBSURFACE changes would result in:			
Removal of coal	Moderate, permanent on existing mine areas	Same as No Action on expanded mine areas	
Removal and replacement of topsoil and overburden	Moderate, long term on existing mine areas	Same as No Action on expanded mine areas	
Physical characteristic alterations in geology	Moderate, permanent on existing mine areas	Same as No Action on expanded mine areas	
Loss of CBM ³	Moderate, permanent on existing mine areas	Same as No Action on expanded mine areas	
SOILS (Applicable to all five tracts)			
CHANGES IN PHYSICAL PROPERTIES would include:			
Increased near-surface bulk density	Moderate, long term on existing mine areas	Same as No Action on expanded mine areas	
More uniformity in soil type, thickness, and texture	Moderate, beneficial, long term on existing mine areas	Same as No Action on expanded mine areas	
Increased uniformity in mixed soils (e.g., texture)	Moderate, beneficial, long term on existing mine areas	Same as No Action on expanded mine areas	
Decreased soil loss due to topographic modification	Moderate, beneficial, long term on existing mine areas	Same as No Action on expanded mine areas	
CHANGES IN CHEMICAL PROPERTIES would include:			
Uniform soil nutrient distribution	Moderate, beneficial, long term on existing mine areas	Same as No Action on expanded mine areas	
CHANGES IN BIOLOGICAL PROPERTIES would include:			
Organic matter reduction	Moderate, long term on existing mine areas	Same as No Action on expanded mine areas	
Microorganism population reduction	Moderate, long term on existing mine areas	Same as No Action on expanded mine areas	
Existing plant habitat reduction in soils stockpiled before placement	Moderate, long term on existing mine areas	Same as No Action on expanded mine areas	

¹ Refer to Section 4.0 and 4.1 for a discussion on magnitude of impacts.

² All impacts are assumed to be adverse unless noted otherwise.

³ Most of the CBM reserves could be recovered prior to initiation of mining activity, those reserves not recovered prior to mining would be lost.

Table 2-5. Summary Comparison of Magnitude¹ and Duration of Direct and Indirect Impacts for the Proposed Action, Alternative 2, Alternative 3, and the No Action Alternative for the NARO North, NARO South, Little Thunder, West Roundup, and West Antelope LBA Tracts² (Continued).

DESCRIPTION OF POTENTIAL IMPACT BY RESOURCE		MAGNITUDE AND DURATION OF IMPACT	
RESOURCE NAME	NO ACTION ALTERNATIVE	PROPOSED ACTION, ALTERNATIVE 2, & ALTERNATIVE 3	
AIR QUALITY			
(Applicable to all five tracts)			
IMPACTS ASSOCIATED WITH MINING OPERATIONS would include:			
Elevated concentrations of particulate matter	Moderate, short term on existing mine areas	Same as No Action on expanded mine areas	
Elevated concentrations of gaseous emissions	Moderate, short term on existing mine areas	Same as No Action on expanded mine areas	
WATER RESOURCES			
(Applicable to all five tracts)			
<u>SURFACE WATER</u>			
CHANGES IN RUNOFF CHARACTERISTICS AND SEDIMENT DISCHARGE would include:			
Disruption of surface drainage systems	Moderate, short term on existing mine areas	Same as No Action on expanded mine areas	
Increased runoff and erosion rates	Moderate, short term on existing mine areas	Same as No Action on expanded mine areas	
Increased infiltration	Moderate, long term on existing mine areas	Same as No Action on expanded mine areas	
Reduction in peak flows	Moderate, long term on existing mine areas	Same as No Action on expanded mine areas	
<u>GROUNDWATER</u>			
IMPACTS ASSOCIATED WITH MINING OPERATIONS would include:			
Removal of coal and overburden aquifers	Negligible, short term on existing mine areas	Same as No Action on expanded mine areas	
Replacement of existing coal and overburden with spoil aquifers	Negligible, long term on existing mine areas	Same as No Action on expanded mine areas	
Depressed water levels in aquifers adjacent to mines	Moderate, short term on existing mine areas	Same as No Action on expanded mine areas	
Change in hydraulic properties	Negligible, long term on existing mine areas	Same as No Action on expanded mine areas	
Change in groundwater quality in backfilled areas	Moderate, long term on existing mine areas	Same as No Action on expanded mine areas	
ALLUVIAL VALLEY FLOORS			
(Applicable to all five tracts)			
While final determinations have not been made by WDEQ/LQD, it is believed that there are no AVFs significant to agriculture on the proposed lease tracts	No impact on existing mine areas	Same as No Action on expanded mine areas	
WETLANDS			
(Applicable to all five tracts)			
Removal of all existing wetlands	Wetlands on existing mine areas would be mined and reclaimed	Same as No Action on expanded mine areas	
VEGETATION			
(Applicable to all five tracts)			
PROGRESSIVE REDUCTION IN NATIVE VEGETATION would result in:			
Increased erosion	Moderate, short term on existing mine areas	Same as No Action on expanded mine areas	
Wildlife and livestock habitat loss	Moderate, short term on existing mine areas	Same as No Action on expanded mine areas	
Wildlife habitat carrying capacity loss	Moderate, long term on existing mine areas	Same as No Action on expanded mine areas	

¹ Refer to Section 4.0 and 4.1 for a discussion on magnitude of impacts.

² All impacts are assumed to be adverse unless noted otherwise.

Table 2-5. Summary Comparison of Magnitude¹ and Duration of Direct and Indirect Impacts for the Proposed Action, Alternative 2, Alternative 3, and the No Action Alternative for the NARO North, NARO South, Little Thunder, West Roundup, and West Antelope LBA Tracts² (Continued).

DESCRIPTION OF POTENTIAL IMPACT BY RESOURCE		MAGNITUDE AND DURATION OF IMPACT
RESOURCE NAME	NO ACTION ALTERNATIVE	PROPOSED ACTION, ALTERNATIVE 2, & ALTERNATIVE 3
VEGETATION (Continued) (Applicable to all five tracts) AFTER RECLAMATION the following could result:		
Changes in vegetation patterns	Negligible, long term on existing mine areas	Same as No Action on expanded mine areas
Reduction in vegetation diversity	Negligible, long term on existing mine areas	Same as No Action on expanded mine areas
Reduction in shrub density	Negligible, long term on existing mine areas	Same as No Action on expanded mine areas
WILDLIFE (Applicable to all five tracts) DURING MINING the following could occur:		
Wildlife displacement	Moderate, short term on existing mine areas	Same as No Action on expanded mine areas
Pronghorn passage reduction	Moderate, short term on existing mine areas	Same as No Action on expanded mine areas
Increased mortality rate to small mammals	Moderate, short term on existing mine areas	Same as No Action on expanded mine areas
Temporary displacement of small mammals	Moderate, short term on existing mine areas	Same as No Action on expanded mine areas
Sage grouse habitat removal	Moderate, short term on existing mine areas	Same as No Action on expanded mine areas
Abandonment of raptor nests	Negligible, short term on existing mine areas	Same as No Action on expanded mine areas
Foraging habitat reduction for raptors	Negligible, short term on existing mine areas	Same as No Action on expanded mine areas
Loss of nesting and foraging habitat for Migratory Birds of Management Concern	Negligible, short term on existing mine areas	Same as No Action on expanded mine areas
Reduction in waterfowl resting and feeding habitat	Negligible, short term on existing mine areas	Same as No Action on expanded mine areas
Loss of songbird foraging habitat	Moderate, short term on existing mine areas	Same as No Action on expanded mine areas
Temporary wildlife habitat loss	Negligible, short term on existing mine areas	Same as No Action on expanded mine areas
Continued road kills by mine-related traffic	Negligible, short term on existing mine areas	Same as No Action on expanded mine areas
THREATENED, ENDANGERED, PROPOSED, AND CANDIDATE SPECIES (NARO North and NARO South)		
Loss of black-footed ferret colonies	No effect due to lack of occurrence in area	Same as No Action on expanded mine areas
Loss of bald eagle nesting and foraging habitat	Disturbance of potential foraging habitat	Same as No Action on expanded mine areas
Loss of Ute Ladies'-tresses orchid habitat	Disturbance of potential habitat	Same as No Action on expanded mine areas
Loss of mountain plover habitat	Typical suitable habitat not present	Same as No Action on expanded mine areas
Loss of black-tailed prairie dog habitat	Disturbance of potential habitat, mining will potentially directly affect individuals	Same as No Action on expanded mine areas
(Little Thunder)		
Loss of black-footed ferret colonies	No effect due to lack of occurrence in area	Same as No Action on expanded mine area
Loss of bald eagle nesting and foraging habitat	Disturbance of potential foraging habitat	Same as No Action on expanded mine area
Loss of Ute Ladies'-tresses orchid habitat	Disturbance of artificially created potential habitat	Same as No Action on expanded mine area
Loss of mountain plover habitat	Little to no typical suitable habitat present	Typical suitable habitat not present on tract
Loss of black-tailed prairie dog habitat	Disturbance of potential habitat, mining will potentially directly affect individuals	Disturbance of potential habitat

¹ Refer to Section 4.0 and 4.1 for a discussion on magnitude of impacts.

² All impacts are assumed to be adverse unless noted otherwise.

Table 2-5. Summary Comparison of Magnitude¹ and Duration of Direct and Indirect Impacts for the Proposed Action, Alternative 2, Alternative 3, and the No Action Alternative for the NARO North, NARO South, Little Thunder, West Roundup, and West Antelope LBA Tracts² (Continued).

DESCRIPTION OF POTENTIAL IMPACT BY RESOURCE	MAGNITUDE AND DURATION OF IMPACT	
RESOURCE NAME	NO ACTION ALTERNATIVE	PROPOSED ACTION, ALTERNATIVE 2, & ALTERNATIVE 3
THREATENED, ENDANGERED, PROPOSED, AND CANDIDATE SPECIES (Continued)		
(North Roundup)		
Loss of black-footed ferret colonies	No effect due to lack of occurrence in area	Same as No Action on expanded mine area
Loss of bald eagle nesting and foraging habitat	Disturbance of potential foraging habitat	Same as No Action on expanded mine area
Loss of Ute Ladies’-tresses orchid habitat	Disturbance of artificially created potential habitat	Same as No Action on expanded mine area
Loss of mountain plover habitat	Little to no typical suitable habitat present	Same as No Action on expanded mine area
Loss of black-tailed prairie dog habitat	Disturbance of potential habitat, mining will potentially directly affect individuals	Disturbance of potential habitat, mining would potentially affect individuals on the tract under Alternatives 2 & 3
(West Antelope)		
Loss of black-footed ferret colonies	No effect due to lack of occurrence in area	Same as No Action on expanded mine area
Loss of bald eagle nesting and foraging habitat	Disturbance of potential foraging habitat	Same as No Action on expanded mine area
Loss of Ute Ladies’-tresses orchid habitat	Potential habitat may be disturbed	Same as No Action on expanded mine area
Loss of mountain plover habitat	Mining has or will affect mountain plover use areas	Same as No Action on expanded mine area
Loss of black-tailed prairie dog habitat	Mining will potentially directly affect individuals	Same as No Action of expanded mine area
LAND USE AND RECREATION		
(Applicable to all five tracts)		
ENVIRONMENTAL CONSEQUENCES ON LAND USE would be:		
Reduction of livestock grazing	Moderate, long term on existing mine areas	Same as No Action on expanded mine areas
Loss of wildlife habitat	Moderate, long term on existing mine areas	Same as No Action on expanded mine areas
Curtailement of oil and gas development	Moderate, long term on existing mine areas	Same as No Action on expanded mine areas
Loss of public land available for recreation activities	Moderate, short term on existing mine areas	Same as No Action on expanded mine areas
Loss of CBM reserves ³	Moderate, permanent on existing mine areas	Same as No Action on expanded mine areas
CULTURAL RESOURCES		
(NARO North and NARO South)		
75 sites not eligible or recommended not eligible for NRHP	Impacts to eligible or unevaluated sites are not permitted; any site eligible for the NRHP would be avoided or mitigated through data recovery	Same as No Action on expanded mine areas
4 eligible for NRHP		
(Little Thunder)		
34 sites not eligible or recommended not eligible for NRHP	Impacts to eligible or unevaluated sites are not permitted; any site eligible for the NRHP would be avoided or mitigated through data recovery	Same as No Action on expanded mine area
None eligible for NRHP		

¹ Refer to Section 4.0 and 4.1 for a discussion on magnitude of impacts.

² All impacts are assumed to be adverse unless noted otherwise.

³ Most of the CBM reserves could be recovered prior to initiation of mining activity, those reserves not recovered prior to mining would be lost.

Table 2-5. Summary Comparison of Magnitude¹ and Duration of Direct and Indirect Impacts for the Proposed Action, Alternative 2, Alternative 3, and the No Action Alternative for the NARO North, NARO South, Little Thunder, West Roundup, and West Antelope LBA Tracts² (Continued).

DESCRIPTION OF POTENTIAL IMPACT BY RESOURCE		MAGNITUDE AND DURATION OF IMPACT	
RESOURCE NAME	NO ACTION ALTERNATIVE	PROPOSED ACTION, ALTERNATIVE 2, & ALTERNATIVE 3	
CULTURAL RESOURCES (Continued)			
(West Roundup)			
30 sites not eligible or recommended not eligible for NRHP None eligible for NRHP	Impacts to eligible or unevaluated sites are not permitted; any site eligible for the NRHP would be avoided or mitigated through data recovery	Same as No Action on expanded mine area	
(West Antelope)			
49 sites not eligible or recommended not eligible for NRHP 4 eligible for NRHP	Impacts to eligible or unevaluated sites are not permitted; any site eligible for the NRHP would be avoided or mitigated through data recovery	Same as No Action on expanded mine area	
(Applicable to all five tracts)			
Possible increase in vandalism Possible increase in unauthorized collecting	No impacts on existing mine areas No impacts on existing mine areas	Negligible on expanded mine areas Negligible on expanded mine areas	
NATIVE AMERICAN CONCERNS			
(Applicable to all five tracts)			
	No impact identified on existing mine areas	Same as No Action on expanded mine areas	
PALEONTOLOGICAL RESOURCES			
(Applicable to all five tracts)			
Overburden removal could expose fossils for scientific examination	Disturbance of USFS classified Class 3 and Class 5 formations on existing mine areas	Same as No Action on expanded mine areas	
VISUAL RESOURCES			
(Applicable to all five tracts)			
EVIDENT IMPACTS DURING MINING would include: Alteration of landscape classified as Class IV by the BLM	Negligible, short term on existing mine areas	Same as No Action on expanded mine areas	
IMPACTS FOLLOWING RECLAMATION could be: Smoother sloped terrain Reduction in sagebrush density	Negligible, long term on existing mine areas Negligible, short term on existing mine areas	Same as No Action on expanded mine areas Same as No Action on expanded mine areas	
NOISE			
(NARO North and NARO South)			
INCREASED NOISE LEVELS could affect: Occupied dwellings within one mile	Moderate, short term on existing mine area	Same as No Action on expanded mine areas	
(Little Thunder)			
INCREASED NOISE LEVELS could affect: Occupied dwellings within one mile	Moderate, short term on existing mine area	Same as No Action on expanded mine area	

¹ Refer to Section 4.5 for a discussion of cumulative impacts.

² All impacts are assumed to be adverse unless noted otherwise.

Table 2-5. Summary Comparison of Magnitude¹ and Duration of Direct and Indirect Impacts for the Proposed Action, Alternative 2, Alternative 3, and the No Action Alternative for the NARO North, NARO South, Little Thunder, West Roundup, and West Antelope LBA Tracts² (Continued).

DESCRIPTION OF POTENTIAL IMPACT BY RESOURCE		MAGNITUDE AND DURATION OF IMPACT	
RESOURCE NAME	NO ACTION ALTERNATIVE	PROPOSED ACTION, ALTERNATIVE 2, & ALTERNATIVE 3	
NOISE (Continued)			
(West Roundup)			
INCREASED NOISE LEVELS could affect: Occupied dwellings within one mile	None for existing mine area	Same as No Action on expanded mine area	
(West Antelope)			
INCREASED NOISE LEVELS could affect: Occupied dwellings within one mile	None for existing mine area	Same as No Action on expanded mine area	
(Applicable to all five tracts)			
INCREASED NOISE LEVELS could affect: Wildlife in immediate vicinity	Negligible, short term on existing mine areas	Same as No Action on expanded mine areas	
TRANSPORTATION FACILITIES			
(NARO North and NARO South)			
Increase in duration that coal is shipped on railroads and employees travel on highways by 3 to 5.5 years	No impact on existing mine area	Negligible, short term on expanded mine areas	
(Little Thunder)			
Increase in duration that coal is shipped on railroads and employees travel on highways by 0.3 to 10.7 years	No impact on existing mine area	Negligible, short term on expanded mine area	
(West Roundup)			
Increase in duration that coal is shipped on railroads and employees travel on highways by 4.5 to 7.1 years	No impact on existing mine area	Negligible, short term on expanded mine area	
(West Antelope)			
No increase in time that coal is shipped on railroads and employees travel on highways.	No impact on existing mine area	Same as No Action on expanded mine area	
(Applicable to all five tracts)			
Relocation of pipelines	No impact on existing mine areas	Negligible, short term on expanded mine areas	
Relocation of utility lines	No impact on existing mine areas	Short term on expanded mine areas	
SOCIOECONOMICS			
(NARO North and NARO South)			
EFFECTS DURING MINING would include: Employment Potential (10 additional jobs in expanded mine area are expected)	Moderate, beneficial short term on existing mine area	Same as No Action on expanded mine areas	

¹ Refer to Section 4.0 and 4.1 for a discussion on magnitude of impacts.

² All impacts are assumed to be adverse unless noted otherwise.

Table 2-5. Summary Comparison of Magnitude¹ and Duration of Direct and Indirect Impacts for the Proposed Action, Alternative 2, Alternative 3, and the No Action Alternative for the NARO North, NARO South, Little Thunder, West Roundup, and West Antelope LBA Tracts² (Continued).

DESCRIPTION OF POTENTIAL IMPACT BY RESOURCE		MAGNITUDE AND DURATION OF IMPACT	
RESOURCE NAME	NO ACTION ALTERNATIVE	PROPOSED ACTION, ALTERNATIVE 2, & ALTERNATIVE 3	
SOCIOECONOMICS (Continued)			
(Little Thunder and West Antelope)			
EFFECTS DURING MINING would include:			
Employment Potential (No additional jobs in expanded mine area are expected)	Moderate, beneficial short term on existing mine area	Same as No Action on expanded mine area	
(West Roundup)			
EFFECTS DURING MINING would include:			
Employment Potential (176 additional jobs in expanded mine area are expected)	Moderate, beneficial short term on existing mine area	Same as No Action on expanded mine area	
(Applicable to all five tracts)			
EFFECTS DURING MINING would include:			
Revenues from royalties and taxes to the state government	Moderate, beneficial short term on existing mine areas	Same as No Action on expanded mine areas	
Revenues from royalties and taxes to the federal government	Moderate, beneficial short term on existing mine areas	Same as No Action on expanded mine areas	
Economic development	Moderate, beneficial short term on existing mine areas	Same as No Action on expanded mine areas	
Population in Campbell and Converse Counties	No impact on existing mine areas	Same as No Action on Expanded mine areas	

¹ Refer to Section 4.0 and 4.1 for a discussion on magnitude of impacts.

² All impacts are assumed to be adverse unless noted otherwise.

Table 2-6. Summary Comparison of Magnitude and Duration of Cumulative Impacts^{1, 2}.

DESCRIPTION OF POTENTIAL IMPACT BY RESOURCE	MAGNITUDE TYPE AND DURATION OF IMPACT	
	NO ACTION ALTERNATIVE	PROPOSED ACTION, ALTERNATIVE 2, & ALTERNATIVE 3
TOPOGRAPHY & PHYSIOGRAPHY		
REDUCED RELIEF AND SUBDUED TOPOGRAPHY could result in:		
Reduction in topographic diversity	Negligible, long term on existing mine areas	Same as No Action on expanded mine areas
Increased precipitation infiltration	Negligible, long term on existing mine areas	Same as No Action on expanded mine areas
Biodiversity reduction	Negligible, long term on existing mine areas	Same as No Action on expanded mine areas
Big game carrying capacity reduction	Negligible, long term on existing mine areas	Same as No Action on expanded mine areas
GEOLOGY AND MINERALS		
RECOVERY OF COAL would result in:		
Stabilization of municipal, county and state economies	Significant, beneficial, short term on existing mine areas	Same as No Action on expanded mine areas
SOILS		
RECLAIMED SOILS could result in:		
Increased soil productivity	Negligible, long term on existing mine areas	Same as No Action on expanded mine areas
Reduced erosion	Negligible, long term on existing mine areas	Same as No Action on expanded mine areas
AIR QUALITY		
IMPACTS ASSOCIATED WITH MINING OPERATIONS would include:		
Elevated concentrations of gaseous emissions	Short term on existing mine areas	Same as No Action on expanded mine areas
Elevated concentrations of particulate matter	Short term on existing mine areas, may overlap with impacts caused by other development on adjacent lands	Same as No Action on expanded mine areas
WATER RESOURCES		
<u>SURFACE WATER</u>		
IMPACTS TO SURFACE WATER could result in:		
Temporary reduction in soil infiltration rates and increased runoff	Negligible, short term on existing mine areas	Same as No Action on expanded mine areas
<u>GROUNDWATER</u>		
IMPACTS ON GROUNDWATER could result in:		
Removal of coal and overburden aquifers	Negligible, long term on existing mine areas	Same as No Action on expanded mine areas
Depressed water levels in aquifer adjacent to mines	Moderate, short term on existing mine areas, impacts may overlap with impacts caused by other developments on adjacent lands	Same as No Action on expanded mine areas
Replacement of existing coal and overburden with spoil aquifers	Negligible, long term on existing mine areas	Same as No Action on expanded mine areas
Change in hydraulic properties	Negligible to moderate, short term on existing mine areas	Same as No Action on expanded mine areas
Change in groundwater quality in backfilled areas	Negligible, long term on existing mine areas	Same as No Action on expanded mine areas

¹ Refer to Section 4.5 for a discussion of cumulative impacts.² All impacts are assumed to be adverse unless noted otherwise.

Table 2-6. Summary Comparison of Magnitude and Duration of Cumulative Impacts^{1, 2} (Continued).

DESCRIPTION OF POTENTIAL IMPACT BY RESOURCE		MAGNITUDE TYPE AND DURATION OF IMPACT	
RESOURCE NAME		NO ACTION ALTERNATIVE	PROPOSED ACTION, ALTERNATIVE 2, & ALTERNATIVE 3
ALLUVIAL VALLEY FLOORS		No cumulative impacts anticipated on existing mine areas	Same as No Action on expanded mine areas
WETLANDS Removal of existing wetlands		Wetlands on existing mine areas would be mined and reclaimed	Same as No Action on expanded mine areas
VEGETATION SURFACE DISTURBANCE would result in: Loss of common native vegetation types for wildlife Regional loss of vegetative diversity		Negligible, short term on existing mine areas Negligible, long term on existing mine areas	Same as No Action on expanded mine areas Same as No Action on expanded mine areas
WILDLIFE IMPACTS ON WILDLIFE FROM SURFACE MINING could result in: Loss of pronghorn habitat Mule deer population reduction Reduction in raptor nesting sites and foraging habitat Reduction in sage grouse leks Loss of nesting and foraging habitat for Migratory Birds of Management Concern Reduction in waterfowl habitat Permanent reduction in wildlife habitat diversity Permanent reduction in some wildlife carrying capacity		Moderate, short term on existing mine areas Negligible, short term on existing mine areas Negligible, short term on existing mine areas Negligible, short term on existing mine areas Negligible, short term on existing mine areas Negligible, short term on existing mine areas Minor, short term on existing mine areas Major, long term on existing mine areas Major, long term on existing mine areas	Same as No Action on expanded mine areas Same as No Action on expanded mine areas Same as No Action on expanded mine areas Same as No Action on expanded mine areas Same as No Action on expanded mine areas Same as No Action on expanded mine areas Same as No Action on expanded mine areas Same as No Action on expanded mine areas Same as No Action on expanded mine areas
THREATENED, ENDANGERED, PROPOSED, AND CANDIDATE SPECIES		Individuals of some T&E species will potentially be directly affected by mining operations on the existing leases, impacts may overlap with other developments on adjacent lands	Same as No Action on expanded mine areas
LAND USE AND RECREATION IMPACTS ON LAND USE could result in: Loss of agricultural production Disruption of oil and gas development/production Reduction of wildlife habitat		Moderate, short term on existing mine areas Moderate to significant, short term on existing mine areas Moderate, short term on existing mine areas	Same as No Action on expanded mine areas Same as No Action on expanded mine areas Same as No Action on expanded mine areas
IMPACTS ON RECREATION could result in: Loss of access to public lands used by recreationists, particularly hunting		Moderate, short term on existing mine areas	Same as No Action on expanded mine areas

¹ Refer to Section 4.5 for a discussion of cumulative impacts.² All impacts are assumed to be adverse unless noted otherwise.

Table 2-6. Summary Comparison of Magnitude and Duration of Cumulative Impacts^{1, 2} (Continued).

DESCRIPTION OF POTENTIAL IMPACT BY RESOURCE		MAGNITUDE TYPE AND DURATION OF IMPACT	
RESOURCE NAME		NO ACTION ALTERNATIVE	PROPOSED ACTION, ALTERNATIVE 2, & ALTERNATIVE 3
CULTURAL RESOURCES		Sites eligible for NRHP would be mitigated on existing mine areas	Same as No Action on expanded mine areas
NATIVE AMERICAN CONCERNS		No impact identified on existing mine areas	Same as No Action on expanded mine areas
PALEONTOLOGICAL RESOURCES		No impact identified on existing mine areas	Same as No Action on expanded mine areas
VISUAL RESOURCES			
Impacts on visual resources by mining activities		Moderate, short term on existing mine areas	Same as No Action on expanded mine areas
NOISE			
		Negligible, short term outside of existing mine areas	Same as No Action outside expanded mine areas
TRANSPORTATION FACILITIES			
Continued use of existing transportation facilities		Negligible, short term on existing mine area	Same as No Action on expanded mine areas
SOCIOECONOMICS			
IMPACTS ON SOCIOECONOMICS could include:			
Mineral and energy related development		Moderate, beneficial, short term on existing mine areas	Same as No Action on expanded mine areas
Employment		Significant, beneficial, short term on existing mine areas	Same as No Action on expanded mine areas
Housing market		Significant, short term due to existing mines	Same as No Action on expanded mine areas
Economic development		Significant, beneficial, short term due to existing mine areas	Same as No Action on expanded mine areas
Revenues and royalties		Significant, beneficial, short term due to existing mine areas	Same as No Action on expanded mine areas

¹ Refer to Section 4.5 for a discussion of cumulative impacts.² All impacts are assumed to be adverse unless noted otherwise.

2.0 Proposed Action and Alternatives

and alternatives for each of the five LBA tracts are analyzed in Chapter 4.

These summary impact tables are derived from the following explanation of impacts and magnitude. NEPA requires all agencies of the federal government to include, in every recommendation or report on proposals for legislation and other major federal actions significantly affecting the quality of the human environment, a detailed statement by the responsible official on:

- (i) the environmental impact of the Proposed Action,
- (ii) any adverse environmental effects which cannot be avoided should the proposal be implemented,
- (iii) alternatives to the Proposed Action,
- (iv) the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and
- (v) any irreversible and irretrievable commitments of resources which would be involved in the Proposed Action should it be implemented (42 USC § 4332[C]).

Impacts can be beneficial or adverse, and they can be a primary result of an action (direct) or a secondary result (indirect). They can be permanent, long-term (persisting beyond the end of mine life and reclamation) or short-term (persisting during mining and reclamation and through the time the reclamation bond is released). Impacts also vary in terms of significance. The basis for conclusions regarding significance are

the criteria set forth by the Council on Environmental Quality (40 CFR 1508.27) and the professional judgement of the specialists doing the analyses. Impact significance may range from negligible to substantial; impacts can be significant during mining but be reduced to insignificance following completion of reclamation.

3.0 AFFECTED ENVIRONMENT

This chapter describes the existing conditions of the physical, biological, cultural, and socioeconomic resources in the General Analysis Area that includes all five of the 5L.A.¹ tracts. The resources that are addressed here were identified during the scoping process or interdisciplinary team review as having the potential to be affected. Figure 3-1 shows the General Analysis Area for most environmental resources.

Additional, more detailed site-specific information about the affected environment for the study area identified for each LBA tract is contained in a separate document entitled *Supplementary Information on the Affected Environment in the General Analysis Area for the South Powder River Basin Coal EIS*, which is available on request.

The study area for each tract includes the tract as applied for, the adjacent lands that BLM is considering adding to each tract, and the anticipated permit amendment study area for each applicant mine. The anticipated permit amendment study area is defined as those lands adjacent to and outside of an applicant mine's current permit area that the applicant anticipates would be contained within the amended mine permit area, to include the new federal coal lease.

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

3.1 General Setting

The General Analysis Area is located in the PRB, a part of the Northern Great Plains that includes most of northeastern Wyoming. Vegetation is primarily sagebrush and mixed grass prairie. The climate is semi-arid, with an average annual precipitation at Wright (Figure 1-1) of just over 11 inches (Martner 1986). June (2.35 inches) and May (2.04 inches) are the wettest months, and February (0.29 inch) is the driest. Snowfall averages 25.1 inches per year, with most

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

Figure 3-1

occurring in March (5.0 inches) and December (4.5 inches). Potential evapotranspiration, at approximately 31 inches (National Oceanic and Atmospheric Administration 1969), exceeds annual precipitation. The average daily mean temperature is 44.2°F. The highest recorded temperature was 103°F and the lowest was -34°F. July is the warmest month, with a mean daily temperature of 70°F, and January is the coldest (20.5°F). The frost-free period is 100-125 days.

In the General Analysis Area the regional wind speeds average from nine to 13 mph with local variations in speed and direction due to differences in topography. Wind speeds are highest in the winter and spring and are predominantly from the northwest or southeast. Wind velocity tends to increase during the day and decrease during the night. Winter gusts often reach 30-40 mph. During periods of strong wind, dust may impact air quality across the region. There are an average of 15 air-stagnation events annually in the PRB with an average duration of two days each (BLM 1974).

3.2 Topography and Physiography

The General Analysis Area is a high plains area within the eastern portion of the PRB. The PRB is bounded by the Black Hills on the east; the Big Horn Mountains on the west; the Hartville Uplift, Casper-Arch, and Laramie Mountains on the south; and the Miles City Arch and the Yellowstone River on the north. Landforms of the area consist of a dissected rolling upland plain with

low relief, broken by low red-capped buttes, mesas, hills, and ridges. Playas are common in the basin, as are buttes and plateaus capped by clinker or sandstone. Elevations in the PRB range from less than 2,500 ft to greater than 6,000 ft above sea level. The major river valleys have wide, flat floors and broad floodplains. The drainages dissecting the area are incised, typically are ephemeral or intermittent, and do not provide year-round water sources.

The General Analysis Area and its tributaries are drained by the Cheyenne River. Elevations range from about 4,500 ft to 5,000 ft above sea level. Slopes in the General Analysis Area range from flat to greater than 50 percent. In the individual LBA tracts, the average slopes range from one to five percent.

3.3 Geology

Stratigraphic units in the General Analysis Area that would be impacted if the tracts under consideration for leasing are mined include, in descending order, recent (Holocene age) alluvial and eolian deposits, the Eocene age Wasatch Formation (the overburden), and the Paleocene age Fort Union Formation (which contains the target coal beds). Variations between the LBA tracts occur primarily in the thickness of the mineable coal seams, the thickness of overburden, the parting thickness(es) between the various seams comprising the Wyodak coal seam and the surface topography. Figure 3-2 is a chart showing the stratigraphic

Figure 3-2. Stratigraphic Relationships and Hydrologic Characteristics of Upper Cretaceous, Lower Tertiary, and Recent Geologic Units, PRB, Wyoming. (Compiled from Hodson et al. 1973 and Lewis and Hotchkiss 1981).

relationships of the surface and subsurface geologic units in the General Analysis Area. Surficial deposits in the General Analysis Area include alluvial and eolian deposits, clinker, and weathered Wasatch and Fort Union Formations. Although clinker is present throughout the General Analysis Area, the NARO South LBA Tract is the only LBA tract analyzed in this EIS that contains appreciable amounts of clinker. There are thin alluvial deposits along ephemeral streams and closed basin drainage channels. These alluvial deposits typically consist primarily of poorly to well-sorted, irregularly bedded to laminated, unconsolidated sand, silt, and clay with minor intervals of fine gravel. The valley floors of Porcupine Creek and Antelope Creek contain appreciable amounts of alluvium both in width and depth. The alluvial deposits in Porcupine Creek and Antelope Creek contain much more coarse-grained material (sands and gravels) than the ephemeral tributaries that drain most of the General Analysis Area.

The Wasatch Formation forms most of the overburden on top of the recoverable coal seams in the General Analysis Area. It consists of interbedded lenticular sandstones, siltstones, shales, and thin discontinuous coals. There is no distinct boundary between the Wasatch Formation and the underlying Fort Union Formation. From a practical standpoint, however, the top of the mineable coal zone is considered as the contact between the two formations. Overburden thicknesses in the tracts under consideration for leasing range from

around 110 ft to more than 300 ft. The overburden is relatively thin in the NARO South and West Antelope LBA Tracts and relatively thicker in the NARO North, Little Thunder, and West Roundup LBA Tracts.

The Fort Union Formation consists primarily of shales, mudstones, siltstones, lenticular sandstones, and coal. It is divided into three members: Tongue River (which contains the target coal seams), Lebo, and Tullock, in descending order (Figure 3-2).

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

Within the General Analysis Area there are up to four mineable coal seams. The nomenclature of these seams varies from mine operator to mine operator. The U.S. Geological Survey (Flores et al. 1999) refers to the thick mineable coals in the Gillette coal field as the Wyodak-Anderson coal zone of the Tongue River member of the Fort Union Formation. Locally these beds are referred to as Wyodak, Wyodak-Anderson, Anderson, and Canyon. The number of mineable coal seams varies from tract to tract. There is one mineable seam in the West Roundup LBA Tract (Wyodak); two mineable coal seams in the NARO North and NARO South LBA Tracts (referred to by the operator as the Wyodak-Anderson 1 and 2); three mineable coal seams in the Little Thunder LBA Tract (referred to by the

operator as the Upper, Middle, and Lower Wyodak); and four mineable seams in the West Antelope LBA Tract (referred to by the operator as the Anderson, Lower Anderson, Canyon/Upper Canyon, and Lower Canyon). Interburden between the coal seams varies from 0 to around 100 ft.

The Fort Union coal seams are subbituminous and are generally low-sulfur, low-ash coals. Typically, the coal being mined has a higher heating value and lower sulfur content south of Gillette than north of Gillette. In the tracts under consideration for leasing, the heating values of the coal seams is expected to range from 7,850 to 9,130 Btu/lb. The ash content in the coal seams is expected to vary from 4 to 14 percent, the sulfur content from 0.1 to 0.6 percent, the fixed carbon from 30 to 41 percent, and the moisture content from 22 to 29 percent.

The Lebo Shale and Tullock members of the Fort Union Formation underlie the Tongue River member (Figure 3-2). They consist primarily of sandstone, siltstone, mudstone, shale and coal. In general, the Tullock member contains more sand than the Lebo Shale member.

3.3.1 Mineral Resources

The PRB contains large reserves of fossil fuels including oil, natural gas (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 (WSGS, 2002a).

Coal

There are 15 coal mines lying along a north/south line that parallels Highway 59, starting north of Gillette, Wyoming and extending south for about 75 miles (Figure 1-1). These mines are located where the Wyodak coal is at its shallowest depths, i.e., nearest the outcrop. A 16th mine, the Dave Johnston Mine, located near Glenrock, Wyoming about 30 miles southwest of the Antelope Mine, has shut down coal mining operations.

Oil and Gas

Oil and conventional (non-CBM) gas have been produced in the PRB for more than 100 years from reservoir beds that range in age from Pennsylvanian to Oligocene (De Bruin 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 ft³ of recoverable, non-CBM gas (USGS 1995). Depth to gas and oil-bearing strata are generally between 4,000 ft and 13,500 ft, but some wells are as shallow as 250 ft.

The LBA tracts overlie geologic structures that contain producible quantities of oil and gas. A portion of the Little Thunder LBA Tract is over the Hilight Oil and Gas Field, which was discovered in 1969. The main zone of production at the Hilight Field is the Early Cretaceous Muddy Sandstone which lies approximately 9,000 ft below the surface in this area. The western edge of the West Roundup LBA Tract overlies a portion

of the House Creek Oil and Gas Field, which produces from the Parkman Sandstone of the Upper Cretaceous Mesaverde Group. The Parkman Sandstone is approximately 6,400 ft below the surface in the vicinity of the West Roundup LBA Tract. The western portion of the NARO South LBA Tract overlies both the Porcupine and House Creek Oil and Gas Fields. The Porcupine Field produces from the Upper Cretaceous Parkman, Sussex, and Turner Sandstones and the Niobrara Shale, also Upper Cretaceous in age. The Porcupine Field also produces from the Lower Cretaceous Muddy and Dakota Sandstones (De Bruin 1999). See Section 3.11 for further discussion of producing wells and their associated facilities.

Coal Bed Methane

The generation of methane gas from coal beds occurs as a natural process. Methane generated in the coal may be trapped there 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 an appreciable quantity of methane generated by the coal beds in the PRB has gradually escaped into the atmosphere because of the relatively

shallow coal burial depths. However, a large amount remains in the coal. One study estimates that there are approximately 38.2 trillion ft³ of CBM gas in place in coal beds that are thicker than 20 ft and deeper than 200 ft. This study estimates that there are 25.6 trillion ft³ of recoverable CBM reserves (Finley and Goolsby 2000).

Historically, methane has been reported flowing from shallow water wells and coal exploration holes in parts of the PRB. According to De Bruin 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. that began producing gas for domestic use in 1916.

CBM has been commercially produced in the PRB since 1989 when production began at the Rawhide Butte Field, west of the Eagle Butte Mine. CBM exploration and development is currently ongoing throughout the PRB in Wyoming, and more than 12,000 CBM wells have been drilled or are permitted for drilling. The predominant CBM production to date has occurred from coal beds of the Wyodak - Anderson zone in seams known as the Anderson, Canyon, Wyodak, Big George and other locally-used names. These are the same (or equivalent) seams that are being mined along the eastern margin of the basin, including the mines which are included in this analysis.

CBM is being produced from other, deeper seams locally throughout the PRB. The only CBM well completions

within the General Analysis Area to date have been within the Wyodak - Anderson coal seams. Coal mining does not directly affect production of CBM from coal seams below the Wyodak-Anderson, however, it does delay any proposed CBM development in the deeper seams in order to avoid interference with mining.

The presence of splits in the coal seams affects potential CBM development. Current CBM well completion technology within the PRB will not accommodate completion of two seams separated by thick shales within a single wellbore. As a result, in the areas where the coal seams are split, two wells would be required to produce essentially the same reserve that would be produced from a single well in a single contiguous seam.

Since the early 1990s, the BLM has completed numerous EAs and three EISs analyzing CBM projects. The latest of these is the *Draft Environmental Impact Statement and Draft Planning Amendment for the Powder River Basin Oil and Gas Project*, the draft of which was completed in 2002. That DEIS covers almost 12,500 square miles, encompasses almost the entire PRB in all or parts of Campbell, Converse, Johnson, and Sheridan Counties, and covers both private and public (state and federal) lands. It analyzes the impacts of drilling, completing, and operating approximately 39,400 new CBM wells over the next ten years. These wells would be in addition to the more than 12,000 CBM wells that have been drilled or are permitted for drilling. The DEIS also analyzes the

impacts of developing 3,200 new conventional oil and gas wells, constructing, operating, and reclaiming various ancillary facilities needed to support the new wells, including roads, pipelines for gathering gas and produced water, electrical utilities, and compressors by the end of 2011 (BLM 2002a).

The Little Thunder LBA Tract is the only LBA tract included in this analysis with producing CBM wells. The other LBA tracts included in this analysis contain CBM wells in various stages of development (e.g., permitting, drilling, etc.) which were not producing when this Draft EIS was prepared. Approved spacing for CBM wells is one well per 80 acres or eight wells per section. A maximum of 243 CBM wells could be drilled on all of the LBA tracts under the largest alternative tract configurations being analyzed in this EIS. The ownership of oil and gas resources in the LBA tracts is discussed in Section 3.11 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 any of the proposed LBA tracts.

Uranium

There are substantial uranium resources in southwestern Campbell and northwestern Converse Counties. Uranium exploration and mining were very active in the 1950s, when numerous claims were filed in the PRB. 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 the PRB. Production at a third ended in 2000. No known uranium reserves exist on the LBA tracts.

Scoria

Scoria or clinker is present in the General Analysis Area and has been and continues to be a major source of aggregate for road construction in the area. Only the NARO South LBA Tract contains scoria. No scoria from the NARO South LBA Tract has ever been sold for use as an aggregate for road construction or any other uses.

A search of the BLM mining claim index revealed that no mining claims are presently located within the General Analysis Area.

3.4 Soils

Numerous baseline soil surveys associated with surface mining operations and oil field development have been conducted in the General Analysis Area. Soil surveys of Campbell and Converse Counties, Wyoming, including the General

Analysis Area, have also been conducted by the NRCS. Each of the LBA study areas is comprised of the LBA tract as applied for, BLM's alternative tract configurations, and the applicant mine's anticipated permit amendment study area.

Soils within the LBA study areas were identified by series, which consist of soils that have similar horizons in their profile. Horizons are soil layers having similar color, texture, structure, reaction, consistency, mineral and chemical composition, and arrangement in the profile.

Soils vary depending upon where and how they were formed. Major factors involved in the formation of soils include whether or not the material was transported and how the material was weathered during transportation. Three primary transportation processes causing three different soil types were noted: 1) those soils developed predominantly in alluvial or colluvial fan deposits, 2) those soils developed predominantly in residuum on uplands, and 3) those soils developed predominantly in eolian sand deposits. The major soil series encountered within the General Analysis Area were grouped according to the primary transportation processes and are listed as follows:

Soils developed predominantly in alluvial or colluvial fan deposits

- | | |
|-----------|----------------|
| • Arvada | • Hilight |
| • Absted | • Kishona |
| • Bahl | • Lawver |
| • Bankard | • Lithic Ustic |

- Bidman
- Bone
- Briggsdale
- Cambria
- Clarkelen
- Decolney
- Dillingson
- Draknab
- Felix
- Forkwood
- Fort Collins
- Glenberg
- Heldt
- Haverdad
- Haverson
- Hiland
- Lohmiller
- Openay
- Parmleed
- Pugsley
- Rauzi
- River Wash
- Savageton
- Shingle
- Silhouette
- Taluce
- Teckla
- Turnercrest
- Ulm
- Wags
- Zigweid

Soils developed predominantly in residuum on uplands

- Bowbac
- Cushman
- Gateson
- Gullied land
- Hiland
- Hilight
- Keeline
- Parmleed
- Razor
- Renohill
- Samday
- Shingle
- Savageton
- Samsil
- Sear
- Taluce
- Tassel
- Terro
- Thedalund
- Theedle
- Tullock
- Turnercrest
- Ustic Torrifluent
- Wags
- Wibaux
- Worf
- Worfka

Soils developed predominantly in aeolian sand deposits

- Delconey
- Dwyer
- Embry
- Maysdorf
- Nomil
- Orpha
- Pugsley
- Rauzi
- Turnercrest
- Vonalee

The baseline soil studies of the LBA study areas indicate that the amount of suitable topsoil which would be available for redistribution on all disturbed acres during reclamation would vary from an average depth of 1.5 ft to an average depth of 3.3 ft.

3.5 Air Quality and Climate

The air quality of any region is controlled primarily by the magnitude and distribution of pollutant emissions and the regional climate. The transport of pollutants from specific source areas is strongly affected by local topography. In the mountainous western United States, topography is particularly important in channeling pollutants along valleys, creating upslope and downslope circulations that may entrain airborne pollutants, and blocking the flow of pollutants toward certain areas. In general, local effects are superimposed on the general synoptic weather regime and are most important when the large-scale wind flow is weak.

3.5.1 Topography

The General Analysis Area is located in the southern portion of the PRB, a part of the Northern Great Plains that includes most of northeastern Wyoming. The topography is primarily rolling plains and

tablelands of moderate relief (with occasional valleys, canyons, and buttes). Elevations range from about 4,500 ft to 5,000 ft above sea level. Slopes in the General Analysis Area range from flat to greater than 50 percent.

3.5.2 Climate and Meteorology

The climate in the General Analysis Area is semi-arid, with an average annual precipitation at Wright of just over 11 inches (Martner 1986). Snowfall averages 25.1 inches per year, with most occurring in March and December. Evaporation exceeds annual precipitation, with relatively short warm summers and longer cold winters. The average daily mean temperature is 44.2 degrees F. The highest recorded temperature within the General Analysis Area was 103 degrees F and the lowest was minus 34 degrees F. July is the warmest month, with a mean daily temperature of 70 degrees F, and January is the coldest (20.5 degrees F). The frost-free period is 100-125 days.

In the General Analysis Area, the regional wind speeds average from nine to 13 mph with local variations in speed and direction due to differences in topography. Winds are predominantly from the northwest or southeast and tend to be strongest in the winter and spring and calmer in the summer. Wind velocity tends to increase during the day and decrease during the night. The air quality and meteorological sampling locations and associated wind rose diagrams for the North Antelope/Rochelle Complex and Black Thunder, North Rochelle,

and Antelope Mines are shown in Figures 3-3 through 3-6.

3.5.3 Existing Air Quality

WDEQ/AQD detects changes in air quality through monitoring and maintains an extensive network of air quality monitors throughout the state. Particulate matter is most commonly measured as particles finer than 10 microns or PM₁₀. The eastern side of the PRB has one of the most extensive networks of monitors for PM₁₀ in the nation due to the density of coal mines (Figure 3-7). There is a monitoring network associated with the coal mines, which is discussed more in Section 3.5.4. In addition, there are also monitors in Sheridan and Gillette, and the WDEQ/AQD installed monitors at Arvada and Wright, Wyoming in November 2002.

WDEQ/AQD uses monitors located throughout the state to anticipate issues related to air quality. These monitoring stations are located to measure ambient air quality and not located to measure impacts from a specific source. Monitors located to

Figure 3-3

Figure 3-4

Figure 3-5

Figure 3-6

Figure 3-7

measure impacts from a specific source may also be used for trends. These data are used to pro-actively arrest or reverse trends towards air quality problems. When WDEQ became aware that particulate readings were increasing due to increased CBM activity and exacerbated by prolonged drought, the WDEQ approached the counties, coal mines, and CBM industry. A coalition involving the counties, coal companies, and CBM operators have made significant efforts towards minimizing dust from roads. Measures taken have ranged from the implementation of speed limits to paving of heavily traveled roads.

Monitoring is also used to measure compliance. Where monitoring shows a violation of any standard, the WDEQ can take a range of enforcement actions to remedy the situation. Where a standard is exceeded specific to an operation, the enforcement action is specific to the facility. For many facilities, neither the cause nor the solution is simple. The agency normally uses a negotiated settlement in those instances.

WDEQ has also sited two visibility monitoring stations in the PRB. One of these sites is 32 miles north of Gillette and includes a Nephelometer, a Transmissometer, an Aerosol Monitor (IMPROVE Protocol), instruments to measure meteorological parameters (temperature, RH, wind speed, wind direction), a digital camera, instruments to measure Ozone and instruments to measure Oxides of Nitrogen (NO, NO₂, NO_x). The other

visibility monitoring station is located 14 miles west of Buffalo and includes a Nephelometer, a Transmissometer, an Aerosol Monitor (IMPROVE Protocol), instruments to measure meteorological parameters (temperature, RH, wind speed, wind direction), and a digital camera.

Other air quality monitoring in the PRB includes WDEQ NO₂ monitoring along the east side of the Basin, WARMS monitoring of sulfur and nitrogen concentrations near Buffalo, Sheridan, and Newcastle, and NADP monitoring of precipitation chemistry in Newcastle.

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

As part of an analysis of air quality impacts that was conducted to analyze potential air quality impacts from the oil and gas development alternatives being considered in the Wyoming FEIS and Draft Planning Amendment for the PRB Oil and Gas Project (BLM 2003), the Proposed RMP Amendments FEIS (BLM in press), and the Montana Statewide

Oil and Gas FEIS and Proposed Amendment of the Powder River and Billings RMPs (BLM in press), monitoring data measured throughout northeastern Wyoming and southeastern Montana were assembled and reviewed. Although monitoring is primarily conducted in urban or industrial areas, the data selected are considered the best available representation of background air pollutant concentrations throughout the PRB in Wyoming and Montana. Specific values are presented in Table 3-1, along with applicable ambient air quality standards and PSD increments, and were used to define background conditions in the air quality impact analysis. The assumed background pollutant concentrations are below applicable NAAQS and WAAQS for all criteria pollutants and averaging times.

The major types of emissions that come from surface coal mining activities are in the form of fugitive dust and tailpipe emissions from large mining equipment. Activities such as blasting, loading and hauling of overburden and coal, and the large areas of disturbed land all produce fugitive dust. Stationary or point sources are associated with coal crushing, storage, and handling facilities. In general, particulate matter (PM₁₀) is the major significant pollutant from coal mine point sources.

Blasting is responsible for another type of emission from surface coal mining. Overburden blasting sometimes produces gaseous, orange-colored clouds that contain NO₂.

Exposure to NO₂ may have adverse health effects, as discussed in Section 4.1.4. NO₂ is one of several products resulting from the incomplete combustion of explosives used in the blasting process. Wyoming's ambient air standards for NO₂ are shown in Table 3-1.

Other existing air pollutant emission sources within the region include:

- exhaust emissions (primarily CO and NO_x) from existing natural gas fired compressor engines used in production of natural gas and CBM; gasoline and diesel vehicle tailpipe emissions of combustion pollutants (VOCs, CO, NO_x, PM₁₀, PM_{2.5}, and SO₂);
- dust (particulate matter) generated by vehicle travel on unpaved roads, windblown dust from neighboring areas, and road sanding during the winter months;
- transport of air pollutants from emission sources located outside the region;
- emissions from railroad locomotives used to haul coal (primarily NO₂ and PM₁₀); and
- SO₂ and NO_x from power plants.

3.5.4 Historical Ambient Air Quality: Particulates

Until 1989, the federally regulated particulate matter pollutant was measured as TSP. This measurement included all suspendable dust (generally less than 100 microns in diameter). In 1989 the federally regulated particulate matter pollutant

Table 3-1. Assumed Background Air Pollutant Concentrations, Applicable Ambient Air Quality Standards, and PSD Increment Values (in $\mu\text{g}/\text{m}^3$).

Pollutant	Averaging Time¹	Background Concentration	Primary NAAQS²	Secondary NAAQS²	Wyoming Standards	PSD Class I Increments	PSD Class II Increments
Carbon monoxide	1-hour	3,500 ³	40,000	40,000	40,000	---	---
	8-hour	1,500	10,000	10,000	10,000	---	---
Nitrogen dioxide	Annual	16.5 ⁴	100	100	100	2.5	25
Ozone	1-hour	82 ⁵	235	235	235	---	---
	8-hour	130 ⁵	157	157	157	---	---
PM ₁₀	24-hour	42 ⁷	150	150	150	8	30
	Annual	17 ⁷	50	50	50	4	17
PM _{2.5}	24-hour	19 ⁷	65	65	65	---	---
	Annual	7.6 ⁷	15	15	15	---	---
Sulfur dioxide	3-hour	8 ⁶	---	1,300	1,300	25	512
	24-hour	8 ⁶	365	---	---	5	91
	Annual	3 ⁶	80	---	---	2	20

¹ Annual standards are not to be exceeded; short-term standards are not to be exceeded more than once per year.

² Primary standards are designed to protect public health; secondary standards are designed to protect public welfare.

³ Amoco Ryckman Creek collected for an eight month period during 1978-1979, summarized in the Riley Ridge (BLM 1983).

⁴ Data collected in Gillette, WY (1996 - 1997).

⁵ Data collected in Pinedale, WY (1992 - 1994).

⁶ Data collected in Devil's Tower, WY (1983).

⁷ Data collected in Gillette, WY (1999).

Source: (Argonne 2002)

was changed from a TSP based standard to a PM₁₀ based standard. PM₁₀ is particulate matter with an aerodynamic diameter of 10 microns or less that can potentially penetrate into the lungs and cause health problems. Wyoming added PM₁₀ based standards to match the federal standards in 1989 and retained the TSP standards as state standards until March 2000. Wyoming's ambient air standards for PM₁₀ are shown in Table 3-1.

Regional

WDEQ/AQD requires the collection of information documenting the quality of the air resource at each of the SPRB mines. Each mine monitored air quality for a 24-hour period every six days at multiple monitoring sites through the end of 2001. All PM₁₀ monitors are now required by WDEQ/AQD to sample air quality for a 24-hour period every three days beginning in 2002. Data for TSP dates back to 1980 with data for PM₁₀ dating back to 1989. This has resulted in nearly 52,000 TSP and 8,000 PM₁₀ samples collected through 2000 and makes the eastern PRB one of the most densely monitored areas in the world (Figure 3-7). Table 3-2 uses the annual arithmetic average of all sites to summarize these data.

As indicated in Table 3-2, the long-term trend in particulate emissions remained relatively flat through 1998. TSP concentration from 1980 through 1998 averaged 33.1 µg/m³, ranging between 27.8 µg/m³ and 39.4 µg/m³. There were increases in 1988 and 1996, which may have been the result of fires in the region during those

years. PM₁₀ concentration from 1989 through 1998 averaged 15.4 µg/m³, ranging between 12.9 and 16.5 µg/m³.

This time period (1980-1998) was associated with significant growth in the surface coal mining industry. Coal production increased from about 59 mmtpy to over 308 mmtpy (an increase of over 249 mmtpy), and associated overburden production increased from 105 mmby to over 710 mmby per year (a 605 mmby per year increase). From 1990 through 2000 the average annual increase in coal production was 7.4 percent, while annual overburden production increased an average of 14.6 percent over the same time period. The larger annual increase in overburden production is probably due to the fact that mines are gradually moving into deeper coals as the shallower reserves are mined out.

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

Concentrations increased from 33.9 µg/m³ in 1998 to 55.3 µg/m³ in 1999, and continued to increase at a slightly slower pace in 2000. There were no major fires in the region during this time. The increases in

Table 3-2. Summary of WDEQ/AQD Reports on Air Quality Monitoring in Wyoming's PRB, 1980-2000.

Year	Coal Produced (mmtpy)	Yards Moved (mmbcy)	Number of Mines Operating/ Monitoring TSP/ Monitoring PM₁₀¹	Number of Sites TSP/PM₁₀² (µg/m³)	TSP Average (µg/m³)	PM₁₀ Average (µg/m³)
1980	58.7	105.3	10/14/0	34/0	35.5	na ³
1981	71.0	133.4	11/13/0	35/0	39.4	na
1982	76.1	141.1	11/14/0	40/0	31.2	na
1983	84.9	150.9	13/14/1	41/1	32.6	11.2
1984	105.3	169.5	14/16/1	42/1	33.9	11.1
1985	113.0	203.4	16/17/0	49/0	32.3	na
1986	111.2	165.7	16/17/0	45/0	29.3	na
1987	120.7	174.6	16/17/0	43/0	31.7	na
1988	138.8	209.7	16/17/0	43/0	37.7	na
1989	147.5	215.6	15/17/3	40/3	32.1	15.9
1990	160.7	223.5	17/17/5	47/5	34.3	14.8
1991	171.4	245.9	17/17/5	46/6	32.7	16.5
1992	166.1	296.0	17/17/7	41/7	31.7	15.9
1993	188.8	389.5	17/17/8	40/11	27.8	14.5
1994	213.6	483.9	17/18/8	44/11	31.7	15.5
1995	242.6	512.7	16/18/8	41/12	29.6	12.9
1996	257.0	605.4	17/18/8	41/12	35.4	16.0
1997	259.7	622.0	16/17/10	39/15	33.3	15.9
1998	308.6	710.7	16/17/12	36/17	33.9	15.9
1999	317.1	758.0	15/17/12	36/18	55.3	21.6
2000	322.5	845.3	15/15/12	31/17	56.1	23.4

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

² Some sites include more than one sampler, so the number of samplers is greater than the number of sites.

³ Not applicable because no monitoring for PM₁₀ was done.

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

coal production over those two years (2.3 percent per year and 13.9 mmtpy over the two year period) and associated overburden production (9.5 percent per year and 135 mmbcy over the two year period) were not larger than the two-year increases during some of the previous 18 years, but the particulate concentration increase was much larger than in previous years.

Site Specific

Within the General Analysis Area, historical particulate matter ambient air quality data generally show the same results as described above for the PRB as a whole. At the four mines included in this analysis, there are 13 TSP monitoring samplers and 11 PM₁₀ monitoring samplers. Each mine has a meteorological station. Figure 3-8 presents the average annual TSP and PM₁₀ measured at these samplers within the General Analysis Area. These data were collected for the years 1995 through 2000.

Cumulative coal and overburden production for the SPRB mines for these years are also shown on Figure 3-8. As discussed above, coal and overburden production for the SPRB mines have steadily increased since 1980.

As discussed above, TSP was the federally regulated pollutant until 1989 and was retained as a state regulated pollutant until 2000. PM₁₀ became a federal standard in 1989 and was also adopted by the State of Wyoming. There were no violations of the TSP standard at the North

Antelope/Rochelle Complex, Black Thunder, North Rochelle, or Antelope Mines when TSP was the federally regulated pollutant. After 1989, and until recently, TSP measurements were used as a surrogate for PM₁₀ in lieu of having to replace and/or co-locate an existing TSP sampler with a new PM₁₀ sampler. There were no violations of the PM₁₀ standards anywhere in the PRB through the first quarter of 2001.

In 2001 and 2002 the 24-hour PM₁₀ standard was exceeded several times in the General Analysis Area (specific monitoring data are presented in Appendix E). The WDEQ/AQD is continually reviewing the data and considering regulatory options. Particulate emissions from non-mining sources have not been quantified; however, more intense monitoring and regulatory inspections have been implemented at all PRB coal mines. In addition, the close proximity of the monitors where the standard was exceeded to unpaved county roads has resulted in county/industry partnerships to treat portions of these roads with chemical dust suppressants.

Control Measures

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

Figure 3-8

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

3.5.5 Historical Ambient Air Quality: NO₂

Regional

NO₂ was monitored from 1975 through 1983 in Gillette and from March 1996 through April 1997 at four locations in the PRB. One of these locations is in the General Analysis Area. Table 3-3 summarizes the results of that monitoring. Beginning in 2001, the coal industry in cooperation with WDEQ/AQD installed a network of NO₂ monitors in the PRB. The 2001 data from this regional network are summarized in Table 3-4.

Annual NO₂ levels measured in the March 1996 to April 1997 timeframe were below applicable standards. The highest reading was 22 µg/m³ as compared to the 100 µg/m³ standard. All 2001 annual mean NO₂ concentrations are well below the 100 µg/m³ standard.

Site Specific

As discussed above, NO₂ monitoring results are available from several sites in the General Analysis Area. The Gillette monitoring site is located approximately 38 miles north, the Belle Ayr Mine site is located approximately 23.5 miles north, the Black Thunder Mine site is located within the General Analysis Area, and the Bill site is located approximately 18 miles south.

Control Measures

All four mines included in this analysis have implemented programs designed to control/limit public exposure to the intermittent, short-term NO₂ releases associated with blasting and they all comply with the blasting plan publication/notification requirements associated with the Permits to Mine issued by WDEQ/LQD.

There have been no reported events of public exposure to NO₂ from blasting activities at the North Antelope/Rochelle Complex, the North Rochelle Mine, or the Antelope Mine. These mines have instituted voluntary measures to be implemented when large blasts are

Table 3-3. Annual Ambient NO₂ Concentration Data.

Site	Gillette		Black Thunder Mine		Belle Ayr Mine		Bill	
Year	NO ₂ (µg/m ³) ¹	Percent of Standard	NO ₂ (µg/m ³) ¹	Percent of Standard	NO ₂ (µg/m ³) ¹	Percent of Standard	NO ₂ (µg/m ³) ¹	Percent of Standard
1975	6*	6						
1976	4*	4					1*	1
1977	4*	4					5*	5
1978	11*	11						
1979	11	11						
1980	12	12						
1981	14	14						
1982	11	11						
1983 ²	17	17						
1996 ³	16	16	16	16	22	22	22	22

¹ Based on arithmetic averaging of data.

² Monitoring discontinued December 1983, reactivated March 1996 to April 1997.

³ Arithmetic average - actual sampling ran from March 1996 to April 1997.

* Inadequate number of samples for a valid annual average.

Source: McVehil-Monnett 1997

Table 3-4. 2001 Annual Ambient NO₂ Concentration Data.

Monitor	Annual Mean NO ₂ Concentration (µg/m ³)
Antelope Mine	7
Belle Ayr Mine	14
Black Thunder Mine	5*

* Data for the 3rd quarter is questionable and therefore is not used in the determination of the annual mean for the site.

planned. These voluntary measures include:

- phone notification of neighbors and workers in the general area of the mine prior to large blasts;
- monitoring of weather and atmospheric conditions prior to

the decision to detonate a large blast;

- minimizing blast size to the extent possible; and
- posting of signs on major public roads that enter the general mine area and on all locked gates accessing the active mine area.

Black Thunder Mine received several reports of public exposure to NO₂ from blasting prior to 2001. Measures to prevent future such incidences have been instituted at the Black Thunder Mine when large overburden blasts are planned. These measures include:

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

All of the mines in the General Analysis Area are participating in a coal industry study of blasting emissions. They have also participated in the installation and operation of the regional NO₂ monitoring network discussed earlier.

3.5.6 Air Quality Related Values - Visibility and Acidification of Lakes

AQRVs, including the potential air pollutant effects on visibility and the acidification of lakes and streams, are applied to PSD Class I and sensitive Class II areas. The land management agency responsible for the Class I area sets an LAC for each AQRV. The

AQRVs reflect the land management agency's policy and are not legally enforceable standards.

3.5.6.1 Visibility

Potential impacts to visibility were considered at 29 PSD Class I and sensitive Class II areas in the vicinity of the General Analysis Area. Table 3-5 shows the nearest distances from the sensitive receptor areas to the General Analysis Area.

Visibility can be defined as the distance one can see and the ability to perceive color, contrast, and detail. Fine particulate matter (PM_{2.5}) is the main cause of visibility impairment. Visual range, one of several ways to express visibility, is the furthest distance a person can see a landscape feature. Maximum visual range in the western United States would be about 140 miles. Presently, the visibility conditions monitored in the Bridger Wilderness Area are among the best in the United States. Visual range monitoring in the Bridger Wilderness Area shows that one can see more than 70 miles 70 percent of the time.

Visibility impairment is expressed in terms of deciview (dv). The dv index was developed as a linear perceived visual change (Pitchford and Malm 1994), and is the unit of measure used in the EPA's Regional Haze Rule to achieve the National Visibility Goal. A change in visibility of 1.0 dv represents a "just noticeable change" by an average person under most circumstances. Increasing dv values

Table 3-5. Approximate Distances and Directions from the General Analysis Area to PSD Class I and Class II Sensitive Receptor Areas.

Receptor Area	Distance (miles)	Direction to Receptor
Mandatory Federal PSD Class I		
Badlands Wilderness Area ¹	135	E
Bridger Wilderness Area	195	WSW
Wind Cave National Park	85	E
Yellowstone National Park	230	W
Tribal Federal PSD Class I		
Fort Peck Indian Reservation	210	N
Northern Cheyenne Indian Reservation	125	NNW
Federal PSD Class II		
Bighorn Canyon National Recreation Area	155	NW
Black Elk Wilderness Area	80	ENE
Cloud Peak Wilderness Area	85	WNW
Crow Indian Reservation	115	NW
Devils Tower National Monument	65	NNE
Fort Laramie national Historic Site	90	SSE
Jewel Cave National Monument	70	E
Mount Rushmore National Memorial	90	ENE

¹ The U.S. Congress designated the Wilderness Area portion of Badlands National Park as a mandatory federal PSD Class I area. The remainder of Badlands National Park is a PSD Class II area.

represent proportionately larger perceived visibility impairment. Figure 3-9 shows annual averages for the 20 percent best, worst, and middle visibility days at Badlands and Bridger Wilderness Areas from 1988 to 1998, respectively (IMPROVE 2002).

3.5.6.2 Acidification of Lakes

The acidification of lakes and streams is caused by atmospheric deposition of pollutants (acid rain). Lake acidification is expressed as the change in ANC measured in microequivalents per liter ($\mu\text{eq/L}$), the lake's capacity to resist

Figure 3-9

acidification from acid rain. Table 3-6 shows the existing ANC monitored in some mountain lakes and their distance from the General Analysis Area.

3.5.7 Regulatory Framework

The potential impacts of leasing the LBA tracts must be evaluated with respect to two programs, NAAQS and PSD, as applicable.

The NAAQS set nationwide thresholds for maximum acceptable concentrations of various pollutants. WAAQS must be at least as stringent as NAAQS. Selected Wyoming and national ambient air standards are shown in Table 3-1. The NAAQS and WAAQS set the absolute upper limits for specific air pollutant concentrations at all locations where the public has access. Existing air quality throughout most of the PRB in Wyoming is in attainment with all

ambient air quality standards, as demonstrated by the relatively low concentration levels presented in Table 3-1. However, the Sheridan, Wyoming area has been designated as a federal non-attainment area (PM₁₀ - moderate) where the applicable standards have been violated in the past. EPA Region 8 staff are concerned that PM₁₀ monitoring data collected near and south of Gillette, Wyoming, have also exceeded both the NAAQS and the available PSD Class II increment. Specific monitoring data are presented in Appendix E (EPA 2002a). The analysis of the proposed Alternatives must demonstrate continued compliance with all applicable local, state, tribal, and federal air quality standards.

Future development projects which have the potential to emit more than 250 tons per year of any criteria pollutant (or certain listed sources that have the potential to emit more

Table 3-6. Existing Acid Neutralizing Capacity in Sensitive Lakes.

Wilderness Area	Lake	Background ANC (µeq/L)
Bridger	Black Joe	69.0
	Deep	61.0
	Hobbs	68.0
	Upper Frozen	5.8 ¹
Cloud Peak	Emerald	55.3
	Florence	32.7
Fitzpatrick	Ross	61.4
Popo Agie	Lower Saddlebag	55.5

¹ Since the background ANC value is less than 25 µeq/L, the potential ANC change is expressed in µeq/L, and the applicable threshold is one µeq/L

Source: Argonne (2002)

than 100 tons per year) would be required to undergo a regulatory PSD Increment Consumption analysis under the federal New Source Review permitting regulations. Development projects subject to the PSD regulations must also demonstrate the use of BACT and show that the combined impacts of all PSD sources will not exceed the allowable incremental air quality impacts for NO₂, PM₁₀, or SO₂. A regulatory PSD Increment Consumption analysis may be conducted as part of a New Source Review, or independently. The determination of PSD increment consumption is a legal responsibility of the applicable air quality regulatory agencies, with EPA oversight. Finally, an analysis of cumulative impacts due to all existing sources and the permit applicant's sources, is also required during PSD analysis to demonstrate that applicable ambient air quality standards will be complied with during the operational lifetime of the permit applicant's operations. In addition, sources subject to PSD permitting requirements would provide specific analysis of potential impairment of AQRVs such as visibility and acid rain.

The federal CAA also provides specific visibility protection of mandatory federal Class I areas. Mandatory Federal Class I areas were designated by the U.S. Congress on August 7, 1977, and include wilderness areas greater than 5,000 acres in size and national parks greater than 6,000 acres in size. The mandatory federal Class I areas located nearest to the General Analysis Area are listed in Table 3-5. In addition, the Northern Cheyenne Tribe (located north of the

General Analysis Area in Montana) has designated their lands as PSD Class I. As shown in Table 3-1, the allowable incremental impacts for NO₂, PM₁₀, and SO₂ within these PSD Class I areas are very limited. Most of the PRB in Wyoming is designated as PSD Class II with less stringent requirements.

This NEPA analysis compares potential air quality impacts from the Proposed Action and Alternatives to applicable ambient air quality standards, PSD increments, and AQRVs (such as visibility), but it does not represent a regulatory PSD analysis. Comparisons to the PSD Class I and II increments are intended to evaluate a threshold of concern for potentially significant adverse impacts, and do not represent a regulatory PSD Increment Consumption Analysis. Even though the development activities would occur within areas designated PSD Class II, the potential impacts are not allowed to cause incremental effects greater than the stringent Class I thresholds to occur inside any distant PSD Class I area. Finally, the CAA directs the EPA to promulgate the Tribal Authority Rule, establishing tribal jurisdiction over air emission sources within the exterior boundaries of tribal lands. Pursuant to this rule, the Crow and Northern Cheyenne tribes north of the General Analysis Area in Montana may request that they be treated in the same manner as a state (including Section 105 grants and formal recognition as an affected "state" when emission sources are located within 50 miles of tribal lands) under the CAA.

Coal mining in the General Analysis Area is not currently affected by the PSD regulations for two reasons: surface coal mines are not on the EPA list of 28 major emitting facilities for PSD regulation, and point-source emissions from individual mines do not exceed the PSD emissions threshold of 250 tons per year.

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

In order to obtain a construction permit, an operator may be required to demonstrate that the proposed activities will not increase air pollutant levels above annual standards established by the Wyoming Air Quality Standards and Regulations (WDEQ/AQD 2000). The operator will also be required to utilize BACT for minimizing emissions from the facility. Monitoring may be required as a condition of the permit to construct. A permit to operate will also be required and will contain specific emission limitations and other measures of performance for operation of the facility.

The demonstration required for a construction permit often entails development of an emission inventory for the proposed facility, an estimate of the emissions from all other permitted sources of air pollutants in the vicinity, and the collection of local

ambient air quality and meteorology data. This information is utilized in dispersion modeling to predict the cumulative impact of the proposed facility along with existing sources on the quality of the air in the immediate vicinity, including the impact on any special resource areas.

3.6 Water Resources

3.6.1 Groundwater

The General Analysis Area contains three water-bearing geologic units that could be disturbed by mining. In descending order, these units are the recent Alluvium, Wasatch Formation overburden, and the Wyodak coal seam or its local equivalent. The sub-coal Fort Union Formation and the Fox Hills Sandstone of the Lance Formation are utilized for water supply by coal mines within the General Analysis Area, but these units are not physically disturbed by mining activities. Site-specific data have been collected by PRCC, TBCC, TCC, and ACC to characterize baseline hydrologic conditions in each of the respective LBA tracts. Figure 3-2 presents the hydrostratigraphic units underlying the General Analysis Area. The four mines included in this analysis have a total of 64 monitoring wells within or near the five LBA tracts. These include 10 monitoring wells in the alluvium, 12 monitoring wells in the Wasatch overburden, 32 monitoring wells in the coals, and 10 monitoring wells in the underburden.

Recent Alluvium

With the exception of Porcupine Creek (NARO North LBA Tract) and Antelope Creek (West Antelope LBA Tract), which both contain alluvial aquifers composed of coarse-grained sand and fine gravels, the drainages in the LBA tracts are generally dry draws. The alluvial and colluvial deposits associated with these draws are generally thin and not laterally extensive enough to be considered an aquifer.

Wasatch Formation

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

Another geologic unit which may be considered a part of the Wasatch Formation is scoria, also called clinker or burn. It consists of sediments which were baked, fused,

and melted in place when the underlying coal burned spontaneously. These burned sediments collapsed into the void left by the burned coal. Scoria deposits can be a very permeable aquifer and can extend laterally for miles in the eastern PRB. The occurrence of scoria is site specific; the NARO South LBA Tract is the only tract in the General Analysis Area containing any appreciable amount of scoria. The hydrologic function of scoria in the general area is to provide infiltration of precipitation and recharge to laterally contiguous overburden and Wyodak coal.

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

Water quality in the Wasatch Formation is extremely variable, with TDS concentrations ranging from 360 mg/L to 7,360 mg/L in the General Analysis Area.

Wyodak Coal

Within the General Analysis Area the Wyodak coal seam is most often

divided by partings that separate it into two or more units. The separate units are typically given local names which vary from mine to mine. (e.g., Upper and Lower Wyodak). A general discussion of the coal seam aquifer is presented as follows.

Due to its continuity, the Wyodak coal seam is considered a regional aquifer within the PRB. Hydraulic conductivity within the Wyodak coal seam is highly variable and is reflective of the amount of fracturing the coal has undergone, as unfractured coal is virtually impermeable. The yield of groundwater to wells and mine pits is smallest where the permeability of the coal is derived primarily from localized unloading fractures. These fractures, which are the most common, were created by the expansion of the coal as the weight of overlying sediments was slowly removed by erosion. The highest permeability is imparted to the coal by tectonic fractures. These are through-going fractures of areal importance created during deformation of the south Powder River structural basin. The presence of these fractures can be recognized by their linear expression at the ground surface, controlling the orientation of stream drainages and topographic depressions. Due to their pronounced surface expression, these tectonic fractures are often referred to as “lineaments”. Coal permeability along lineaments can be increased by orders of magnitude over that in the coal fractured by unloading only.

The chemistry of groundwater in the coal is variable within the General Analysis Area. In general, it is a sodium-bicarbonate type with TDS concentrations increasing in a downdip direction. Within the General Analysis Area, TDS concentrations range from 382 mg/L to 4,840 mg/L.

Prior to mining, the direction of groundwater flow within the coal aquifer was generally from recharge areas near the outcrop and burn zone into the basin, following the dip of the coal. Site-specific water-level data collected by mining companies and presented in the GAGMO 20-year report (Hydro-Engineering 2000) indicate that the groundwater flow directions have been influenced by mining activities. Near active mining areas, groundwater flow within the coal aquifer is typically toward the mine pits.

Subcoal Fort Union Formation

The subcoal Fort Union Formation can be divided into three hydrologic units: the Tongue River aquifer, the Lebo member, and the Tullock aquifer (Law 1976). The hydrologic units below the Wyodak coal are not directly disturbed by mining, but many mines use them for water supply wells. In a few cases there have been drawdowns in the subcoal aquifer due to leakage into mine pits, dewatering, and CBM development (BLM 2001b). The Tongue River aquifer consists of lenticular fine-grained shale and sandstone. The Lebo member, also referred to as “the Lebo confining layer”, is typically more fine-grained than the other two

members and generally retards the movement of water (Lewis and Hotchkiss 1981). The Tullock aquifer consists of discontinuous lenses of sandstone separated by interbedded shale and siltstone. Transmissivity is the equal to an aquifer's hydraulic conductivity or permeability times its thickness and is commonly used when discussing the hydraulic properties of the Fort Union Formation, where wells are completed by exposing many discrete sand lenses to the well bore. Transmissivities are generally higher in the deeper Tullock aquifer than in the Tongue River or Lebo, and many mines in the PRB have water-supply wells completed in this interval (Martin et al. 1988). The average transmissivity for this member as reported by OSM (1984) is 290 ft²/day. All five of the mines located within the General Analysis Area use deep wells completed in the subcoal Fort Union Formation for water supply. Fort Union water supply wells in the General Analysis Area generally range from 600 to 2,000 ft in depth.

The water quality of the Fort Union Formation is generally good. TDS concentrations measured at various Fort Union Formation water supply wells in the General Analysis Area range from 230 mg/L to 520 mg/L. Water from the subcoal Fort Union Formation is of the sodium-bicarbonate type. This water is generally suitable for domestic use and may be suitable for livestock and wildlife watering, and irrigation, depending upon site-specific SAR values.

Lance and Fox Hills Formations

Underlying the Fort Union Formation is the Lance Formation of Cretaceous age. At the base of the Lance Formation is the Fox Hills Sandstone. The Lance Formation and Fox Hills Sandstone are used for water supply by PRCC at the North Antelope/Rochelle Complex. The North Antelope/Rochelle Complex water supply well is 5,400 ft deep and capable of producing about 400 gpm. Water from this well is of the sodium-bicarbonate type with a TDS concentration of approximately 1,200 mg/L. This water is suitable for livestock and wildlife watering.

3.6.2 Surface Water

From north to south, the General Analysis Area is drained by North Prong Little Thunder Creek, Little Thunder Creek, Porcupine Creek, Spring Creek, and Antelope Creek (Figure 3-10). North Prong Little Thunder Creek is a tributary of Little Thunder Creek, which is a tributary of Black Thunder Creek. Porcupine Creek and Spring Creek are tributaries of Antelope Creek. Both Black Thunder Creek and Antelope Creek are tributaries of the Cheyenne River.

Figure 3-10

The Little Thunder and West Roundup LBA Tracts are located in the headwater area of Little Thunder Creek. Surface water flow in this area is typically ephemeral (i.e., only in direct response to rainfall or snowmelt).

The NARO North LBA Tract is drained by Porcupine Creek and its tributaries. In this area, flow in Porcupine Creek is ephemeral.

The NARO South and West Antelope LBA Tracts are in the Antelope Creek watershed. Antelope Creek is an intermittent stream that, prior to mining, received a small degree of baseflow from coal seams.

Water quality in each of these streams is highly dependent on flow. Typically, high flows are low in TDS and low flows are higher in TDS. The ephemeral nature of the majority of these streams results in a paucity of surface water quality data. Antelope Creek does, however, have regular flow, and as such, ACC has extensive flow and quality records.

3.6.3 Water Rights

Water rights in Wyoming are administered by Wyoming SEO. Water rights are granted for both groundwater and surface water appropriations. Prior to development of water resources associated with energy development, water appropriations (either groundwater or surface water) in the southern PRB were typically for livestock use. Currently, the majority of the water rights in the General Analysis Area

are held by mining companies and methane development.

Records of the SEO were searched for groundwater rights within a three-mile radius of each LBA as applied for under the Proposed Action and Alternatives. This information is required for WDEQ permitting. The results of these searches are provided below for each tract. A listing of the non-coal mine groundwater rights within three miles of each tract is presented in Appendix F.

For the NARO North LBA Tract, SEO data indicate there are 539 permitted water wells within three miles of the tract, of which 412 are owned by coal mining companies. The other 127 wells are permitted for the following uses:

- 49 monitoring and miscellaneous
- 37 livestock
- 16 livestock and CBM development
- 11 miscellaneous
- 6 livestock and domestic
- 3 CBM development
- 2 livestock and miscellaneous
- 2 livestock, miscellaneous, and CBM development
- 1 industrial

For the NARO South LBA Tract, SEO data indicate there are 615 permitted water wells within three miles of the tract, of which 544 are owned by coal mining companies. The 71 other wells are apportioned into the following use categories:

- 27 livestock

- 6 livestock and CBM development
- 16 monitoring and miscellaneous
- 6 livestock and domestic
- 3 industrial
- 1 CBM development
- 1 livestock and irrigation
- 1 livestock, miscellaneous and CBM development

SEO data indicate there are 634 permitted water wells within three miles of the Little Thunder LBA Tract, of which 182 are owned by coal mining companies. The other 451 wells are permitted for the following uses:

- 233 CBM development only
- 116 CBM development and livestock watering
- 38 monitoring and miscellaneous
- 37 livestock watering only
- 10 livestock watering and domestic use
- 5 CBM development and miscellaneous
- 5 monitoring, livestock watering and miscellaneous
- 3 livestock watering, industrial and miscellaneous
- 2 reservoir supply and miscellaneous
- 2 CBM development, livestock watering and miscellaneous

SEO data indicate there are 441 permitted water wells within three miles of West Roundup LBA Tract, of which 221 are owned by coal mining companies. The other 220 other wells are permitted for the following uses:

- 90 CBM development only

- 50 monitoring or miscellaneous
- 38 livestock watering only
- 27 CBM development and livestock watering
- 8 monitoring only
- 3 industrial
- 2 domestic use and livestock watering
- 2 CBM development, livestock watering and miscellaneous

SEO data indicate there are 276 permitted water wells within three miles of West Antelope LBA Tract, of which 198 are owned by coal mining companies. Permitted uses of the 78 other wells are summarized as follows:

- 33 livestock watering only
- 16 CBM development and livestock watering
- 10 monitoring or miscellaneous
- 8 livestock watering or domestic
- 5 CBM development only
- 2 livestock watering and miscellaneous
- 1 livestock watering and reservoir supply
- 1 industrial
- 1 livestock watering, miscellaneous and CBM development
- 1 domestic use only

3.7 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 agriculture operations on the land of which the AVF is a part. For any designated AVF, regardless of its significance to agriculture, it must be demonstrated that the essential hydrologic functions of the valley will be protected.

Guidelines established by OSM and WDEQ/LQD for the identification of AVFs require detailed studies of geomorphology, soils, hydrology, vegetation, and land use. These technical disciplines are applied as limiting criteria along three paths to identify 1) the possibility for artificial flood irrigation, 2) past and/or present flood irrigation, and 3) apparent subirrigated areas and the possibility for natural flood irrigation. Areas passing the limiting criteria are subjected to an assessment of their practical use for agriculture.

Investigations have been conducted by PRCC, TBCC, TCC, and ACC to determine the presence of AVFs within and surrounding the North Antelope/Rochelle Complex, Black

Thunder, North Rochelle, and Antelope Mines, respectively.

AVF investigations conducted within the General Analysis Area have identified AVFs that occur along Porcupine Creek, Antelope Creek, Little Thunder Creek, and North Prong Little Thunder Creek downstream of the LBA tracts (see Figure 3-10 for the general location of surface water features in the General Analysis Area). One 250-acre flood-irrigated hay meadow near the confluence of Porcupine Creek and Antelope Creek has been determined to be significant to agriculture. This hay meadow is the only flood-irrigated land identified in the SPRB General Analysis Area. This flood-irrigated AVF is not within the North Antelope/Rochelle Complex's current mine permit area, with the exception of 2.5 acres of flood-irrigated land within the mine's railroad spur. This AVF does lie within the North Antelope/Rochelle Complex's anticipated permit amendment study area. A total of approximately 100 acres of declared AVF occur within the mine's railroad spur along Porcupine and Antelope Creeks, east-southeast of the NARO South LBA Tract. This AVF is outside the area of anticipated coal removal. Special measures have been designated to ensure that the mine operation will not interrupt or preclude farming on the flood-irrigated lands, and Porcupine Creek downstream from the mine's facilities will not be affected by mining. No other declared AVFs or potential AVFs identified in the General Analysis Area have been determined by the

WDEQ/LQD to be significant to agriculture.

The NARO North and Little Thunder LBA Tracts have been declared non-AVF by WDEQ/LQD. The NARO South LBA Tract, West Roundup LBA Tract and portions of the West Antelope LBA Tract have not yet been formally evaluated for the presence of AVFs.

Portions of Porcupine Creek and its tributaries, Boss Draw and Corder Creek, cross the NARO North LBA Tract (Figure 3-10). WDEQ/LQD has determined that no AVF lands are present within these drainages. The declared AVF on Porcupine Creek is located several miles downstream of the NARO North LBA Tract.

Portions of Little Thunder Creek and North Prong Little Thunder Creek cross the Little Thunder LBA Tract (Figure 3-10). WDEQ/LQD has declared 143 acres along the lower reach of Little Thunder Creek and 194 acres along the lower reach of North Prong Little Thunder Creek as AVFs. The declared AVFs are located several miles downstream from the Little Thunder LBA Tract and will not be affected by the planned mining and reclamation within the tract.

No unconsolidated stream laid deposits are found within the NARO South LBA Tract; therefore, it is unlikely that an AVF declaration would be made.

A portion of Olson Draw, a tributary of Trussler Creek which is a tributary of the Little Thunder Creek, is located on the West Roundup LBA Tract

(Figure 3-10). Based on previous non-AVF declarations made on Olson Draw downstream of the West Roundup LBA Tract, it is unlikely that this channel would receive an AVF declaration upstream on the LBA tract where the drainage is smaller and AVF characteristics are negligible.

Antelope Creek within and extending two miles upstream from the existing Antelope Mine permit boundary, including a portion of the West Antelope LBA Tract (Figure 3-10), has been investigated for the presence of an AVF (ACC 1998). A portion of Antelope Creek within the current permit area has been designated by WDEQ/LQD as “possible subirrigated AVF of minor importance to agriculture”. ACC’s approved mining plan avoids disturbing Antelope Creek and an adjacent buffer zone. Portions of Spring Creek within the West Antelope LBA Tract are potential AVF due to the presence of stream laid deposits that are subirrigated, however historical efforts at flood irrigation within the Spring Creek valley have not been successful.

Site-specific studies will be part of the mine permitting process if lease sales are held and the LBA tracts are proposed for mining. Declarations of the presence or absence of AVFs, their significance to agriculture, and the appropriate perimeters will then be made by the WDEQ/LQD. It is reasonable to assume that if the WDEQ/LQD determines AVFs are present within any of the LBA tracts that are leased, mining would be permitted because all of the proposed

lease areas consist entirely of undeveloped rangeland.

3.8 Wetlands

Waters of the U.S. is a collective term for all areas subject to regulation by the COE under Section 404 of the Clean Water Act. *Waters of the U.S.* include *special aquatic sites*, wetlands, and jurisdictional wetlands. *Special aquatic sites* are large or small geographic areas that possess special ecological characteristics of productivity, habitat, wildlife protection or other important and easily disrupted ecological values (40 CFR 230.3). Wetlands are a type of *special aquatic site* that includes “those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas” (33 CFR 328.3(a)(7)(b)). Jurisdictional wetlands are defined as those wetlands which are within the extent of COE regulatory review. They must contain three components: hydric soils, a dominance of hydrophytic plants, and wetland hydrology. As the result of a recent Supreme Court ruling (*Solid Waste Agency of Northern Cook County v. United States Army Corps of Engineers*, January 9, 2001) non-navigable, isolated intrastate wetlands (e.g., playas) and other waters of the U.S. are not considered jurisdictional. Navigable, non-isolated wetlands and other waters of

the U.S. are still considered jurisdictional by the COE.

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

Several types of wetland systems are present within the General Analysis Area. These wetland systems are limited in size, however the vegetation in these environments is highly productive and diverse, and provides habitat for many wildlife species. Further, the systems as a whole play important roles in controlling flood waters, recharging groundwater, and filtering pollutants (Niering 1985).

Wetlands can occur in a variety of forms within the General Analysis Area. Riverine wetlands, defined by their close association with perennial streams, occur sporadically along drainages within the General Analysis Area. These areas are supported not only by the groundwater associated with the drainages, but also by periodic flooding events. Common species in these settings can include willows (*Salix* spp.), scouring rush (*Equisetum* spp.), sedges (*Carex* spp.), and rushes (*Juncus* spp.) (USFS 1987a).

Depressional areas that are naturally subirrigated support palustrine wetlands. These wetlands are commonly referred to as wet meadows and support a variety of lush plant

life. Common species are sedges, rushes, cordgrass (*Spartina* spp.), mint (*Mentha* spp.), and buttercup (*Ranunculus* spp.). Depressional areas that hold water may support lacustrine wetlands. When natural, these wetland areas are called playa lakes; however, man made structures such as stock ponds also may support these systems. Cattails (*Typha* spp.) and bulrush (*Scirpus* spp.) are the most common species in these systems, although lady's thumb (*Polygonum* spp.), verbena (*Verbena* spp.), and milkweed (*Asclepias* spp.) also may occur (USFS 1987a).

The NARO North and NARO South LBA Tracts and anticipated disturbance area include 46.9 acres of waters of the U.S. of which 18.4 acres are jurisdictional wetlands and 28.5 acres are non-jurisdictional wetlands.

The Little Thunder LBA Tract and anticipated disturbance area includes 8.59 acres of jurisdictional waters of the U.S., with 5.19 acres of jurisdictional wetlands. The tract includes an additional 16.77 acres of non-jurisdictional wetlands.

The West Roundup LBA Tract and anticipated disturbance area includes 28.85 acres of waters of the U.S. with 6.8 acres of jurisdictional wetlands. The tract includes 20.21 acres of non-jurisdictional wetlands.

The West Antelope LBA Tract and anticipated disturbance area includes 33.52 acres of waters of the U.S. with 31.77 acres of jurisdictional wetlands. No non-jurisdictional wetlands were identified on this tract.

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

3.9 Vegetation

Numerous baseline vegetation surveys associated with surface mining operations have been conducted within the General Analysis Area. Vegetation surveys of the General Analysis Area have been conducted by Intermountain Resources of Laramie, Wyoming, BKS Environmental Associates, Inc. of Gillette, Wyoming, and Ecologic of Bakersfield, California. Each of the LBA study areas is comprised of the LBA tract as applied for, BLM's alternative tract configuration, and the applicant mine's anticipated permit amendment study area.

The vegetation of the General Analysis Area consists of species common to eastern Wyoming. Forty vegetation types were identified within the General Analysis Area: Blue Grama Roughland, Blue Grama Upland, Big Sagebrush Upland/Shrubland/Grassland, Birdsfoot Sagebrush Upland, Sandy Saline Meadow, Grassy Bottom, Mixed Sandy Upland, Wet Meadow/Water/Riparian, Greasewood Lowland, Silver Sagebrush Lowland, Treated Grazing Land, Big Sagebrush Draw, Disturbed Lands, Mixed Grass Prairie, Rough Breaks Shrublands, Streamside Meadow, Playa Barrens/Grassland, Reservoirs, Cultivated Pastureland, Pastureland/Hayland, Alkali Shrubland, Densely/Sparsely Vegetated Playa, Cropland, Reclaimed Lands, Alkali Bottomland Grass, Spicebush Playa, Upland Grassland, Breaks Grassland, Scoria Grassland, Greasewood Grassland, Meadow Grassland, Salt Grassland, Agriculture, and Silver Sagebrush.

The vegetation of the General Analysis Area varies from sagebrush and grassland-dominated uplands to the heavily vegetated riparian areas and stream terraces. The predominant vegetation types, in terms of total acres or occurrence, are the sagebrush and grassland types, which occur on approximately 65 percent of the lands inventoried in the General Analysis Area. Other common plant species on the level uplands include western wheatgrass, needleandthread grass, and plains pricklypear. On the stream terraces, common species include blue grama, silver sagebrush, and greasewood.

Spicebush, foxtail barley, and inland saltgrass occur near and around playas. Within the bottomlands and riparian areas are mixtures of western wheatgrass, Kentucky bluegrass, and sedges. Cottonwood trees varying in density and extent occur within some of the larger stream valleys. Blue grama, big sagebrush, and bluebunch wheatgrass occur on the ridges and rougher areas. The occurrence and relative distribution of the dominant vegetation types is shown in Table 3-7.

3.9.1 Threatened, Endangered, Proposed, and Candidate Plant Species and USFS Region 2 Sensitive Species

Refer to Appendix G.

3.10 Wildlife

Background information on wildlife in the General Analysis Area was drawn from several sources, including:

- FEIS for the North Jacobs Ranch Coal Lease Application (BLM 2001b);
- FEIS for the Horse Creek Coal Lease Application (BLM 2000a);

Table 3-7. Dominant Vegetation Types in the General Analysis Area.

Vegetation Types	Acreage	Percentage
Grassland	14,674	33.40
Big Sagebrush	14,075	32.00
Breaks Grassland	3,894	8.90
Playa Barrens	2,119	4.80
Disturbed Areas	1,907	4.30
Meadows/Riparian	1,828	4.20
Greasewood	1,530	3.50
Pasture/Hayland	1,190	2.70
Saline Grasslands	1,135	2.60
Agriculture	649	1.50
Birdsfoot Sagebrush	280	0.64
Silver Sagebrush	256	0.60
Playa Grasslands	252	0.76
Reservoirs/Stockponds	154	0.40
Reclaimed Land	40	0.09
Total	43,983	100.00

- FEIS for the Powder River Coal and Thundercloud Coal Lease Applications (BLM 1998);
- FEIS for the North Rochelle Coal Lease Application (BLM 1997b);
- FEA for the Antelope Coal Lease Application (BLM 1995);
- FEIS for the West Black Thunder Coal Lease Application (BLM 1992a);
- Wyoming Natural Diversity Database (University of Wyoming 2001);
- WGFD and USFWS records; and
- personal contacts with WGFD and USFWS biologists.

Site-specific data for the proposed lease areas were also obtained from WDEQ/LQD permit applications and annual wildlife reports for the applicant mines. Baseline and annual monitoring surveys cover large perimeters around each mine's

current permit areas. Consequently, a majority of the LBA tracts as applied for under the Proposed Actions, BLM's alternative tract configurations, and the applicant mines' anticipated permit amendment study areas have been surveyed during baseline and annual wildlife surveys for the Jacobs Ranch, Black Thunder, North Rochelle, North Antelope/Rochelle Complex, and Antelope Mines. In addition, PRCC conducted wildlife baseline investigations in 2000 on the NARO North and NARO South LBA Tracts as proposed, the area added by Alternative 2, the North Antelope/Rochelle Complex's anticipated permit amendment study area, and areas within a two-mile radius. No comprehensive wildlife baseline studies have yet been conducted expressly for the Little Thunder, West Roundup, and West Antelope LBA Tracts, although site-specific surveys for the entire

proposed lease areas and appropriate perimeters will be part of the mine permitting process if lease sales are held and the tracts are proposed for mining.

The General Analysis Area consists primarily of uplands. The topography is relatively level to gently sloping, except along some of the drainages where channel incision has created some steeper slopes and gullying.

All of the vegetation types listed in the vegetation section provide habitat for some wildlife species. In an undisturbed condition, the major vegetation types in the General Analysis Area provide high quality habitats for many species. Vegetation types tend to occur in a mosaic across the landscape; therefore, many wildlife species can be expected to utilize more than one habitat type. Wildlife habitat types include sagebrush-grassland, upland grassland, seeded grassland, bottomland grassland and riparian areas. The predominant habitat is sagebrush-grassland, which consists mostly of big sagebrush, western wheatgrass, needleandthread, prairie junegrass, sandberg bluegrass, blue grama, and cheatgrass brome. The upland grassland or mixed-grass prairie is the next largest habitat type and it consists mostly of needleandthread, western wheatgrass, prairie junegrass, six-weeks-grass, cheatgrass brome, and fluffweed. Seeded grassland is dominated by crested wheatgrass, but older seedings have a mixture of less dominant species including needleandthread, fringed sagewort, prairie junegrass, threeawn, and big

sagebrush. Bottomland grassland and riparian habitat is limited to corridors along Antelope Creek, Spring Creek, Horse Creek, Porcupine Creek, Trussler Creek, West School Creek, Little Thunder Creek, North Prong Little Thunder Creek, and some of the larger tributaries of these streams. Vegetation common to these areas includes Kentucky bluegrass, western wheatgrass, blue grama, green needle grass, mutton bluegrass, sedges, foxtail barley, Japanese brome, alkali bluegrass, and poverty weed.

Several playas dominated by western wheatgrass are scattered throughout the General Analysis Area. Very few trees are present in the General Analysis Area with the exception of some stands of cottonwood along Antelope Creek and a few isolated cottonwoods along some of the larger drainages.

An occasional rough breaks habitat is found within the General Analysis Area and is distinguished by the irregularity of vegetation, slopes, and soils. Vegetation on the rough breaks is typically sparse and comprised mostly of western wheatgrass, needleandthread, blue grama, broom snakeweed, rubber rabbitbrush, wildbuckwheat, birdfoot sagewort, and big sagebrush.

All streams are ephemeral or intermittent, but a few persistent pools are often present in their channels. Development of CBM resources in the area west of and within the General Analysis Area could potentially increase surface flows in some drainages and fill

reservoirs, ponds, and playas, resulting in an increase in habitat for waterfowl, shorebirds, and aquatic species.

3.10.1 Big Game

The four big game species that are expected to occur in suitable habitat throughout the General Analysis Area include pronghorn (*Antilocapra americana*), mule deer (*Odocoileus hemionus*), white-tailed deer (*Odocoileus virginianus*), and elk (*Cervus elaphus*). No crucial big game habitat or migration corridors are recognized by the WGFD in this area.

Pronghorn are the most common big game species in this area. This species is most abundant in the upland grassland or mixed-grass prairie habitats. Reclaimed grassland constitutes only a small portion of the available habitat around the mines, although a large portion of pronghorn are observed during winter surveys in these areas. Home range for pronghorn can vary between 400 acres to 5,600 acres, according to several factors including season, habitat quality, population characteristics, and local livestock occurrence. Typically, daily movement does not exceed six miles. Pronghorn make seasonal migrations between summer and winter habitats, but migrations are often triggered by availability of succulent plants and not local weather conditions (Fitzgerald et al. 1994). The WGFD has classified the General Analysis Area as yearlong and winter/yearlong pronghorn range. The WGFD Cheyenne River Herd Unit encompasses the majority of the

General Analysis Area, while a small part of the area is included the WGFD Hilight Herd Unit. In post-season 2000, the WGFD estimated the Cheyenne River Herd Unit to be roughly 34,200 animals with an objective of 38,000. The WGFD estimated the 2000 post-season population of the Hilight Herd Unit to be approximately 10,000 animals, just under the objective of 11,000 (WGFD 2000).

Mule deer use nearly all habitats, but prefer sagebrush grassland, rough breaks, and mixed-grass prairie. Browse is an important component of the mule deer's diet throughout the year, comprising as much as 60 percent of total intake during autumn, while forbs and grasses typically make up the rest of their diet (Fitzgerald et al. 1994). This species tends to be more migratory than white-tailed deer, traveling from higher elevations in the summer to winter ranges that provide more food and cover. The WGFD has classified most of the General Analysis Area as out of the normal mule deer use range, although areas that roughly follow the predominant stream channels are classified as yearlong range and some winter/yearlong range is found near Antelope Creek in Converse County. The entire area is located within the WGFD Thunder Basin Mule Deer Herd Unit. The WGFD estimated the post-season 2000 mule deer population for that unit at approximately 21,700, roughly 67 percent over the current objective of 13,000. However, as reported in the 2000 WGFD Annual Big Game Herd Unit Report (WGFD 2000), historical data suggest that a herd

objective of 20,000 would be more appropriate for the Thunder Basin Herd Unit. Consequently, the WGFD has proposed increasing the herd unit objective to that higher level.

White-tailed deer are not managed separately by WGFD, but are included with mule deer as part of the Thunder Basin Herd Unit. White-tailed deer prefer riparian habitats and are therefore seldom observed in the General Analysis Area due to the lack of that particular habitat. WGFD classifies the entire General Analysis Area, with the exception of a narrow corridor along Antelope Creek, as out of the normal white-tailed deer use range. White-tailed deer are occasionally recorded along Antelope Creek, which is classified as yearlong range.

Elk reside in the Rochelle Hills that border the eastern edge of the General Analysis Area. Elk do wander from the protection of the Rochelle Hills to forage in native and reclaimed grasslands within the General Analysis Area, although none of the area is classified by the WGFD as an elk use area. As more lands are reclaimed from mining, elk are shifting their winter use to these areas. The WGFD has designated an approximately five square mile area on reclaimed lands within the Jacobs Ranch Mine permit area as crucial winter habitat for the Rochelle Hills elk herd (Odekoven 1994).

3.10.2 Other Mammals

A variety of small and medium-sized mammal species occur in the vicinity of the General Analysis Area. These

include predators and furbearers, such as coyote (*Canis latrans*), red fox (*Vulpes vulpes*), bobcat (*Lynx rufus*), striped skunk (*Mephitis mephitis*), long-tailed weasel (*Mustela frenata*), badger (*Taxidea taxus*), muskrat (*Ondatra zibethicus*), raccoon (*Procyon lotor*), and beaver (*Castor canadensis*). Prey species include various rodents (such as mice, rats, voles, gophers, ground squirrels, chipmunks, muskrats, and prairie dogs) and lagomorphs (jackrabbits and cottontails). These species are cyclically common and widespread throughout the region (Commonwealth 1980, Powder River Eagle Studies 1987-1999). Porcupines and bats (hoary and big brown) have also been recorded. The prey species are important for raptors and other predators.

Surveys have been conducted to locate prairie dog colonies on and within a half mile of the proposed lease areas, current mine permit areas and anticipated permit amendment study areas in the General Analysis Area.

There are six prairie dog towns located on or within a half mile of the two NARO LBA tracts. No colonies were observed on the NARO North LBA Tract and one colony is within a half-mile radius of that tract. Three colonies were observed on the NARO South LBA Tract and two others are within a half-mile radius of that tract. No colonies were observed on the area added to the NARO South tract under Alternate 2.

Recent surveys indicate prairie dog colonies are not located on or within

one-half mile of the proposed lease area for the Little Thunder LBA Tract or the area added under Alternative 2.

Recent surveys indicate no prairie dog colonies are located within the West Roundup LBA Tract. One small colony is located within the area added under Alternatives 2 and 3. One other colony is located just over a half mile south of the LBA tract.

Four small black-tailed prairie dog colonies have been inventoried on and within one-half-mile of the West Antelope LBA Tract and Alternative 2 area. Two colonies are included in, or overlap the proposed lease area; one in the north-central part and one in the south-central part of the LBA tract as applied for under the Proposed Action. A third colony covers roughly 2.5 acres in the southwestern corner of the lands added by Alternative 2. The fourth colony is on an existing lease at the Antelope Mine just beyond the eastern boundary of the LBA tract and has been disturbed by the Antelope Mine operations.

3.10.3 Raptors

Common raptor species expected to occur in suitable habitats in the General Analysis Area include golden eagle (*Aquila chrysaetos*), ferruginous hawk (*Buteo regalis*), red-tailed hawk (*Buteo jamaicensis*), Swainson's hawk (*Buteo swainsoni*), rough-legged hawk (*Buteo lagopus*), northern harrier (*Circus cyaneus*), American kestrel (*Falco sparverius*), prairie falcon (*Falco mexicanus*), great horned owl (*Bubo virginianus*), burrowing owl (*Athene cunicularia*), and short-eared owl (*Asio flammeus*). Those species that

commonly nest in the General Analysis Area are the ferruginous hawk, golden eagle, red-tailed hawk, Swainson's hawk, great horned owl, and burrowing owl. Habitat is limited for those species that nest exclusively in trees or on cliffs, but several species are adapted to nesting on the ground, creek banks, buttes, or rock outcrops. Over time, natural forces have destroyed many nests, while others have been relocated for mitigation or removed by mining activities. In some cases, nests have been created to mitigate other nest sites impacted by mining operations at these mines.

As of a survey that was completed in 2000, there were 77 intact raptor nests within the NARO North and NARO South LBA Tracts and a two-mile radius area, 45 of which were active.

After the 2001 breeding season 63 known nests were intact within Black Thunder Mine's current raptor survey area, which includes the current Black Thunder Mine permit area and a two-mile radius area.

After the 2001 breeding season 28 known nests were intact within the West Roundup LBA Tract raptor survey area, which includes West Roundup LBA tract, areas added under Alternatives 2 and 3, and a two-mile perimeter. One of those intact nests is within the LBA tract as proposed, one nest is within the area added under Alternative 3, and the other 26 nests are in the two-mile perimeter survey area.

At the end of 2000, there were 42 intact raptor nests within the raptor

survey area for the West Antelope LBA Tract, which includes the tract as proposed, lands added by Alternative 2 and a two-mile radius. Nine nests in the survey area were occupied: seven on the LBA tract as proposed and two on the lands added under Alternative 2.

3.10.4 Game Birds

A few upland game birds are known to regularly occur in suitable habitats in the General Analysis Area. The species include mourning doves (*Zenaida macroura*), sage grouse (*Centrocercus urophasianus*), and wild turkeys (*Meleagris gallopavo*). The gray partridge (*Perdix perdix*) and the sharp-tailed grouse have also been observed sporadically in the vicinity of the General Analysis Area. The sage grouse is a yearlong resident and the most common upland game bird species in the area. Sage grouse leks, or strutting grounds, occur within the General Analysis Area. SPRB mining companies conduct searches for leks and document the number of male sage grouse attending them every spring. Overall, the population appears to be steadily declining. Disturbance of leks, nesting areas, and brood-rearing areas are the key threats to this species in the General Analysis Area.

The sage grouse is a yearlong resident and is found on lands within and adjacent to the NARO North and NARO South LBA Tract wildlife study area. There are no historic sage grouse leks on or within two miles of the LBA tracts and none were located on or within two miles of the LBA tracts during the 2000 survey.

The sage grouse is a yearlong resident in the general Black Thunder Mine area but does not appear to frequent the Little Thunder LBA Tract. One sage grouse lek was discovered on the Black Thunder Mine permit area in 1984. Annual monitoring of that lek, known as the Black Thunder Lek, began in 1985 and has continued to the present. In 2001, for the eighth consecutive year, no grouse were observed at the former Black Thunder Lek.

The Black Thunder Lek, discussed above, is located approximately a half mile north of the West Roundup LBA Tract. As indicated above, the lek has been abandoned since 1994. No new leks were found and no sage grouse were observed during a survey conducted during the spring of 2001 in the North Rochelle Mine permit area and a one-mile perimeter.

Sage grouse are not common in the vicinity of the West Antelope LBA wildlife study area or the adjacent Antelope Mine. The lack of use of this area by sage grouse has been documented since the late 1970s. No sage grouse leks have been observed on or near the Antelope Mine during baseline studies (1978-1979) or the mine's annual wildlife monitoring surveys (1982-2000), which included the eastern 73 percent of the LBA tract as proposed and the entire Alternative 2 area. The nearest known lek is approximately five miles southeast of the LBA tract.

3.10.5 Migratory Bird Species of Management Concern in Wyoming

Table 3-8 provides a list of the 40 Migratory Bird Species of Management Concern in Wyoming that the USFWS will use exclusively for reviews concerning existing and proposed coal mine leased land (USFWS 2002). This listing was taken directly from the Wyoming Bird Conservation Plan (Cerovski et al. 2000). The regional status and expected occurrence, historical observations, and breeding records on and near the SPRB LBA tracts for each listed species are included in Table 3-8. Depending on the location, between 19 and 21 of the listed species have historically been observed within the General Analysis Area. The species commonly observed nesting in the area include the ferruginous hawk, burrowing owl, Brewer's sparrow, lark bunting, Swainson's hawk, McCown's longspur, and vesper sparrow. The mountain plover, upland sandpiper, short-eared owl, loggerhead shrike, chestnut-collared longspur, grasshopper sparrow, and the greater sage grouse do not have abundant nesting habitat available, but have been documented to nest within the General Analysis Area.

The bald eagle is seasonally common and most frequently observed during the winter months. The burrowing owl is common and classified as a recent common breeder in the General Analysis Area. Sage grouse, recently added to the Level 1 list, is uncommon in the General Analysis Area and is classified as an uncommon breeder.

Sited as the potential limiting factor, suitable nesting habitat is scarce if

not absent in the General Analysis Area for most of the Migratory Bird Species of Management Concern in Wyoming. The other species that are listed in Table 3-8 have rarely or never been recorded in the General Analysis Area.

3.10.6 Other Species

Wildlife surveys within the General Analysis Area have documented numerous other wildlife species that inhabit the region, including various nongame birds, waterfowl, shorebirds, herptiles, and nongame fish. All these species were generally common inhabitants of the area and none were of specific concern to state or federal agencies. Under natural conditions, aquatic habitat is very limited by the ephemeral nature of surface waters in the General Analysis Area. The lack of deep-water habitat and extensive and persistent water sources limits the presence and diversity of fish and other aquatic species. All perennial streamflow and bodies of water in the area are now the result of CBM-associated discharges. With the addition of produced water from CBM wells in

3.0 Affected Environment

Table 3-8. 40 Migratory Bird Species of Management Concern in Wyoming for Coal Mines: Their Regional Status, and Expected and Actual Occurrence on or Near the SPRB Coal LBA Tracts.

Species	Seasonal Status/Breeding Records in Northeastern WY ¹	Expected Occurrence on and in Vicinity of the LBA Tracts ²	Historical Sighting Records and Breeding Status in Vicinity of the LBA Tracts ³
LEVEL I (species need conservation action)			
Mountain plover*	Summer/Breeder	Uncommon	None-Few sightings
Greater sage-grouse*	Resident/Breeder	Uncommon	Uncommon breeder
McCown's longspur*	Summer/Breeder	Common	Occasional-Common breeder
Baird's sparrow*	Summer/Observed	Rare	None-Few sightings
Ferruginous hawk*	Summer/Breeder	Common	Common breeder
Brewer's sparrow*	Summer/Breeder	Common	Common breeder
Sage sparrow	Summer/Breeder	Not Expected	None
Swainson's hawk	Summer/Breeder	Common	Common breeder
Long-billed curlew*	Summer/Observed	Uncommon	Few sightings, potential migrant
Short-eared owl*	Summer/Breeder	Uncommon	Few sightings, potential breeder
Peregrine falcon	Resident/Observed	Uncommon Migrant	None
Burrowing owl*	Summer/Breeder	Common	Recent common breeder
Bald eagle*	Resident/Breeder	Seasonally Common	Frequent in winter
Upland sandpiper*	Summer/Breeder	Uncommon	Few sightings, potential breeder
LEVEL II (species need monitoring)			
Cassin's kingbird	Never Recorded	Not Expected	None
Lark bunting*	Summer/Breeder	Common	Common breeder
Dickcissel*	Summer/Observed	Rare	None-Few Sightings
Chestnut-collared longspur*	Summer/Breeder	Common	Occasional breeder
Black-chinned Hummingbird	Never Recorded	Not Expected	None
Pygmy nuthatch	Never Recorded	Not Expected	None
Marsh wren	Never Recorded	Not Expected	None
Western bluebird	Summer/Breeder	Not Expected	None
Sage thrasher	Summer/Breeder	Uncommon	Uncommon breeder
Grasshopper sparrow*	Summer/Breeder	Uncommon	Few sightings, potential breeder
Bobolink	Summer/Observed	Rare	None
Common loon*	Summer/Observed	Not Expected	None-Few Sightings
Black-billed cuckoo	Never Recorded	Not Expected	None
Red-headed woodpecker	Summer/Breeder	Uncommon	None
Yellow-billed cuckoo	Summer/Observed	Very Rare	None
Eastern screech-owl	Never Recorded	Not Expected	None
Western screech-owl	Never Recorded	Not Expected	None
Western scrub-jay	Never Recorded	Not Expected	None
Loggerhead shrike*	Summer/Breeder	Uncommon	Occasional breeder
Vesper sparrow	Summer/Breeder	Common	Common breeder
Lark sparrow*	Summer/Breeder	Uncommon	Few sightings
Ash-throated flycatcher	Summer/Observed	Not Expected	None
Bushtit	Never Recorded	Not Expected	None
Merlin*	Resident/Observed	Uncommon	Few sightings
Sprague's pipit	Never Recorded	Not Expected	None
Barn owl	Summer/Observed	Very Rare	None

¹ Compiled from Luce, et al. (1999), for extreme southern Campbell and northern Converse Counties.

² Expected occurrence in the study area was based on range, history of occurrence, and habitat availability.

³ Sighting records were derived from actual occurrence on or within one-half mile of the LBA tracts and anticipated permit amendment study area.

* Species marked with an asterisk have historically been recorded during baseline or monitoring surveys for the four applicant mines.

the area, an increase in habitat for waterfowl and aquatic species may continue to occur.

3.10.7 Threatened, Endangered, Proposed, and Candidate Animal Species and USFS Region 2 Sensitive Species

Refer to Appendix G.

3.11 Ownership and Use of Land

Land ownership within the General Analysis Area consists of private lands intermingled with federal lands. Table 3-9 summarizes the distribution of surface ownership for each LBA tract, including the tract and the entire study area. BLM is evaluating in the alternatives for each tract. Federally owned lands in the General Analysis Area include portions of the TBNG administered by the USFS. Livestock grazing on native rangeland is the primary land use, while oil and gas production, wildlife habitat, and recreation are secondary land uses for both public and private lands. Surface ownership for each

LBA tract is shown in Figures 3-11 through 3-14.

Areas of disturbance within and near the five proposed lease areas include roads, oil and gas wells and associated production facilities, and surface mine-related facilities and activities. State Highways 59 and 450 are in the vicinity of the LBA tracts. Several paved county roads traverse and provide public and private access within the General Analysis Area. These include County Road 37, Antelope Road, Reno Road, and Edwards Road.

The oil and gas estate within the LBA tracts is both federally and privately owned, with the majority (approximately 67 percent) being federally owned. Most of the federally owned oil and gas estate is leased. The ownership of the oil and gas estate for each LBA tract is shown in Figures 3-15 through 3-18. Lists of the current federal oil and gas lessees for each tract are shown in Tables 3-10 through 3-13.

Table 3-9. Distribution of Surface Ownership Within Each LBA Tract and Study Area.

LBA Tract	Federal Ownership		Private Ownership	
	(Acres)	(Percent)	(Acres)	(Percent)
NARO North (As Proposed)	1,718.6	9.8	650.8	3.7
NARO South (Alternative 2)	0.0	0.0	3,201.8	18.2
Little Thunder (Alternative 2)	1,100.7	6.3	3,982.8	22.7
West Roundup (Alternative 3)	1,257.1	7.2	1,783.1	10.1
West Antelope (Alternative 2)	0.0	0.0	3,877.9	22.1
Totals	4,076.4	23.3	13,496.4	76.7

Figure 3-11

Figure 3-12

Figure 3-13

Figure 3-14

Figure 3-15

Figure 3-16

Figure 3-17

Figure 3-18

Table 3-10. NARO North and South LBA Tracts Oil and Gas Ownership.

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

Location	Lease Number	Lessees of Record
T.42N., R.70W.		
<u>Section 28</u> Lots 9,10	WYW 143496	Independent Prod. Co.
<u>Section 28</u> Lots 11-14	WYW 127399	Big West Oil & Gas Inc.
<u>Section 28</u> Lots 15, 16	WYW 125978	Michael L. Diefenderfer
<u>Section 29</u> Lots 11-14	WYW 49833	Big West Oil & Gas Inc. Independent Prod. Co. Key Production Co. Inc.
<u>Section 30</u> Lot 11 <u>Section 29</u> Lot 5	WYW 0100872A	Damson Oil Corp. Independent Prod. Co. IL Stalls R. Lee Tucker
<u>Section 29</u> Lots 6-10, 15,16	WYW 0100872	Independent Prod. Co.
<u>Section 30</u> Lot 12	WYW 75680	Independent Prod. Co.
<u>Section 30</u> Lots 13,14	WYW 89160	Independent Prod. Co.
<u>Section 30</u> Lots 15-20	WYW 67022	Maurice W. Brown
T.42N., R.71W.		
<u>Section 25</u> Lots 5, 9-15	WYW 67220A	Powder River Coal Co.
<u>Section 25</u> Lot 6	Expired	Not Posted
<u>Section 25</u> Lots 7, 8	WYW 43652	Big West Oil & Gas Inc. Citadel Energy Inc. Key Production Co. Inc.

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Location	Lease Number	Lessees of Record
<u>Section 26</u> Lots 7, 8	WYW 185974B	Caroline Hunt Trust Est. Cenex Harvest States Coop. Hunt Oil Company Independent Prod. Co. Ocean Energy Inc. Reunion Energy Co.
<u>Section 35</u> Lots 9, 10, 15, 16	WYW 67220C	Axel Johnson Expl. Black Hills Expl. & Prod. Co. D.L. Cook Jerry D. Ladd Meyer Oil Co. Inc. Whiting Petro. Corp. Dale O Wright
<u>Section 35</u> Lots 1, 2, 7, 8	WYW 147135	Independent Prod. Co.
T.41N., R.70W.		
<u>Section 30</u> Lot 5	WYW 61641	DNR Oil & Gas Inc.
<u>Section 19</u> Lots 15-18 <u>Section 20</u> Lots 5-16 <u>Section 29</u> Lots 1-12	WYW 136937	R.K. O'Connell
<u>Section 21</u> Lots 5, 12, 13 <u>Section 28</u> Lots 3-6	WYW 63650	Citation 1998 Investment LP
<u>Section 28</u> Lot 11, NESW	WYW 59583	DNR Oil & Gas Inc. GPM Inc. Jetta Production Co. Inc. JPG LLC Providence Energy Corp.
<u>Section 19</u> Lots 6-11, 13, 14, 19, 20 <u>Section 30</u> Lots 6, 7-10, 11-12		Not Posted
T.41N., R.71W.		
<u>Section 23</u> Lots 1,9	WYW 141206	Williams Prod. RMT Co.

Location	Lease Number	Lessees of Record
<u>Section 23</u> Lot 8 <u>Section 24</u> Lot 12	WYW 141205	Williams Prod. RMT Co.
<u>Section 24</u> Lots 1-10, 15, 16	WYW 143508	Lance Oil & Gas Co. Inc. Williams Prod. RMT Co.
<u>Section 24</u> Lots 11, 13, 14	WYW 138118	Redstone Resources Inc. Yates Petroleum Corp.
<u>Section 25</u> Lots 1-4	WYW 140769	Lance Oil & Gas Co. Inc. Williams Prod. RMT Co.
<u>Section 25</u> Lots 9, 10, 12	WYW 136942	Gregor Klurfeld
Note: For the rest of the LBA tract, the oil and gas rights (including coal bed methane) are privately owned, and the coal rights are federally owned.		

Table 3-11. Little Thunder LBA Tract Oil and Gas Ownership.

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

Location	Lease Number	Lessees of Record
T.43N., R.71W.		
<u>Section 2</u> Lots 5, 6, 11-14, 19, 20	WYW 127786	John P. Caviuolo
<u>Section 12</u> Lots 2-8, 11-14	WYW 0263451	M&K Oil Co Inc
<u>Section 12</u> Lot 15	WYW 9923A	Chisholm Trail Ventures LP Key Production Co. Inc. M&K Oil Co. Inc. Questar Expl. & Prod. Co.
<u>Section 12</u> Lots 9,10,16	WYW 0263451A	M&K Oil Co. Inc.
<u>Section 14</u> Lots 2, 6, 9, 14	WYW 140772	Western Gas Resources Inc.
<u>Section 24</u> Lots 4, 5, 10-15	WYW 143063	Devon Energy Prod. Co. LP Western Gas Resources Inc. Williams Prod. RMT Co.
<u>Section 25</u> Lots 1- 8	WYW 140940	Western Gas Resources Inc.
<u>Section 1</u> Lot 16	WYW 0196946	Chisholm Trail Ventures LP M&K Oil Co. Inc.

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		Questar Expl. & Prod. Co.
<u>Section 11</u> Lots 3-6, 11-14	WYW 036006	Big West Oil & Gas Inc. Chisholm Trail Ventures LP Robert W. Deputy Thomas H. Farley Jr. G.F. Collins Jr. Trust Kerr McGee Corp. Key Production Co. Inc. Questar Expl. & Prod. Co. RBC Expl. Co. Ryder Stilwell Oil Diana L. Stadelman Joseph R. Stadelman WP Properties Corp.
Note: For the rest of the LBA tract, the oil and gas rights (including coal bed methane) are privately owned, and the coal rights are federally owned.		

Table 3-12. West Roundup LBA Tract Oil and Gas Ownership.

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

Location	Lease Number	Lessees of Record
T.42N., R.70W.		
<u>Section 4</u> Lots 17,18	Not Posted	
<u>Section 6</u> Lots 8, 9, 15, 16, 23	WYW 144471	Lance Oil & Gas Co., Inc. Williams Prod. RMT Co.
<u>Section 6</u> Lot 22	WYW 116352	Expired
<u>Section 7</u> Lots 13, 14	WYW 8396	Myco Industries Inc. Sacramento Partners LP
<u>Section 8</u> Lots 1-8	WYW 143932	Williams Prod. RMT Co. Lance Oil & Gas Co., Inc.
<u>Section 8</u> Lots 9-12, 16	WYW 042736C	Independent Prod. Co.
<u>Section 9</u> Lots 3-6	WYW 140760	Abo. Petr. Corp. Myco Industries Inc. Yates Drilling Co. Yates Petroleum Co.
<u>Section 9</u> Lots 11-14	WYW 141022	Julian C. Tucker
<u>Section 9</u> Lots 1, 2, 7, 8	WYW 027703	Clayton Conrad Independent Prod. Co. George P. Jouflas
T.43N., R.70W.		

<u>Section 31</u> Lots 13, 20	WYW 129487	Westport Oil & Gas Co, Inc.
<u>Section 31</u> Lots 14, 19	WYW 130024	Westport Oil & Gas Co, Inc.
<u>Section 31</u> Lots 15-18	WYW 130556	Westport Oil & Gas Co. Inc
T.42N., R.71W.		
<u>Section 1</u> Lots 7-10	WYW 143940	Lance Oil & Gas Co. Inc Williams Prod. RMT Co.
<u>Section 1</u> Lot 15	WYW 147833	Lance Oil & Gas Co. Inc Williams Prod. RMT Co.
Note: For the rest of the LBA tract, the oil and gas rights (including coal bed methane) are privately owned, and the coal rights are federally owned.		

Table 3-13. West Antelope LBA Tract Oil and Gas Ownership.

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

Location	Lease Number	Lessees of Record
T.40N., R.71W.		
<u>Section 3</u> Lots 15-18	WYW 143504	Abo Petroleum Corp. Myco Industries Inc. Yates Drilling Co. Yates Petroleum Co.
<u>Section 4</u> Lots 7-10, 13, 14, 19, 20	WYW 141204	Swift Energy Co.
<u>Section 4</u> Lots 5, 6, 11, 12, 15-18 <u>Section 5</u> Lots 5-7, 10-12, 15 <u>Section 9</u> Lot 1	WYW 136674	Swift Energy Co.
<u>Section 5</u> Lots 13, 14, 19, 20	WYW 140768	Swift Energy Co.
<u>Section 10</u> Lots 3, 4	WYW 142769	M.J. Harvey Jr.
T.41N., R.71W.		
<u>Section 22</u> Lot 2	WYW 141206	Williams Prod. RMT Co.
<u>Section 22</u>	WYW 138119	Bowers Oil & Gas Inc.

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Lot 16

Spring Creek Ranch

<u>Section 27</u> Lots 6-11	WYW 136942	Gregor Klurfeld
<u>Section 32</u> Lots 15, 16		
<u>Section 33</u> Lots 13-16		
<u>Section 28</u> Lots 1, 2, 7-10, 15, 16	WYW 140769	Lance Oil & Gas Co. Inc. Williams Prod. RMT Co.
<u>Section 28</u> Lots 3-6, 11-14	WYW 138120	Bowers Oil & Gas Inc. Spring Creek Ranch
<u>Section 29</u> Lots 1-4, 6-9, 13, 14	WYW 142771	Lance Oil & Gas Co. Inc. Williams Prod. RMT Co.
<u>Section 32</u> Lots 2, 3, 6-11, 14	WYW 127785	Fred L. Engle
<u>Section 33</u> Lots 1-3, 9-12	WYW 124831	Abo Petroleum Co. Key Production Co. Myco Industries Yates Drilling Co. Yates Petroleum Co.

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

There are 35 permitted conventional oil and gas wells on lands included in the LBA tracts as proposed and the lands added under BLM's alternatives. Of these, 20 wells are plugged and abandoned or shut in and 15 wells are still producing. Of the 15 producing wells, 12 are on federal oil and gas leases and three are on private leases. All of the conventional oil and gas wells within the LBA tract configurations were originally drilled between 1968 and 1989.

The Supreme Court has ruled that the CBM belongs to the owner of the oil and gas estate (98-830). Therefore, the oil and gas lessees have the right to develop CBM as well

as conventional oil and gas on the LBA tracts.

The most extensive CBM development within the General Analysis area is located west of the proposed LBA tracts. The proposed Little Thunder LBA Tract is the only LBA tract that currently contains productive CBM wells. CBM wells capable of production occur adjacent to, but not within, the other four LBA tracts included in this analysis. There are currently over 150 CBM wells that are capable of production on or in sections adjacent to the proposed tracts. These wells are listed in Appendix H.

Thirty-two CBM wells have been completed for production within the lands encompassed by the Little Thunder LBA Tract. The WOGCC has approved a well spacing pattern of one well per 80 acres for development of CBM resources in the PRB. Most of the available 80-acre spacing units within the Little Thunder LBA Tract have been drilled (Figure 3-16). Review of WOGCC records on June 30, 2002 indicates that all but five of these have had some production. The reported cumulative production from each of these wells through April 2002 ranged from approximately 100 MCF to more than 180,000 MCF gas. These wells have only limited production history and can not be used for reliable forecasting of production, reserves or economics. They do, however, demonstrate that CBM production is possible in areas subject to mining-related groundwater drawdown.

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

pressure transmission pipelines for delivering the gas to market. Currently, some of these oil and gas production facilities, particularly oil and gas pipelines, exist on the LBA tracts, as discussed in Section 3.17 of this EIS. Additional support facilities will continue to be constructed on the LBA tracts as new conventional oil and gas and CBM wells are drilled and completed.

Coal mining is a dominant land use within the General Analysis Area. The North Antelope/Rochelle Complex, Black Thunder, North Rochelle, Antelope, and Jacobs Ranch Mines form a group of contiguous or nearly contiguous active surface coal mines located in southern Campbell and northern Converse counties (Figure 3-1). Coal production at these five mines increased by 214 percent between 1990 and 2001 (from approximately 70 million tons in 1990 to nearly 220 million tons in 2001). Since 1992, nine maintenance coal leases have been sold within this group and the five LBA tracts being evaluated in this EIS are in this group of mines (Tables 1-1 and 1-2).

Neither Campbell nor Converse Counties have applicable countywide land use plans, nor do the proposed lease areas have designated zoning classifications. The *City of Gillette/Campbell County Comprehensive Planning Program* (City of Gillette 1978) provides general land use goals and policies for state and federal coal leases in the county. The *Converse County Land Use Plan* (Converse County 1978) does not specifically address coal leasing.

Big game hunting is the principal recreational land use within the General Analysis Area, and pronghorn, mule deer, white-tailed deer, and elk are present within the area. On private lands, hunting is allowed only with landowner permission. Land ownership within the PRB is largely private (approximately 80 percent), with some private landowners permitting sportsmen to cross and/or hunt on their land. There has been a trend over the past two decades towards a substantial reduction in private lands that are 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 for sportsmen who desire access to these animals (WGFD 1996).

In general, publicly owned lands are open to hunting if legal access is available. Due to safety concerns, however, public surface lands contained within an active mining area are often closed to the public, further limiting recreational use. There are public surface lands included within the NARO North LBA Tract, the Little Thunder LBA Tract as, and the West Roundup LBA Tract. There are no public surface lands included in the NARO South or West Antelope LBA Tracts. (Figures 3-11 through 3-14)

Specific details regarding big game herd management objectives within and near the General Analysis Area are contained in the *Casper and*

Sheridan Region Annual Big Game Herd Unit Reports (WGFD 2000). The WGFD classifies the entire General Analysis Area as yearlong and winter/yearlong habitat for antelope. The extreme southern portion of the General Analysis Area is within severe winter range for antelope. All of the LBA tract configurations are classified as yearlong and/or winter/yearlong antelope habitat. No crucial or critical pronghorn habitat is recognized by the WGFD in this area. The proposed lease areas are within pronghorn antelope Hunt Areas 24 and 27, which contain the Hilight and Cheyenne River Herd Units, respectively. In post-season 2000, the population of the Hilight Herd Unit was estimated to be approximately 10,352 animals, slightly below the objective of 11,000. The post-season 2000 population of the Cheyenne River Herd Unit was estimated to be approximately 34,161 animals with a population objective of 38,000 antelope (WGFD 2000).

Historical problems associated with the management of the Hilight Herd Unit include hunter access, over harvest on limited public lands, and quantifying landowner preferences and desires. Prior to 1996, not all of the licenses were usually sold for this herd, resulting in harvest rates below those needed for population regulation. Since the recent population has been below objective levels, fewer licenses have been offered and all are sold through a drawing. As the population approaches objective levels, more licenses will be needed and these may be difficult to sell in this mostly private land area. Nearly all

landowners charge access fees for hunting and private land access is based on the desires and perceptions of the landowners.

A series of harsh winter conditions and correspondingly poor reproduction rates are believed to be the main reasons that population of the Cheyenne River Herd Unit is under objective. In an effort to increase the population of this herd, the WGFD will decrease the availability of hunting licenses in areas where winters have been particularly hard and where the antelope population has been low for several years. Management direction will be to decrease female harvest slightly to compensate for severe winters.

The WGFD has classified the entire General Analysis Area as either out of the normal mule deer use range or yearlong range, with some winter/yearlong range in the extreme southern portion of the area. Crucial or critical mule deer habitat does not occur within the General Analysis Area. The proposed lease areas are located within mule deer Hunt Areas 10 and 21, which include the Thunder Basin Mule Deer Herd Unit. In post-season 2000, the population of the Thunder Basin Mule Deer Herd Unit was estimated at approximately 21,742 animals, which is roughly 67 percent above the current objective of 13,000 head. However, WGFD's historical data suggest that a herd objective of 20,000 animals would be more appropriate for the Thunder Basin Herd Unit. The WGFD has therefore recommended that the herd

objective be increased to 20,000 head.

The Rochelle Hills Elk herd resides in the Rochelle Hills that border the eastern edge of the General Analysis Area. The LBA tracts within the General Analysis Area are within Elk Hunt Areas 113 and 123; however, very limited use of these lands by elk occurs. The herd favors the ponderosa pine/juniper woodlands, savanna, and steeper terrain habitat offered by the Rochelle Hills. As more lands are reclaimed from coal mining adjacent to the Rochelle Hills, elk are shifting their winter use to those sites. Such lands typically offer excellent winter grass supplies, especially during more severe winters when other sites are less accessible. Presently, elk are regularly using the reclaimed mined lands of the Jacobs Ranch, Black Thunder, and North Rochelle Mines. More such habitat should become available over the next several years. Much of the occupied range of this herd is located on the TBNG, which is administered by the USFS. While hunting in Areas 113 and 123 has been permitted every two or three years, Area 126, which is south of the General Analysis Area, has had an annual hunting season. Bull quality is very good for this herd, and many taken have scored in the record books. Owing to their habituation to humans, many people enjoy these elk along Highway 450 and within accessible USFS land; thus, they provide nonconsumptive recreational use opportunities. These elk are not causing significant damage to private lands and most area landowners as well as hunters generally desire a high quality herd.

Elk have been observed dispersing from the designated herd boundary, possibly due to increasing population density and habitat limitations.

White-tailed deer are not managed separately by WGFD, but are included with mule deer as part of the Thunder Basin Herd Unit. White-tailed deer are seldom observed within the General Analysis Area due to their preference for riparian woodlands and irrigated agricultural lands. WGFD classifies the entire General Analysis Area, with the exception of a narrow corridor along Antelope Creek, as out of normal white-tailed deer use range. The narrow corridor along Antelope Creek is classified as yearlong range.

Under natural conditions, aquatic habitat is very limited by the ephemeral nature of surface waters in the General Analysis Area; therefore, public fishing opportunities are very limited. The lack of deep-water habitat and extensive and persistent water sources limits the presence and diversity of fish and other aquatic species. Only one fishery exists within the General Analysis Area. Little Thunder Creek supports channel catfish and a variety of nongame fish.

3.12 Cultural Resources

Cultural resources, which are protected under the National Historic Preservation Act of 1966, are nonrenewable remains of past human activity. The PRB, including the

General Analysis Area, appears to have been inhabited by aboriginal hunting and gathering people for more than 11,000 years. Throughout the prehistoric past, the area was used by highly mobile hunters and gatherers who exploited a wide variety of resources. Several thousand cultural sites have been recorded within the PRB.

The general chronology for aboriginal occupation (dated as years before present [B.P.]) is:

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

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

seasonal and environmental changes that influenced the occurrence of subsistence resources (BLM 1979).

Protohistoric and early Historic sites are found in the PRB, including the General Analysis Area. This period is characterized by rare historic trade goods, sites, and routes associated with early trappers and military expeditions, and early ranching attempts that date to the 1880s. A few small coal mining sites also exist.

Historic sites within the General Analysis Area have been recorded as debris scatters representing sheepherder camps and related activities. No historic trails are known or have been recorded within the General Analysis Area, although the Bozeman Trail crosses the southwestern portion of the PRB.

A Class III cultural resources survey is a professionally conducted, intensive and comprehensive inventory of a target area, designed to locate all cultural properties which have surface and exposed profile indications. The goal of the survey is to locate and evaluate for the NRHP all cultural resources 50 years and older within the study area. Cultural properties are recorded and sufficient information collected on them to allow evaluation for possible inclusion in the NRHP. That determination is made by the managing federal agency in consultation with SHPO. Consultation with SHPO must be completed prior to approval of the MLA mining plan.

Once a Class III survey is completed, site-specific testing or limited

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

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

Numerous Class I (survey records review) and Class III cultural resource surveys associated with oil field development and surface mining operations have been conducted in the General Analysis Area. PRCC,

TBCC, TCC and ACC all contracted with GCM Services, Inc. of Butte, Montana to perform Class III and Class I surveys of their respective LBA study areas in 1999 and 2001. Each of the LBA study areas is comprised of the LBA tract as applied for, BLM's proposed alternative tract configurations, and the applicant mine's anticipated permit amendment study area. These areas include all anticipated areas of disturbance assuming the coal is mined by the existing adjacent mines.

The NARO North and South LBA study area has been entirely surveyed for cultural resources at a Class III level. A total of 194 cultural sites were documented in the study area, of which 79 sites are located within the NARO North and NARO South LBA Tracts and quarter mile disturbance buffers. These sites are classified as prehistoric (59 sites), historic (17 sites), multi-component (one site), or undetermined (two sites). Four prehistoric sites have been recommended as eligible for the NRHP by the cultural site recorder.

The Little Thunder LBA study area has been entirely surveyed for cultural resources at a Class III level. A total of 44 archaeological sites and 16 isolated finds have been documented in the Little Thunder LBA study area. These sites are classified as prehistoric (25 sites), historic (11 sites), or multi-component (eight sites). All of these sites are listed as not eligible for the NRHP by SHPO or were recommended as not eligible by the cultural site recorder. No further work with

cultural resources has been recommended in this study area.

The entire West Roundup LBA study area has been surveyed for cultural resources at a Class III level. A total of 31 archaeological sites have been recorded and documented in the West Roundup LBA study area. These sites are classified as prehistoric (14 sites), historic (11 sites), or multi-component (six sites). One historic and 17 prehistoric isolated finds were also recorded. None of the sites have been recommended by the cultural site recorders or determined by an agency to be eligible for the NRHP, and no further work is recommended.

The West Antelope LBA study area has been entirely surveyed for cultural resources at a Class III level. From these cultural inventories, 53 archaeological sites have been recorded and documented in the West Antelope LBA study area. These sites are classified as prehistoric (42 sites), historic (10 sites), or multi-component (one site). One historic and 12 prehistoric isolated finds were also recorded. Three prehistoric campsites, as well as one site containing prehistoric stone rings, are recommended as eligible for the NRHP by their cultural site recorder. An additional four eligible sites, which are within or adjacent to the existing Antelope Mine's permit area, were previously recorded and have been mitigated to prevent adverse effects to the site's cultural resources.

3.13 Native American Consultation

Native American heritage sites can be classified as prehistoric or historic.

Some may be presently in use as offering, fasting, or vision quest sites. Other sites of cultural interest and importance may include rock art, stone circles, various rock features, fortifications or battle sites, burials, and locations that are sacred or part of the oral history and heritage but have no man-made features. No Native American heritage sites have been identified to date within the General Analysis Area.

No Native American heritage, special interest, or sacred sites have been formally recorded in the General Analysis Area. However, the geographic position of the General Analysis Area between mountains considered sacred by various Native American cultures (the Big Horn Mountains to the west, the Black Hills to the east, and Devils Tower to the north) creates the possibility that existing locations may have special religious or sacred significance to Native American groups.

Tribes that have been identified as potentially having concerns about actions in the PRB include the Crow, Northern Cheyenne, Shoshone, Arapaho, Oglala Lakota, Rosebud Sioux, Flandreau Santee Sioux, Santee Sioux, Crow Creek Sioux, Lower Brule Sioux, Standing Rock Sioux, and Cheyenne River Sioux. These tribal governments and representatives are being sent copies of the DEIS. They are also being provided with maps showing the location of each of the LBA tracts and more specific information about the known cultural sites on each of the tracts in this analysis. Their help is being requested in identifying

potentially significant religious or cultural sites in the General Analysis Area before a leasing decision is made on each of the LBA tracts.

Native American tribes were consulted at a general level in 1995-1996 as part of an effort to update the BLM Buffalo RMP. Some of the Sioux tribes were consulted by BLM on coal leasing and mining activity in the PRB at briefings held in Rapid City, South Dakota in March 2002.

3.14 Paleontological Resources

The formations exposed on the surface of the PRB are the sedimentary Eocene Wasatch and Paleocene Fort Union Formations, which are both known to contain fossil remains. Some intensive paleontological surveys have been conducted in the PRB. Vertebrate fossils that have been described from the Wasatch Formation include mammals such as early horses, tapiroids, condylarths, primates, insectivores, marsupials, creodonts, and carnivores; reptiles such as crocodilians, alligators, lizards, and turtles; birds; amphibians; and fish and non-marine invertebrates such as eggs; plants; mollusks; and ostracods. The Fort Union Formation also contains fossils of plants, reptiles, fish, amphibians, and mammals.

USFS has developed a draft classification system which they have used in the revised *Land and Resource Management Plan for the Thunder Basin National Grassland* (USFS 2001) to classify geological units according to the probability of

them yielding paleontological resources that are of concern to land managers. The classification is based largely on how likely a geologic unit is to produce vertebrate fossils of terrestrial (i.e., non-marine) origin. The five classes referenced in the Final EIS (USFS 2002a) are described below.

Class 1 - Igneous and metamorphic (volcanic ashes are excluded from this category) geologic units that are not likely to contain recognizable fossil remains.

Class 2 - Sedimentary geologic units that are not likely to contain vertebrate fossils or scientifically significant nonvertebrate fossils.

Class 3 - Fossiliferous sedimentary geologic units whose fossil content varies in significance, abundance, and predictable occurrence. Also sedimentary units of unknown fossil potential.

Class 4 - Class 4 geologic units are Class 5 units (see below) that have lowered risks of human-caused adverse impacts and/or lowered risk of natural degradation.

Class 5 - Highly fossiliferous geologic units that regularly and predictably produce vertebrate fossils and/or scientifically significant invertebrate fossils, and that are at risk of natural degradation and/or human-caused adverse impacts.

USFS has determined that the USFS lands included in the NARO North, Little Thunder, and West Roundup

LBA Tracts are classified as Class 3 or Class 5.

Paleontological resource examinations associated with surface mining operations have been conducted in conjunction with cultural resource inventories within the General Analysis Area. The inventories include pedestrian examinations for fossils along rock outcrops. A primary goal of the paleontological surveys that have been conducted is to locate unique concentrations of fossilized bone such as those reported to occur in the Wasatch Formation within the PRB. If unique finds are located, qualified paleontologists are then assigned to assess and mitigate the site.

The lack of good rock outcrops contributes to the lack of vertebrate fossils, as does the low preservation potential and conditions of deposition of the Wasatch and Fort Union Formations. In contrast to the lack of fossil animal material, fossil plant material is common. The fossil plants inventoried are primarily leaves and fossilized wood. The leaves usually occur as lignitic impressions in sandstone and siltstone and as compact masses in shale. Leaves are the most abundant fossils found during paleontological surveys and are frequently encountered during mining operations. The fossilized wood often occurs near the top of a coal seam, in carbonaceous shale or within channel sandstone. Exposures of fossil logs are common, but usually very fragmentary. Like fossil leaves, fossil logs can be readily collected in the PRB.

No significant or unique paleontological localities have been recorded on federal lands in the General Analysis Area.

3.15 Visual Resources

Visual sensitivity levels are determined by people's concern for what they see and the frequency of travel through an area. Landscapes within the General Analysis Area include rolling sagebrush and short-grass prairie, which are common throughout the PRB. There are also areas of altered landscape, such as oil fields and coal mines. Existing surface mines form a nearly continuous band on the east side of Highway 59 from Gillette south about 50 miles. Other man-made intrusions include ranching activities (fences, homesteads, and livestock), oil and gas development (pumpjacks, pipeline ROWs, CBM well shelters, and CBM compressor stations), transportation facilities (roads and railroads) and electrical power transmission lines. The natural scenic quality in the immediate lease area is fairly low because of the industrial nature of the adjacent existing mining operations.

Visual resource management guidelines for BLM lands are to manage public lands for current VRM classifications and guidelines. The VRM system is the basic tool used by BLM to inventory and manage visual resources on public lands. The VRM classes constitute a spectrum ranging from Class I through Class V that provides for an increasing level of change within the characteristic landscape.

BLM evaluated the visual resources on lands in the Buffalo and Platte River RMPs (BLM 1985a and 1985b) for management purposes. The inventoried lands were classified into VRM classes. In the General Analysis Area, which does not include any BLM-administered surface land, the predominant VRM class is IV. For lands classified as VRM Class IV, activities, such as mining, attract attention and are dominant features of the landscape in terms of scale.

The USFS has established visual quality objectives for the TBNG. In the General Analysis Area, facilities and landscape modifications may be visible but should be reasonably mitigated to blend and harmonize with natural features according to the revised *Land and Resource Management Plan for the Thunder Basin National Grassland* (USFS 2001). The NARO North, Little Thunder, and West Roundup LBA Tracts include USFS surface land.

Current mine facilities and activity are visible from various public-use roads in the General Analysis Area, including Antelope Road, Piney Canyon (Mackey) Road, Edwards/Reno Road, Hilight Road and State Highway 59, State Highway 450, and County Road 37. Mining activity and facilities are also visible from the LBA tracts.

3.16 Noise

Existing noise sources in the General Analysis Area include coal mining activities, traffic on nearby state highways and county roads, rail traffic, wind, and CBM compressor

stations. Noise originating from CBM development equipment (e.g., drilling rigs and construction vehicles) is apparent locally over the short term (i.e., 30 to 60 days) where well drilling and associated construction activities are occurring. However, if the drilling and construction sites are sufficiently widespread, then the elevated levels of noise generated from each site should not overlap in time or space with noise from other sites. Long-term noise from the ongoing development of CBM resources is associated with the new compressor stations.

Studies of background noise levels at adjacent mines indicate that ambient sound levels generally are low, owing to the isolated nature of the area. Current noise levels in the proposed LBA tracts are estimated to be 40-60 dBA, with the noise level increasing with proximity to active mining at adjacent mines. Mining activities are characterized by noise levels of 85-95 dBA at 50 ft from actual mining operations and activities (BLM 1992b). The unit of measure used to represent sound pressure levels (decibels) using the A-weighted scale is dBA. It is a measure designed to simulate human hearing by placing less emphasis on lower frequency noise because the human ear does not perceive sounds at low frequency in the same manner as sounds at higher frequencies. Figure 3-19 presents noise levels associated with some commonly heard sounds.

The nearest occupied dwellings to the five LBA tracts included in this analysis are:

- one occupied dwelling is located immediately adjacent to the southern edge of the NARO North LBA Tract;
- one occupied dwelling is located less than one mile from the western edge of the Little Thunder LBA Tract and the area added by Alternative 2;
- the nearest occupied dwelling to the West Roundup LBA Tract is located just over three miles from the southern edge of the tract; and
- one occupied dwelling is located approximately one mile from the western edge of the West Antelope LBA Tract.

3.17 Transportation Facilities

Within the General Analysis Area, the major north-south public transportation corridor is State Highway 59 in Campbell and Converse Counties, and the principal

Figure 3-19

east-west transportation corridor is State Highway 450 in Campbell County. Other paved county roads, including the Edwards Road, Reno Road, and Antelope Road in Campbell County and County Road 37 in Converse County, provide public and private access within the General Analysis Area. There are numerous other improved and unimproved local roads and accesses in the area for both public and private use.

The General Analysis Area presently has one major railroad. The Gillette-Douglas rail spur, used jointly by BNSF & UP, runs north-south through the area with spur lines connecting the railroad with the applicant mines for transporting coal that originates in the General Analysis Area. The DM&E Railroad is presently proposing expansion into Wyoming. Although the specific route is still under consideration, the tracks would terminate at the coal mines located in the General Analysis Area.

There are numerous oil and gas pipelines, power lines, telephone lines, and ROWs in the General Analysis Area. Figures 3-20 through 3-23 depict the current transportation facilities in the LBA tracts included in this analysis.

3.18 Socioeconomics

The social and economic study area for the proposed project involves primarily Campbell County and the cities of Gillette and Wright; however, it also includes the city of Douglas in Converse County. The communities of Gillette and Douglas would most likely attract the majority of any new

residents due to their current population levels and the availability of services and shopping amenities.

3.18.1 Population

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

Converse County's population in 2000 was 12,052, with 5,288 of the county's residents residing in Douglas. Douglas grew from 5,076 persons in 1990 to 5,288 in 2000, an increase of 212 people or 4.2 percent.

CBM-spurred population growth is occurring in both Gillette and Douglas. The current CBM boom is contributing to low housing vacancy and a tight labor market. To date, however, enrollment in Gillette-area schools has not increased as a result of CBM development due to a mobile, relatively young work force (Mathes 2002).

3.18.2 Local Economy

Coal production, as reported by the Wyoming State Inspector of Mines, showed the State's coal mines set a new yearly production record of 368.9 million tons in 2001. This was an

Figure 3-20

Figure 3-21

Figure 3-22

Figure 3-23

3.0 Affected Environment

increase of 8.9 percent over the 338.9 million tons produced in 2000. Campbell County coal production (11 active mines in 2001 and 12 active mines in 2000) increased by 10.0 percent (299.5 million tons to 329.5 million tons) from 2000 to 2001, and Converse County coal production (one active mine in 2001 and two active mines in 2000) increased by 4.2 percent (23.6 million tons to 24.6 million tons) during the same time period. The combined 2001 coal production in these two counties was 96 percent of the state total (Wyoming Department of Employment 2000 and 2001).

In the first two quarters of 2001, 27 percent of the total employment and 43 percent of the total payroll in Campbell County were attributed to mining, which also includes oil and gas employment. During the same time period in Converse County, 14 percent of the employment and 24 percent of the payroll were attributed to mining (Wyoming Department of Employment 2002a).

Approximate taxes and royalties from coal production in Campbell and Converse Counties are presented in Table 3-14. Following is a breakdown of each revenue source, in order from the largest total revenue producer to the smallest. The greatest source of combined state and federal revenue from Wyoming coal is the federal royalty. The current royalty rate for federal coal leases is 12.5 percent of the sales price, with half of this revenue returned to the state. At an average sale price for PRB coal in 2000 of \$4.93 per ton (WSGS 2001), royalties were about \$199.1 million.

Surface coal mines contribute 35 cents per produced ton to the AML program operated by the OSM, with half of this revenue earmarked for reclamation and other approved programs within the state. With 323.1 million tons of coal produced in Campbell and Converse Counties in 2000, AML contributions were about \$113.1 million.

Table 3-14. Estimated 2001 Fiscal Revenues from 2000 Coal Production in Campbell and Converse Counties.

Revenue Item	Campbell County (millions of dollars)	Converse County (millions of dollars)
Federal Mineral Royalties	184.6	14.5
Abandoned Mine Lands Fund	104.8	8.3
Severance Tax	75.1	5.2
Bonus Bid Annual Revenues	76.4	3.3
Ad Valorem Tax	67.5	4.7
Black Lung Tax	59.1	4.7
Sales and Use Tax	1.5	0.3
Totals	569.0	41.0

Severance taxes are collected by the state for removal or extraction of resources such as oil, natural gas, coal, and trona. The current Wyoming severance tax rate is seven percent of the state valuation of produced surface coal. The average 2000 valuation of coal produced in Campbell County was \$3.58 per ton, while that for Converse County was \$3.16 per ton (Wyoming Department of Revenue 2001). The State of Wyoming retains approximately 83 percent of the severance tax, and the remainder is returned to cities, towns, and counties. Coal severance tax collections in the two counties in 2000 were about \$80.3 million.

Lease bonus bids are one-time payments to the BLM for the right to enter into lease agreements for federal minerals. Bonus bids are paid in five annual installments, with half of each installment returned to the state. In the year 2000, bonus bid payments were made for five coal leases (Thundercloud, Antelope, North Rochelle, Powder River, and Horse Creek) and totaled \$79.7 million (BLM 2002b).

Ad valorem taxes are collected by the county and disbursed to schools, cities, towns, the state foundation, and various other subdivisions within the county. Ad valorem taxes comprise production and property taxes, with production taxes being far greater than property taxes for surface coal mines. Production taxes are calculated as 100 percent of the state valuation of produced coal times the sum of mill levies for the production area. Property taxes are calculated as 11.5 percent of the

property valuation at each mine times the mill levies. Campbell and Converse County mill levies averaged 62.16 and 62.26, respectively, in 2000 (Wyoming Department of Revenue 2002a). Production and property taxes paid by surface coal mines in the two counties in 2000 totaled about \$71.3 million and \$1.8 million, respectively.

The federal government levies a four percent tax on the sales price of all surface coal toward the Black Lung Disability Trust Fund. The estimated black lung taxes paid by coal mines in Campbell and Converse County in 2000 were \$63.7 million.

Sales and use taxes are distributed to cities and towns within each county and to the county's general fund. According to the Excise Tax Division of the Wyoming Department of Revenue (2002b), the sales and use taxes collected from coal mines in Campbell and Converse Counties in 2000 were \$1.8 million.

Additional sources of revenue include federal income tax and annual rentals that are paid to the federal government. The total fiscal benefit to the State of Wyoming, including half of the federal mineral royalties, half of the AML fees, half of the bonus bid payments, and all of the ad valorem, severance, sales, and use taxes for 2000 is \$350.3 million, or \$1.08 per ton. This agrees with an estimate previously proposed by the University of Wyoming of \$1.10 per ton (Borden et al. 1994). Figure 3-24 depicts the total revenues to state

Figure 3-24

and federal governments from 2000 coal production in Campbell and Converse Counties.

Nationally, the minerals industry (including oil and gas) accounted for 1.3 percent of the GDP in 2000, and coal mining alone accounted for 0.1 percent (U.S. Department of Commerce 2002). The most recent GSP calculations for Wyoming (1997) indicate that the minerals industry accounted for 31 percent of the GSP, which makes it the largest sector of the Wyoming economy. Coal mining alone accounted for seven percent of the Wyoming GSP (Wyoming Department of Administration and Information 2002).

3.18.3 Employment

Coal mining has changed a great deal since the 1970s, and new technologies have been a major contributor to these changes. The local coal mining labor force grew during the 1970s, declined during the 1980s, and remained fairly constant through the 1990s. Since 1980, overall production has risen while employee numbers have generally decreased or remained constant. The employment decline followed large industry capital investments in facilities and production equipment, the majority of which was aimed at increasing productivity. There has been a recent upturn in Campbell County coal mining employment, where the number of employees increased from 3,011 to 3,400 from 1998 to 2001. Downsizing of the Dave Johnston Mine outweighed growth of the Antelope Mine and caused Converse County mining

employment to decrease during the same time period from 337 to 300 employees (Wyoming Department of Employment 1998, 1999, 2000, and 2001).

In February 2002, the total labor force in Campbell County stood at 23,272 with an unemployment rate of 3.4 percent, compared to 3.3 percent in February 2001 (Wyoming Department of Employment 2002a). In 2001, around 3,950 people were directly employed by surface coal mines or coal contractors, representing about 20 percent of the employed labor force (Wyoming Department of Employment 2001).

The most recent estimates of employment in Campbell County suggest that an all-time employment record at 22,482 was set in February 2002 (Wyoming Department of Employment 2002a). The Campbell County annual employment record of 21,668 was set in 1985, the same year that mining employment (which in this case includes oil and gas workers) peaked at 6,312. Total employment declined to a low of 18,103 in 1988 and has generally increased since that time. The current CBM development has resulted in a tight labor market for both skilled and unskilled labor; however, the mining industry has not had difficulty filling positions due to attractive wage and benefit packages and predictable schedules (Hockert 2000).

As of December 2001, the total Converse County labor force was 6,863 with an unemployment rate of 3.6 percent, compared to 4.2 percent

in December 2000 (Wyoming Department of Employment 2002b). In 2001, 300 people, or four percent of the labor force, were directly employed by area coal mines (Wyoming Department of Employment 2001). Total employment in Converse County declined from 7,643 in 1981 to a low of 5,988 in 1990 and has been increasing since that time. Mining employment (include oil and gas workers) declined from 2,129 in 1981 to a low of 723 in 1991 and has been slowly increasing since that time.

3.18.4 Housing

According to the 2000 census, Campbell County contained 13,288 housing units in April 2000, 7,931 of which were within Gillette city limits. A more recent estimate completed by the City of Gillette (2001) suggests that the number of housing units within city limits in December 2001 was 8,323. This represents a 17.6 percent increase over the 7,078 housing units reported in the 1990 census. In early 2001, the average price of a new three-bedroom home in Gillette was \$133,000, and the average price of an existing three-bedroom home was \$89,000 (Campbell County Economic Development Corporation 2002).

Wright had 544 housing units during the 2000 census. This represents a 3.2 percent increase over the 527 houses reported in the 1990 census. In Wright, the average 2001 prices of new and existing three-bedroom homes were \$120,000 and \$77,000, respectively (Campbell County

Economic Development Corporation 2002).

Campbell County residential building permits rose from 15 in 1990 to 100 in 1998, when the permit system was discontinued for unincorporated Campbell County (Wyoming Department of Administration and Information 2002). Due to population growth associated with CBM development, the housing vacancy rate in Gillette is less than one percent, with apartment vacancy at nearly 0 percent (Campbell County Economic Development Corporation 2002). Although several housing projects are on the horizon in the Gillette area, many new residents are currently unable to find rentals and are living in motels (Gillette News-Record 2002b).

In Converse County, residential building permits varied between 0 and two per year from 1987 to 1990, rose to 27 in 1997, and fell to 11 in 2000 (Wyoming Department of Administration and Information 2002). According to the 2000 census, Converse County contained 5,669 housing units, 2,385 of which were in Douglas. This represents a 5.2 percent increase over the 2,267 housing units reported in the 1990 census. The average price of a new three-bedroom home in Converse County in 2000 was \$132,000, and the average price of an existing three-bedroom home was \$106,000 (Northeast Wyoming Economic Development Coalition 2002). In March 2002, the housing vacancy in Douglas was less than one percent, and the apartment vacancy was around two percent. According to an

area realtor, the tight housing market is typical in Douglas and may not be attributable to CBM development (Hollaway 2002).

According to a 2001 report on housing needs in Campbell County, roughly 61 percent of PRB surface coal mining employees live in Gillette and surrounding areas, 14 percent live in Wright, and 25 percent live outside of Campbell County (Pedersen Planning Consultants 2001).

3.18.5 Local Government Facilities and Services

Gillette has generally maintained a steady population growth since 1987, when it totaled 17,054 (City of Gillette 2002). Owing to the substantial revenues generated by mineral production, local government facilities and services have kept pace with growth and are adequate for the current population. The opening of the new South Campus of Campbell County High School has helped to alleviate overcrowding at the North Campus. South Campus opened on February 1, 1999 with approximately 300 students and 22 teachers. In the 2001-2002 school year, the numbers have increased to approximately 500 students and 41 teachers (Mathes 2002).

The 2000 population of Douglas (5,288) is lower than its peak of 7,800 in 1982, and local government facilities and services are generally adequate for the current population. The town has limited building space (platted lots) available for future growth. Some indoor recreational facilities may also be near capacity.

Wright was established in 1976 by the Atlantic Richfield Company and is the nearest community to the SPRB mines. Wright's population peaked in 1985 at approximately 1,800 and decreased to 1,285 by 1994. The 2000 population of Wright was 1,347. As of October 2000, the town of Wright was not experiencing population growth due to CBM development (Buresh 2000). However, increasing CBM development and the construction of several proposed power plants in Campbell County will likely bring new residents to Wright (Pedersen Planning Consultants 2001). With the possible exception of residential housing units, Wright's infrastructure is more than adequate for the current and planned population, and with the current building going on it can double in population before services become limiting.

3.18.6 Social Conditions

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

reasonable levels of growth and development.

Wyoming's economy reached the bottom of an energy bust in 1987 and started to recover (Wyoming Department of Administration and Information 2002). That recovery began to slow in 1996. The forecast is for slow growth through 2008. Wyoming population is projected to increase at nearly one percent per year. Non-agricultural employment has been projected to increase by 1.4 to 1.7 percent annually in 2001 through 2003 and taper to a 0.8 percent annual increase by 2009 (Wyoming Department of Administration and Information 2001). Actual non-agricultural employment increases in 2001 of 2.6 percent indicate that employment may grow more rapidly than previously estimated (Wyoming Department of Employment 2002a).

Mining employment (including oil and gas) has been projected to increase by 2.1 percent in 2001 and taper to a 0.4 percent annual increase by 2009. In 2001 there were 19,500 jobs in the mining sector in Wyoming. This number was up 13 percent from the 17,200 mining jobs in 2000. This large increase was almost entirely attributed to increases in oil and gas jobs, from 9,400 in 2000 to 11,800 in 2001 (Wyoming Department of Employment 2002a). Continued development of CBM resources in Wyoming may cause greater increases in mining sector employment through 2009 than previously estimated.

3.18.7 Environmental Justice

Environmental Justice issues are concerned with actions that unequally impact a given segment of society either as a result of physical location, perception, design, noise, 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 Campbell and Converse Counties, entities with interests in the area, and individuals with ties to the area all may have concerns about the presence of coal mines within the General Analysis Area. Communities potentially impacted by the presence or absence of a coal mine have been identified in this section of the EIS. Environmental Justice concerns are usually directly associated with impacts on the natural and physical environment, but these impacts are likely to be interrelated with social and economic impacts as well. Native American access to cultural and

religious sites may fall under the umbrella of Environmental Justice concerns if the sites are on tribal lands or access to a specific location has been granted by treaty right.

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

3.19 Hazardous and Solid Waste

Potential sources of hazardous or solid waste on each of the five LBA tracts 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 any of the five LBA tracts. Wastes produced by current mining activities at the North Antelope/Rochelle Complex, Black Thunder, North Rochelle and Antelope Mines are handled according to the procedures described in Chapter 2.

4.0 ENVIRONMENTAL CONSEQUENCES

This chapter discloses the potential environmental consequences that may result from implementing the Proposed Action or alternatives to the action for the NARO North, NARO South, Little Thunder, West Roundup, and West Antelope LBA¹ Tracts. The alternatives for each tract are described in Chapter 2. The effect or impact a consequence will have on the quality of the human environment is also discussed. For instance, the consequence of an action may be to greatly increase the number of roads in an area. If the number of roads in an area is increased, opportunities for road-based recreation would be increased but the opportunities for primitive recreational activities and solitude would be decreased. Evaluation of the impact would depend on an individual's (or a group's) preferred use of that area.

If an LBA tract is leased to an applicant as a maintenance tract under one of the action alternatives, the permit area for the adjacent mine would have to be amended to include the new lease area before it could be disturbed. Tables 4-1 through 4-4 show the areas to be mined and disturbance areas for the existing applicant mines (which represent the No Action Alternatives), and how the mine areas would change under the action alternatives for each LBA tract. If a tract is leased, the area that would have to be added to the existing mine permit area would be that portion of the LBA tract that lies

outside the existing permit boundary plus an adjacent strip of land that would be used for highwall reduction after mining and such mine-related activities as construction of diversions, flood and sediment control structures, roads, and stockpiles. Portions of the LBA tracts that are contiguous to the existing leases will be disturbed under the current mining plans in order to recover the coal in the existing leases. For all five of the LBA tracts included in this analysis, the environmental consequences of implementing either the Proposed Action, Alternative 2, or Alternative 3 would be similar in nature, but in general the action alternative that disturbs the smallest area of land surface would have the least impact. The smallest disturbance area for the NARO North and South LBA Tracts would occur if the Alternative 3 tract configuration for the NARO South LBA Tract is chosen. (Table 4-1). For the Little Thunder and West Roundup LBA Tracts, the Proposed Action tract configuration would have a smaller disturbance area than the other action alternatives (Tables 4-2 and 4-3). For the West Antelope LBA Tract, the Alternative 3 tract configuration would have a smaller disturbance area than the other action alternatives (Table 4-4).

Surface mining and reclamation have been ongoing in the eastern PRB for over two decades. During this time, effective mining and reclamation technologies have been developed and continue to be refined. Mining and reclamation operations are regulated under SMCRA and Wyoming statutes. WDEQ technically reviews all mine permit application packages to ensure

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

4.0 Environmental Consequences

Table 4-1. Comparison of Existing and Proposed North Antelope/Rochelle Complex Disturbance Area and Mining Operations.

	No Action Alternative (Existing Permit Area)	Proposed Action	Alternative 2	Alternative 3
Additional Lease Area (Acres)	---	4,503.02	5,571.19	3,776.27
Total Lease Area (Acres)	14,895.50	19,398.52	20,466.69	18,671.77
Increase in Lease Area (Percent)	---	30.2	37.4	25.4
Estimated Total Disturbance Area (Acres) ¹	20,410	26,000	26,685	25,273
Increase in Estimated Disturbance Area (Percent)	---	27.4	30.7	23.8
Estimated Recoverable Coal Remaining as of 1/02 (Million Tons) ²	904.4	1,411.3	1,518.3	1,339.3
Increase in Estimated Recoverable Coal as of 1/02 (Percent)	---	56.0	67.9	48.1

Notes: 1 Total Disturbance Area = area to be mined + area disturbed for mine facilities, access roads, haul roads, railroad facilities, stockpiles, etc.

2 Estimated Recoverable Coal Resources = tons of in-place coal × recovery factor.

For the NARO North LBA Tract, in-place coal = 323 million tons (Proposed Action), and PRCC's estimated recovery factor = 95 percent, based on historic operations.

For the NARO South LBA Tract, in-place coal = 241 million tons (Proposed Action), and PRCC's estimated recovery factor = 83 percent, based largely upon unmineable reserves within railroad ROW and unrecoverable coal in partially burned areas.

For the NARO South LBA Tract, in-place coal = 387 million tons (Alternative 2), and PRCC's estimated recovery factor = 79 percent, based largely upon unmineable reserves within railroad ROW and unrecoverable coal in partially burned areas.

For the NARO South LBA Tract, in-place coal = 141.4 million tons (Alternative 3), and PRCC's estimated recovery factor = 91 percent, based largely upon unrecoverable coal in partially burned areas.

that the mining and reclamation plans comply with all state permitting requirements and that the proposed coal mining operations comply with the performance standards of the DOI-approved Wyoming program. BLM and USFS may attach special stipulations to all coal leases (Appendix D), and there are a number of federal and state permit approvals that are required in order to conduct surface mining operations (Appendix A). The regulations are designed to ensure that surface coal mining impacts are mitigated. The impact

assessment that follows considers all measures required by federal and state regulatory authorities as part of the Proposed Action and Alternatives. Section 4.1 analyzes the direct and indirect impacts that would be associated with mining the five LBA tracts included in this analysis if they are leased under the respective Proposed Actions and alternative tract configurations. Section 4.2 presents the probable environmental consequences of the No Action Alternatives (Alternative 1, not issuing leases for one or more of the

Table 4-2. Comparison of Existing and Proposed Black Thunder Mine Disturbance Area and Mining Operations.

	No Action Alternative (Existing Permit Area)	Proposed Action	Alternative 2	Alternative 3	
				North Tract	South Tract
Additional Lease Area (Acres)	---	3,449.32	5,083.50	1,065.49	4,018.01
Total Lease Area (Acres)	12,772.90	16,222.22	17,856.40	17,856.40	
Increase in Lease Area (Percent)	---	27.0	39.8	39.8	
Estimated Total Disturbance Area (Acres) ¹	18,476	23,900	25,053	25,053	
Increase in Estimated Disturbance Area (Percent)	---	29.4	35.6	35.6	
Estimated Recoverable Coal as of 1/02 (Million Tons) ²	920.3	1,361.3	1,473.1	1,473.1	
Increase in Estimated Recoverable coal as of 1/02 (Percent)	---	48	60	60	

Notes: ¹ Total Disturbance Area = area to be mined + area disturbed for mine facilities, access roads, haul roads, railroad facilities, stockpiles, etc.

² Estimated Recoverable Coal Resources = tons of in-place coal × recovery factor.
For the Little Thunder LBA Tract, in-place coal = 479.3 million tons (Proposed Action), and TBCC's estimated recovery factor = 92 percent, based on unmineable reserves within railroad ROW.

For the Little Thunder LBA Tract, in-place coal = 695.3 million tons (Alternative 2), and TBCC's estimated recovery factor = 79.5 percent based primarily on unmineable reserves within railroad ROW.

For the Little Thunder LBA Tract, in-place coal = 155.7 million tons (Alternative 3, North Tract), and TBCC's estimated recovery factor = 71.9 percent based primarily on unmineable reserves within railroad ROW.

For the Little Thunder LBA Tract, in-place coal = 539.6 million tons (Alternative 3, South Tract), and TBCC's estimated recovery factor = 81.7 percent based primarily on unmineable reserves within railroad ROW.

4.0 Environmental Consequences

Table 4-3. Comparison of Existing and Proposed North Rochelle Mine Disturbance Area and Mining Operations.

	No Action Alternative (Existing Permit Area)	Proposed Action	Alternative 2	Alternative 2 Plus Lease WY-127221 Modification	Alternative 3	Alternative 3 Plus Lease WY-127221 Modification
Additional Lease Area (Acres)	---	1,870.65	2,496.79	2,652.69	2,894.03	3,049.93
Total Lease Area (Acres)	3,443.5	5,314.15	5,940.29	6,096.19	6,337.53	6,493.43
Increase in Lease Area (Percent)	---	54.3	72.5	77.0	84.0	88.6
Estimated Total Disturbance Area (Acres) ¹	5,288	8,449	8,449	8,449	8,879	8,879
Increase in Estimated Disturbance Area (Percent)	---	59.8	59.8	59.8	67.9	67.9
Estimated Recoverable Coal as of 1/02 (Million Tons) ²	255	410.9	457.1	468.8	501.8	513.5
Increase in Estimated Recoverable Coal as of 1/02 (Percent)	---	61	79	84	97	101

Notes: ¹ Total Disturbance Area = area to be mined + area disturbed for mine facilities, access roads, haul roads, railroad facilities, stockpiles, etc.
² Estimated Recoverable Coal Resources = tons of in-place coal × recovery factor.
For the West Roundup LBA Tract, in-place coal = 173.2 million tons (Proposed Action), 224.6 million tons (Alternative 2), 237.6 million tons (Alternative 2 plus Lease WYW-127221 Modification), 274.2 million tons (Alternative 3) or 287.2 million tons (Alternative 3 plus Lease WYW-127221 Modification) and TCC's estimated recovery factor = 90 percent, based on historic operations.

Table 4-4. Comparison of Existing and Proposed Antelope Mine Disturbance Area and Mining Operations.

	No Action Alternative (Existing Permit Area)	Proposed Action	Alternative 2	Alternative 3
Additional Lease Area (Acres)	---	3,542.19	3,877.90	2,809.13
Total Lease Area (Acres)	8,019.20	11,561.39	11,897.10	10,828.33
Increase in Lease Area (Percent)	---	44.2	48.4	35.0
Estimated Total Disturbance Area (Acres) ¹	8,821	12,021	12,321	11,288
Increase in Estimated Disturbance Area (Percent)	---	36.3	39.7	28.0
Estimated Recoverable Coal Remaining as of 1/02 (Million Tons) ²	347.3	575.7	601.6	517.7
Increase in Estimated Recoverable Coal as of 1/02 (Percent)	---	66	73	49

Notes: ¹ Total Disturbance Area = area to be mined + area disturbed for mine facilities, access roads, haul roads, railroad facilities, stockpiles, etc.
² Estimated Recoverable Coal Resources = tons of mineable coal × recovery factor.
For the West Antelope LBA Tract, in-place coal = 293.9 million tons, mineable coal 245.6 million tons (Proposed Action). For the West Antelope LBA Tract, in-place coal = 321.8 million tons, mineable coal = 273.4 million tons (Alternative 2). For the West Antelope LBA Tract, in-place coal = 202.3 million tons, mineable coal = 183.2 million tons (Alternative 3). ACC's estimated recovery factor = 93 percent after eliminating coal that won't be mined beneath Antelope Creek valley.

tracts). Section 4.3 discusses regulatory compliance, mitigation, and monitoring in terms of what is required by federal and/or state law (and is therefore part of the Proposed Actions and Alternatives) and any additional mitigation and monitoring that may be required. Section 4.4 summarizes the residual effects of the Proposed Actions, and Alternatives. Section 4.5 discusses the cumulative impacts that would occur if all these lands were mined when added to other past, present, and reasonably foreseeable future actions. The cumulative impact analysis includes a discussion of other projects that are in progress, or are proposed in Campbell and Converse Counties, Wyoming, and that would occur independently of leasing the LBA tracts. Projects that have proceeded beyond preliminary planning phases include: 1) construction and operation of the Two Elk power plant, which has been proposed near the Black Thunder Mine; 2) construction and operation of the Wygen #1 power plant, of which construction has begun at the Wyodak Mine site; 3) the construction and operation of the DM&E Railroad line; and 4) the ongoing development of CBM resources adjacent to and west of the area of active mining. Projects that are in preliminary planning stages include: 1) construction and operation of the Two Elk Unit Two Power Plant, also proposed adjacent to the Black Thunder Mine; 2) construction and operation of the Middle Bear Power Plant, proposed to be located east of the Cordero-Rajo Complex; 3) construction and operation of the Wygen #2 power plant which has been proposed near the Wygen #1 power plant at the

Wyodak Mine site; and 4) construction of a power transmission line from the Two Elk power plants. Section 4.6 analyzes the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity. Section 4.7 presents the irreversible and irretrievable commitments of resources that would occur with implementation of the Proposed Actions or action alternatives.

4.1 Direct and Indirect Impacts of Action Alternatives

Impacts can range from beneficial to adverse and they can be a primary result of an action (direct) or a secondary result (indirect). They can be permanent, long-term (persisting beyond the end of mine life and reclamation), or short-term (persisting during mining and reclamation and through the time the reclamation bond is released). Impacts also vary in terms of significance. The basis for conclusions regarding significance are the criteria set forth by the Council on Environmental Quality (40 CFR 1508.27) and the professional judgement of the specialists doing the analyses. Impact significance may range from negligible to substantial; impacts can be significant during mining but be reduced to insignificance following completion of reclamation.

4.1.1 Topography and Physiography

Surface coal mining would permanently alter the topography of each LBA tract that is leased and mined. Topsoil would be removed from the land and stockpiled or

placed directly on recontoured areas. Overburden would be blasted and stockpiled or directly placed into the already mined pit, and coal would be removed. The existing topography on each LBA tract would be substantially changed during mining. Highwalls with vertical heights equal to overburden, interburden, and coal thicknesses would exist in the active pits. If necessary, streams would be diverted into temporary channels or blocked to prevent flooding of the pits.

Typically, a direct permanent impact of coal mining and reclamation is topographic moderation. After reclamation, the restored land surfaces are generally gentler, with more uniform slopes and restored basic drainage networks. The original topography in the NARO North, Little Thunder, West Roundup and West Antelope tracts is relatively flat, with average slopes ranging from one to three percent. As a result, the expected postmining topography on these tracts would be similar to the premining topography. On the NARO South LBA Tract, slopes average about five percent. Since the NARO South LBA Tract is characterized by steeper slopes, the post-mining topography on this tract would be gentler and more uniform than the pre-mining topography. Following reclamation, the average surface elevation on each LBA tract would be lower due to coal removal. The removal of the coal would be partially offset by the swelling that occurs when the overburden and interburden are blasted and removed. Table 4-5 presents the approximate postmining surface elevation change for each LBA tract as applied for

under the Proposed Action and action alternatives. After the coal is removed, the land surface would be restored to approximate original contour or to a configuration approved by WDEQ/LQD when the mining and reclamation permit for the existing mine is revised to include the LBA tract.

Direct adverse impacts resulting from topographic moderation include a reduction in microhabitats (e.g., cutbank slopes) for some wildlife species and a reduction in habitat diversity, particularly a reduction in slope-dependent shrub communities and associated habitat. These impacts would be greater on the tracts characterized by steeper pre-mining topography. A potential indirect impact may be a long-term reduction in big game carrying capacity. A direct beneficial impact of the lower and flatter terrain would be reduced water runoff, which would allow increased infiltration and result in a minor reduction in peak flows. This may help counteract the potential for increased erosion that could occur as a result of higher near-surface bulk density of the reclaimed soils (Section 4.1.3). It may also increase vegetative productivity, and potentially accelerate recharge of groundwater.

For each LBA tract, the approximate original drainage pattern would be restored, and stock ponds and playas would be replaced to provide livestock and wildlife watering sources. These topographic changes would not conflict with regional land use, and the postmining topography would be designed to adequately support anticipated land use.

Table 4-5. Average Overburden, Interburden, and Coal Thicknesses and Approximate Postmining Surface Elevation Changes of the Five LBA Tracts.

LBA Tract and Configuration	Overburden Thickness (ft)	Interburden Thickness (ft)	Coal Thickness (ft)	Swell Factor (percent)	Coal Recovery Factor (percent)	Postmining Elevation Change¹
NARO North						
Proposed Action	307	0	79	15	95	29 ft lower
NARO South						
Proposed Action	113	61	69	12	95	45 ft lower
Alternative 2	145	60	70	12	95	42 ft lower
Alternative 3	99	63	67	12	95	44 ft lower
Little Thunder						
Proposed Action	260	54	97	16	92	39 ft lower
Alternative 2	279	46	98	16	92	38 ft lower
Alternative 3 (North Tact)	310	18	96	16	92	36 ft lower
Alternative 3 (South Tact)	269	58	98	16	92	38 ft lower
West Roundup						
Proposed Action	318	0	69	16	90	11 ft lower
Alternative 2	306	0	67	16	90	11 ft lower
Alternative 3	316	0	67	16	90	10 ft lower
Lease WYW-127221 Modification	233	0	57	16	90	14 ft lower
West Antelope						
Proposed Action	138	68	88	22	93	37 ft lower
Alternative 2	150	67	89	22	93	35 ft lower
Alternative 3	140	62	81	22	93	31 ft lower
Notes: ¹ Reclaimed (postmining) elevation change calculated as: (coal thickness × coal recovery factor) - swell factor × (overburden thickness + interburden thickness).						

These impacts are occurring on the existing North Antelope/Rochelle Complex, Black Thunder, North Rochelle, and Antelope Mine coal leases as coal is mined and mined-out areas are reclaimed. Under the Proposed Action, Alternative 2, or Alternative 3, the areas that would be permanently topographically changed would increase as shown in Tables 4-1 through 4-4.

4.1.2 Geology

The geology from the base of the lowest coal seam mined to the land surface would be subject to permanent change after the coal is removed on the LBA tracts under the Proposed Actions and action alternatives. The subsurface characteristics of these lands would be radically changed by mining. The replaced overburden and interburden (backfill) would be a mixture of the geologically distinct layers of sandstone, siltstone, and shale that currently exist. The resulting physical characteristics would also be significantly altered.

Drilling and sampling programs are conducted on the existing leases by all mine operators to identify overburden material that may be unsuitable for reclamation (i.e., material that is not suitable for use in reestablishing vegetation or that may affect groundwater quality due to high concentrations of certain constituents such as selenium or adverse pH levels). As part of the mine permitting process, each mine operator develops a management plan to ensure that this unsuitable material is not placed in areas where it may affect groundwater quality or

revegetation success. Each mine operator also develops backfill monitoring plans as part of the mine permitting process to evaluate the quality of the replaced overburden. These plans are in place for the existing North Antelope/Rochelle Complex, Black Thunder, North Rochelle, and Antelope Mines and would be developed for the LBA tracts if they are leased.

NARO North and South LBA Tracts

Within the NARO North LBA Tract, mining would remove an average of 307 ft of overburden, no interburden, and 79 ft of coal on about 2,369 acres under the Proposed Action. Within the NARO South LBA Tract under the Proposed Action and Alternatives 2 and 3, the coal reserves beneath an area of approximately 578 acres were burned by spontaneous coal fires in the past. Under the Proposed Action for the NARO South LBA Tract, mining would remove an average of 113 ft of overburden, 61 ft of interburden, and 69 ft of coal on about 1,556 acres. Under Alternative 2, mining would remove an average of 145 ft of overburden, 60 ft of interburden, and 70 ft of coal on about 2,624 acres from the NARO South LBA Tract. Under Alternative 3, mining would remove an average of 99 ft of overburden, 63 ft of interburden, and 67 ft of coal on about 829 acres from the NARO South LBA Tract. Some of the coal that is included in the NARO South LBA Tract under the Proposed Action or Alternative 2 is located within the BNSF & UP railroad ROW and would, therefore, not be mined because it has been determined to be unsuitable for mining according to the coal

leasing unsuitability criteria (43 CFR 3461). Table 4-5 presents the average overburden, interburden, and coal thicknesses for the NARO North and South LBA Tracts as applied for and Alternatives 2 and 3. Table 4-6 presents the average overburden, interburden and mineable coal thicknesses for the existing North Antelope/Rochelle Complex permit area.

The replaced overburden and interburden would be a relatively homogeneous (compared to the premining layered overburden and interburden) and partly recompacted mixture averaging about 357 ft in thickness in the NARO North LBA Tract under the Proposed Action. The backfill in the NARO South LBA Tract would average about 198 ft in thickness under the Proposed Action, about 233 ft in thickness under Alternative 2, and about 185 ft in thickness under Alternative 3. A total of approximately 506.9 million additional tons of coal would be recovered from both tracts under the Proposed Action, compared to an estimated 613.9 million tons under

Alternative 2, or an estimated 434.9 million tons under Alternative 3.

Little Thunder LBA Tract

Within the Little Thunder LBA Tract, there is an average of 260 ft of overburden, 54 ft of interburden, and 97 ft of coal on about 3,449 acres under the Proposed Action. There is an average of 279 ft of overburden, 46 ft of interburden, and 98 ft of coal on about 5,084 acres included in the Little Thunder LBA Tract Alternative 2 tract configuration. Under Alternative 3 for the Little Thunder LBA Tract, there is an average of 310 ft of overburden, 18 ft of interburden, and 96 ft of coal on about 1,065 acres included in the north tract, and an average of 269 ft of overburden, 58 ft of interburden, and 98 ft of coal on about 4,018 acres included in the south tract. Some of the coal that is included in the Little Thunder LBA Tract under the Proposed Action or Alternatives 2 or 3 is located within the BNSF & UP railroad or Wyoming Highway 450 ROWs and would, therefore, not be mined because it has been determined to be unsuitable

Table 4-6. Average Overburden, Interburden, and Coal Thicknesses for the Applicant Mines' Existing Permit Areas.

Applicant Mine	Average Overburden Thickness (ft)	Average Interburden Thickness (ft)	Average Total Mineable Coal Thickness (ft)
North Antelope/Rochelle Complex	205	0	67
Black Thunder	204	11	74
North Rochelle	210	0	60
Antelope	135	62	86

for mining according to the coal leasing unsuitability criteria (43 CFR 3461). Therefore, the area of coal removal under the Proposed Action and Alternatives 2 and 3 would actually be somewhat smaller than the acreages shown above. Table 4-5 presents the average overburden, interburden and coal thicknesses for the Little Thunder LBA Tract as applied for and Alternatives 2 and 3. Table 4-6 presents the average overburden, interburden and mineable coal thicknesses for the existing Black Thunder Mine permit area.

The replaced overburden and interburden would be a relatively homogeneous (compared to the premining layered overburden and interburden) and partly recompact mixture averaging about 372 ft in thickness under the Proposed Action, and about 385 ft in thickness under Alternative 2. Under Alternative 3, the replaced overburden would average about 388 ft in thickness in the North tract and about 387 ft in thickness in the South tract. Approximately 440 million additional tons of coal would be recovered under the Proposed Action, compared to 553 million tons under Alternatives 2 and 3 (111.9 million tons in the North tract and 441.1 million tons in the South tract).

West Roundup LBA Tract

Within the West Roundup LBA Tract, mining would remove an average of 318 ft of overburden, no interburden, and 69 ft of coal on about 1,871 acres under the Proposed Action. Mining would remove an average of 306 ft of overburden, no interburden, and 67 ft

of coal on about 2,497 acres under the Alternative 2 tract configuration. Mining would remove an average of 316 ft of overburden, no interburden, and 67 ft of coal on about 2,894 acres under the Alternative 3 tract configuration. Mining would also remove an average of 233 ft of overburden, no interburden, and 57 ft of coal on about 156 acres of additional lands that would be included in the LBA Tract if federal coal lease WYW-127221 is not modified as is currently proposed. These acreage figures represent the estimated area of actual coal removal under the Proposed Action, Alternatives 2 and 3, and the proposed lease WYW-127221 modification area. Table 4-5 presents the average overburden, interburden and coal thicknesses for the West Roundup LBA Tract as applied for, Alternatives 2 and 3, and lease WYW-127221 modification area. Table 4-6 presents the average overburden, interburden and coal thicknesses for the existing North Rochelle Mine permit area.

The replaced overburden and interburden would be a relatively homogeneous (compared to the premining layered overburden and interburden) and partly recompact mixture averaging about 376 ft in thickness under the Proposed Action, about 362 ft in thickness under Alternative 2, about 373 ft in thickness under Alternative 3, and about 276 ft in thickness on the lease WYW-127221 modification area. Approximately 155.9 million additional tons of coal would be recovered under the Proposed Action, compared to 202.1 million tons under Alternative 2, 246.8 million tons

under Alternative 3, and 11.7 million tons from the lease WYW-127221 modification area.

West Antelope LBA Tract

Within the West Antelope LBA Tract, mining would remove an average of 138 ft of overburden, 68 ft of interburden, and 88 ft of coal on about 2,755 acres under the Proposed Action. Mining would remove an average of 150 ft of overburden, 67 ft of interburden, and 89 ft of coal on about 3,091 acres under the Alternative 2 tract configuration. Mining would remove an average of 140 ft of overburden, 62 ft of interburden, and 81 ft of coal on about 2,022 acres under the Alternative 3 tract configuration. These acreage figures represent the estimated area of actual coal removal under the Proposed Action and Alternatives 2 and 3. Table 4-5 presents the average overburden, interburden and coal thicknesses for the West Antelope LBA Tract as applied for and Alternatives 2 and 3. Table 4-6 presents the average overburden, interburden and coal thicknesses for the existing Antelope Mine permit area.

The replaced overburden and interburden would be a relatively homogeneous (compared to the premining layered overburden and interburden) and partly recompacted mixture averaging about 257 ft in thickness under the Proposed Action, about 271 ft in thickness under Alternative 2, and about 252 ft in thickness under Alternative 3. Approximately 228.4 million additional tons of coal would be recovered under the Proposed Action,

compared to 254.3 million tons under Alternative 2 and 170.4 million tons under Alternative 3.

4.1.2.1 Mineral Resources

During mining, other minerals present on each of the LBA tracts could not be developed. Some of these minerals could, however, be developed after mining. Conventional oil and gas wells would have to be plugged during mining, but could be re-completed after mining if the remaining reserves economically justify the expense of the re-completion. All oil and gas production equipment would have to be removed to a level below the coal. The reservoir which these wells produce from would not be disturbed by removal of the coal. The oil and gas lessee could re-complete or re-drill wells to recover remaining oil and gas resources from any subcoal oil and gas reservoirs following mining. This would only occur if they believe that the value of the remaining reserves would justify the expense of reestablishing production. Section 3.3 includes a discussion on the oil and gas fields in the General Analysis Area and the LBA tracts that overlie them, as well as discussions on the currently producing wells and their associated facilities specific to each of the LBA tracts and associated action alternatives.

CBM resources that are not recovered prior to mining would be irretrievably lost when the coal is removed. As discussed in Sections 3.3 and 3.11, CBM wells are being drilled on and/or near each of the LBA tracts in the General Analysis Area. The Little Thunder LBA Tract is currently the

only LBA tract with producing CBM wells within the General Analysis Area. The NARO North, West Roundup and West Antelope LBA Tracts include CBM wells in various stages of development (e.g., permitting, drilling, etc.) which were not producing when this document was prepared. Since there is a very limited production history from wells within the General Analysis Area, there is limited data available to estimate well life for existing or future CBM wells.

For the purposes of this draft EIS, the BLM WSO-RMG reviewed the existing CBM resource and production data in the General Analysis Area. All productive CBM wells within the ten-township area which covers the General Analysis Area were reviewed to determine whether decline curve analysis could be used to forecast reserves or evaluate well economics. None of the wells had sufficient production to yield decline curves that could be accepted with confidence for forecasting purposes. These analyses did indicate that CBM reserves are probably limited in the General Analysis Area, suggesting that shorter well lives might be expected. Provisional decline curves which were prepared for several wells with the lengthiest production histories suggest that well life periods for wells located on or near the LBA lands might be on the order of one to five years.

Since none of the wells in the General Analysis Area had sufficient production histories to yield decline curves that could be accepted with confidence for forecasting purposes, WSO-RMG evaluated CBM

resources/reserves using volumetric methods: the estimated gas-in-place (in scf/ton) within each proposed LBA tract was multiplied by the reported number of tons of coal within the subject tract to obtain an in-place resource volume.

Detailed CBM resource analyses have been prepared by the WSO-RMG in support of coal leasing actions and other program activities in the General Analysis Area and at other localities in the PRB mining area. Coal seam gas-in-place is dependent on a number of factors, including coal rank, coal lithology, and particularly for the purposes of these analyses, methane adsorptive capacity of the coals, which is controlled by hydrostatic pressure within the coal seam. Methane adsorption analyses describe the volume of methane that can be adsorbed by a specific sample of coal across a varying range. This pressure/volume relationship can be represented by an equation and curve known as an adsorption isotherm. Although gas content can vary widely from sample to sample depending upon other properties of the coal, the adsorption data provide a means of predicting coal bed methane adsorptive capacity based on pressure.

WSO-RMG has developed preliminary CBM reservoir models based on these principles to estimate CBM gas content and in-place resources in the mining areas and elsewhere in the PRB. These analyses use publicly available methane adsorption data collected cooperatively by the WSO-RMG and the U.S. Geological Survey, coal geology from publicly-available coal drill holes, and hydrologic data

from groundwater monitoring wells that are reported by GAGMO. This model can be used to calculate and map hydrostatic pressure within the coal seams based on the annual reported water levels. The data and model were used to calculate and map an estimated coal gas content (in scf/ton) across the General Analysis Area in 1982, prior to extensive mining, and subsequently in 2000 (the latest year for which data are available). An average gas content for each proposed LBA tract can be estimated from the maps (year 2000) of estimated gas content. An evaluation of CBM gas-in-place was prepared using the coal reserves (in tons) reported in each LBA application and the estimated coal gas content (in scf/ton) for each LBA tract as visually estimated from the 2000 gas content map. The results of this evaluation are shown in the following tract discussions.

Implicit in the analysis conducted by WSO-RMG is the observation that coal mining and mine-related dewatering affects CBM resources and development potential. As described, water production from the coal seams is required to reduce hydrostatic pressure in the coal seams so that methane can desorb from the coals for production. Mine-related dewatering of the coal seams has the same effect of reducing hydrostatic pressure and methane desorption. The preliminary CBM reservoir models indicate that depletion of the hydrostatic pressures and methane resources has occurred adjacent to mining areas since not long after mining began. Based on the methane adsorption/pressure analyses, the preliminary model

shows that as much as 60 percent of the original in-place CBM resources in the LBA areas may have been depleted since 1982. This effect will be enhanced as mining proceeds toward the LBA tracts and will continue whether or not they are leased and mined. The short productive life inferred for CBM wells in the LBA areas suggests that wells which are completed early could recover substantial portions of the remaining reserves prior to any mining within the LBA tracts.

NARO North and South LBA Tracts

CBM is not currently being produced on the NARO North and NARO South LBA Tracts as proposed or on lands added under Alternative 2. Under the Proposed Action, there would potentially be 29 and 26 CBM well locations on the NARO North and NARO South LBA Tracts, respectively, if all the 80-acre spacing units within the tract were drilled. There would be 13 more potential CBM well sites on lands added by Alternative 2, while Alternative 3 would remove from the NARO South tract nine potential well sites. As of September 2001, Peabody Natural Gas, LLC had drilled two CBM wells on a private oil and gas lease within the NARO North LBA Tract as it is configured under the Proposed Action. These two wells are not currently producing. No CBM wells have been drilled on the NARO South LBA Tract.

WSO-RMG estimates that the average gas content in the NARO North LBA Tract is seven scf/ton. Based on that estimate, the recoverable CBM resource in the NARO North LBA Tract would be approximately 2.261

billion cubic feet under the Proposed Action. For the NARO South LBA Tract, WSO-RMG estimates that the average gas content is four scf/ton, and the estimated recoverable CBM resource is 0.964 billion cubic feet.

CBM will be produced by the existing CBM wells and other wells, if more are drilled, during the time it takes to lease and permit the LBA tracts and, on a case-by-case basis, until mining activity approaches each well. As indicated above, BLM's analysis suggests that substantial portions of these remaining reserves could be produced prior to initiation of mining activity on the NARO North and NARO South LBA Tracts under the Proposed Actions or Alternatives 2 or 3. CBM reserves that are not recovered prior to mining would be lost. This arrangement, which is dependent on cooperation between the oil and gas lessees and the coal lessees, allows for optimizing recovery of both resources.

Little Thunder LBA Tract

CBM is currently being produced on the Little Thunder LBA Tract as proposed and the area added under Alternative 2. As discussed in Section 3.11, 32 CBM wells have been completed for production within the lands encompassed by the Little Thunder LBA Tract, and most of the available 80-acre spacing units within the tract as proposed have been drilled. Review of WOGCC records on June 30, 2002 indicates that all but five of these wells have had some production.

WSO-RMG estimates that the average gas content in the Little Thunder LBA

Tract is 14 scf/ton. Based on that estimate, the current recoverable CBM resource in the Little Thunder LBA Tract would be approximately 6.7 billion cubic feet.

CBM will be produced by the existing CBM wells and other wells, if more are drilled, during the time it takes to lease and permit the LBA tract and, on a case-by-case basis, until mining activity approaches each well. As indicated above, BLM's analysis suggests that substantial portions of these remaining reserves could be produced prior to initiation of mining activity on the Little Thunder LBA Tract under the Proposed Action or Alternatives 2 or 3. CBM reserves that are not recovered prior to mining would be lost. This arrangement, which is dependent on cooperation between the oil and gas lessees and the coal lessees, allows for optimizing recovery of both resources.

West Roundup LBA Tract

CBM is not currently being produced on the West Roundup LBA Tract as proposed or on the lands added under Alternatives 2 and 3 and by lease WYW-127221 modification. Under the Proposed Action, there would potentially be 28 well locations on the West Roundup LBA Tract if all the 80-acre spacing units within the tract were drilled. There would be nine more potential well sites on lands added by Alternative 2, and 14 more potential well sites on lands added by Alternative 3. As of September 2001, Independent Production Co., Inc. had four approved CBM well permits to drill on a private oil and gas lease within the West Roundup LBA Tract as it is

configured under the Proposed Action.

WSO-RMG estimates that the average gas content in the West Roundup LBA Tract is nine scf/ton. Based on that estimate, the current recoverable CBM resource in the West Roundup LBA Tract would be approximately 1.558 billion cubic feet.

CBM will be produced if wells are completed during the time it takes to lease and permit the LBA tract and, on a case-by-case basis, until mining activity approaches each well. As indicated above, BLM's analysis suggests that substantial portions of these remaining reserves could be produced prior to initiation of mining activity on the West Roundup LBA Tract under the Proposed Action or Alternatives 2 or 3. CBM reserves that are not recovered prior to mining would be lost. This arrangement, which is dependent on cooperation between the oil and gas lessees and the coal lessees, allows for optimizing recovery of both resources.

West Antelope LBA Tract

CBM is not currently being produced on the West Antelope LBA Tract as proposed or on the area added by Alternative 2. Under the Proposed Action, there would potentially be 47 well locations on the West Antelope LBA Tract if all the 80-acre spacing units within the tract were drilled. There would be four more potential well sites on lands added by Alternative 2, while Alternative 3 would remove from the West Antelope tract nine potential well sites.

WSO-RMG estimates that the average gas content in the West Antelope LBA Tract is nine scf/ton. Based on that estimate, the current recoverable CBM resource in the West Antelope LBA Tract would be approximately 2.645 billion cubic feet.

CBM will be produced if wells are completed during the time it takes to lease and permit the LBA tract and, on a case-by-case basis, until mining activity approaches each well. As indicated above, BLM's analysis suggests that substantial portions of these remaining reserves could be produced prior to initiation of mining activity on the West Antelope LBA Tract under the Proposed Action or Alternatives 2 or 3. CBM reserves that are not recovered prior to mining would be lost. This arrangement, which is dependent on cooperation between the oil and gas lessees and the coal lessees, allows for optimizing recovery of both resources.

4.1.3 Soils

Removal and replacement of soil resources during mining and reclamation would cause changes in soil resources. In general, soil chemistry and soil nutrient distribution would be more uniform, and average topsoil quality would be improved in reclaimed areas on the five LBA tracts because soil material that is not suitable to support plant growth would not be salvaged for use in reclamation. This would result in more uniform vegetative productivity on the reclaimed land. On each LBA tract, the replaced topsoil would support a stable and productive vegetation community adequate in quality and quantity to support the

planned postmining land uses (wildlife habitat and rangeland). There would be an increase in the near-surface bulk density of the reclaimed soil resources on each LBA tract. As a result, the average soil infiltration rates would generally decrease, which would increase the potential for runoff and soil erosion. Topographic moderation following reclamation would potentially decrease runoff, which would tend to offset the effects of decreased soil infiltration capacity. The change in soil infiltration rates would not be permanent because revegetation and natural weathering action would form a new soil structure in the reclaimed soils, and infiltration rates would gradually return to premining levels.

Direct biological impacts to reclaimed soil resources on each LBA tract considered in this EIS would include a short-term reduction in soil organic matter, microbial populations, seeds, bulbs, rhizomes, and live plant parts for soil resources that are stockpiled before placement.

Each mine would build sediment control structures as needed to trap eroded soil. Revegetation would reduce wind erosion, and soil or overburden materials containing potentially harmful chemical constituents (such as selenium) would be specially handled. These measures are required by state regulations and are therefore considered part of the Proposed Action and action alternatives. The previous discussion describes the impacts to soil resources that generally occur as a result of surface mining and reclamation. The following discussion is a description

of potential impacts to soil resources on each LBA tract following reclamation under the Proposed Action or Alternatives 2 or 3.

NARO North and South LBA Tracts

Under the currently approved mining and reclamation plan, approximately 20,410 acres of soil resources will be disturbed in order to mine the coal in the existing leases at the North Antelope/Rochelle Complex (Table 4-1). If the NARO North and South LBA Tracts are leased, disturbance related to coal mining would directly affect an additional 5,590 acres of soil resources under the two Proposed Actions, or 6,275 acres under Alternative 2, or 4,863 acres under Alternative 3. Average topsoil thickness would be 20 to 39 inches across the entire reclaimed surface on both tracts. The types and quantities of soils that are present on the NARO North and NARO South LBA Tracts under the Proposed Action and Alternatives 2 and 3 are similar to soils currently being salvaged and utilized for reclamation on the existing North Antelope/Rochelle Complex coal leases.

Little Thunder LBA Tract

Under the currently approved mining and reclamation plan, approximately 18,476 acres of soil resources will be disturbed in order to mine the coal in the existing leases at the Black Thunder Mine (Table 4-2). If the Little Thunder LBA Tract is leased, disturbance related to coal mining would directly affect an additional 5,424 acres of soil resources on and adjacent to the tract under the Proposed Action, or 6,577 acres

under Alternative 2. Under Alternative 3, the total additional disturbance area would also equal 6,577 acres (1,382 acres would be disturbed to mine the North tract and 5,195 acres would be disturbed to mine the South tract). Average topsoil thickness would be about 18 inches across the entire reclaimed surface. The types of soils and the quantities of the soil resource included in the Little Thunder LBA Tract under the alternatives considered in this EIS are similar to the soils on the existing coal leases at the Black Thunder Mine.

West Roundup LBA Tract

Under the currently approved mining and reclamation plan, approximately 5,288 acres of soil resources will be disturbed in order to mine the coal in the existing leases at the North Rochelle Mine (Table 4-3). If the West Roundup LBA Tract is leased, disturbance related to coal mining would directly affect an additional 3,161 acres of soil resources under the Proposed Action, 3,161 acres under Alternative 2, 3,161 acres under Alternative 2 plus lease WYW-127221 modification, or approximately 3,591 acres under Alternative 3 with or without the lease WYW-127221 modification. Average topsoil thickness would be about 38 inches across the entire reclaimed surface. The types of soils and the quantities of the soil resource included in the West Roundup LBA Tract under the alternatives considered in this EIS are similar to the soils on the existing coal leases at the North Rochelle Mine.

West Antelope LBA Tract

Under the currently approved mining and reclamation plan, approximately 8,821 acres of soil resources will be disturbed in order to mine the coal in the existing leases at the Antelope Mine (Table 4-4). If the West Antelope LBA Tract is leased, disturbance related to coal mining would directly affect an additional 3,200 acres of soil resources on and adjacent to the LBA tract under the Proposed Action, 3,500 acres under Alternative 2, or 2,467 acres under Alternative 3. Average topsoil thickness would be about 19 inches across the entire reclaimed surface. The types of soils and the quantities of the soil resource included in the West Antelope LBA Tract under the alternatives considered in this EIS are similar to the soils on the existing leases at the Antelope Mine.

4.1.4 Air Quality

4.1.4.1 General Information

This section describes the impacts on air quality in the General Analysis Area. Specifically, this section deals with how the air quality impacts of mining the LBA tracts would be expected to differ from air quality impacts related to current mining operations in this area. For the purpose of impact assessment, mining the LBA tracts is considered to be a logical consequence of leasing the tracts. Thus, it is actually the impacts of mining on ambient air quality that are being assessed. The impacts of mining the LBA tracts, in conjunction with other activities, on air quality in the area are addressed in Section 4.5.4.

As discussed in Section 3.5, a Wyoming air permit application is required to demonstrate that BACT is utilized to control emissions and that the proposed activities will not cause or significantly contribute to an exceedance of the ambient air quality standards. The demonstration of compliance is typically made with emission inventories and dispersion modeling. Impacts to air quality from mining the LBA tracts included in this analysis can be inferred from the impact demonstrations for currently permitted mining in the vicinity. Impacts would primarily result from emissions of particulates and NO₂. As discussed in Section 3.5.3, there are numerous activities in and around the LBA tracts that produce particulates and NO₂.

Particulates include solid particles and liquid droplets that can be suspended in air. Section 3.5.4 describes historical regional and site-specific particulate levels. Particulates, especially fine particles, have been linked to numerous respiratory-related illnesses and can adversely affect individuals with pre-existing heart or lung disease. They are also a major cause of visibility impairment in many parts of the United States. While individual particles cannot be seen with the naked eye, collectively they can appear as black soot, dust clouds, or gray hazes. Impacts to the particulate annual ambient air quality standard are discussed separately for each LBA tract in the following sections.

NO₂ is a product of incomplete combustion at sources such as gasoline and diesel burning engines

or from mine blasting activities. Gaseous NO₂ is reddish-brown, heavier than air and has a pungent odor. It is highly reactive and combines with water to form nitric acid and nitric oxide. "Nitrogen dioxide gas may cause significant toxicity because of its ability to form nitric acid with water in the eye, lung, mucous membranes, and skin" (EPA 2001). Acute exposure may cause death by damaging the pulmonary system. "Chronic or repeated exposure to lower concentrations of NO₂ may exacerbate pre-existing respiratory conditions, or increase the incidence of respiratory infections" (EPA 2001). Impacts to the NO₂ annual ambient air quality standard are discussed separately for each LBA tract in the following sections.

There is no NAAQS for NO₂ for periods shorter than one year. Concern that there may be a health risk associated with short-term exposure to NO₂ from blasting emissions prompted a study conducted in August 1999 and completed in April 2000 by the WMA with participation from the WDEQ/LQD and WDEQ/AQD.

The study involved collection of 15-minute average NO₂ concentrations in areas accessible to the public near PRB coal mining operations. It was designed to help evaluate possible exposure of the public to NO₂ emissions resulting from blasting activity at surface coal mines. Six monitor locations were selected "...based on their proximity to mining activity and accessibility to the public. Roads adjacent to mining activity were felt to be areas where the public exposure would most likely

occur. Locations were also chosen based on dominant wind direction, and to represent areas having the greatest chance of being impacted by several mining operations” (WMA 2000).

The report presents ambient NO₂ concentrations in the vicinity of the mines, associated blasting information, meteorological data as well as why certain decisions were made in the design of the study. A brief summary of the findings follows.

- Approximately 95 percent of the valid data points were readings of 0 ppm (0 µg/m³) NO₂.
- The maximum 15-minute average valid values observed for each of the six monitors ranged from 0 to 1.65 ppm (0-3,102 µg/m³) NO₂.
- Where readings greater than 0 ppm did occur there was a strong correlation between NO₂ readings and temperatures. This correlation indicates that the NO₂ readings may have been inflated due to temperature considerations.

NIOSH, OSHA, and EPA short-term exposure criteria help put these numbers into perspective. NIOSH’s recommended Immediately Dangerous to Life and Health level is 20 ppm (37,600 µg/m³). OSHA’s Short-Term Exposure Limit, a 15-minute time-weighted average, is five ppm (9,400 µg/m³). The EPA Significant Harm Level, a one-hour average, is two ppm (3,760 µg/m³).

However, according to EPA “...the exact concentrations at which NO₂ will cause various health effects cannot be predicted with complete accuracy because the effects are a function of air concentration and time of exposure, and precise measurements have not been made in association with human toxicity. The information that is available from human exposures also suggests that there is some variation in individual response” (EPA 2001).

In conclusion:

- NO₂ is being actively monitored in the PRB and reported for compliance with the NAAQS annual standard;
- Monitored NO₂ levels are below the NAAQS annual standard; and
- Short-term NO₂ monitoring in areas of public exposure show levels below NIOSH, OSHA, and EPA’s short-term exposure criteria.

There are no state or federal rules that state the public or employees must stay back a certain distance from mine blasting operations in order to limit their exposure to NO₂. Pursuant to an order by the WDEQ, a study was developed to assist the WDEQ establish a safe setback distance from blasting operations at PRB mines. The study, co-sponsored by all of the coal mining companies in the PRB, was overseen and compiled by McVehil-Monnett Associates, Inc. of Englewood, Colorado. The analysis was released in July 2002 and it was based on the results of 76 mine blasts fully measured by TBCC at the Black

Thunder Mine over a 14-month period of time. A formula was developed to calculate safe setback distances for varying amounts of explosives, wind speeds, and type of blast (coal, overburden conventional, or overburden cast). According to the study, a minimum setback distance of 750 feet (coal) to 1,000 feet (overburden) will protect the public from exposure to NO₂ (The Sheridan Press 2002).

This analysis also included a toxicological study by Dr. Edward Faeder, consultant to TBCC on human health impacts from short-term exposure to NO₂. In reviewing this study, EPA expressed significant concern with this report (EPA 2002b). According to EPA's review, Dr. Faeder's report recommends that a 10-minute exposure to a level of five ppm would be "protective of even sensitive subsets of the normal population if the exposure frequency is one to three times a year," while EPA's professional judgment is that "if a concentration of 0.5 ppm were not exceeded, healthy persons would not experience adverse health effects and the most sensitive persons would probably not experience adverse health effects from NO₂". The Wyoming Environmental Quality Council has recently been considering the issue of safe setback distances from blasting operations at surface coal mines (Casper Star Tribune, October 23, 2002).

As discussed in Section 3.5.7, PSD is not an issue to coal mining. However, BLM evaluates such issues for leasing. Regional air quality impacts for this EIS are evaluated under cumulative impacts (Section 4.5.4).

4.1.4.2 NARO North and South LBA Tracts

Air Quality Impacts from Currently Permitted Operations

WDEQ/AQD issued air quality permit MD-657 for the North Antelope/Rochelle Complex on August 14, 2001. This air quality permit reflects analyses based on a maximum coal production of 105 mmtpy. Material movement utilizes draglines, shovels, and trucks in overburden, and shovels, trucks, and conveyors in coal.

Particulate emission inventories for the mining activities at North Antelope/Rochelle Complex were prepared for all years in the currently anticipated life of the mine. Two years, 2001 and 2006, were then selected for worst-case dispersion modeling of PM₁₀. Dispersion modeling was performed for projected mining at North Antelope/Rochelle Complex using the FDM for area and line sources and the ISCLT3 Model for point sources. In accordance with WDEQ policy for modeling coal mining impacts, a PM₁₀ concentration of 15 µg/m³ was added to all modeled emissions to account for background fugitive dust. The resulting particulate levels were then compared to the average annual PM₁₀ standard of 50 µg/m³ to determine compliance with the annual NAAQS. This constitutes a demonstration of compliance with the "long-term" or annual NAAQS.

Long-term modeling indicated the currently projected mine activities would be in compliance with the annual PM₁₀ ambient air standard for

the currently anticipated life of the mine, at the proposed production rates. The highest PM₁₀ level modeled in 2001 was 38.53 µg/m³. In that year, the annual coal tonnage level was only 77 million tons but the pits were all in close proximity and close to the northern ambient air boundary. In 2006 the annual coal production was the maximum permitted production level of 105 million tons. This year showed the highest particulate level in the emission inventory. The dispersion model showed a maximum concentration of 49.94 µg/m³ for 2006. The locations of the maximum-modeled PM₁₀ concentrations are shown on Figures 4-1 and 4-2.

In Wyoming, monitoring results have been used in lieu of short-term (24-hour) modeling for assessing short-term coal mining-related impacts in the PRB. WDEQ has chosen this procedure in accordance with an agreement between EPA and the State. That agreement recognizes that appropriate models do not exist to accurately predict 24-hour impacts.

The validity of using this permit analysis for predicting impacts from the LBA tracts can be established by a comparison with current conditions at the mine. There have been no exceedances of the PM₁₀ 24-hour NAAQS at North Antelope/Rochelle Complex through 2001. It is unlikely that North Antelope/Rochelle Complex has had a large contribution (> one µg/m³) to the recent exceedances experienced at other mines. They are complying with the increased monitoring frequency and cooperating with WDEQ/AQD to try

to determine the causes of PM₁₀ 24-hour exceedances at other locations. BACT measures being utilized to control particulate emissions at North Antelope/Rochelle Complex are described in Section 3.5 of this document.

As discussed in Section 3.5, NO₂ is produced by some of the emission-producing activities in the vicinity of the LBA tracts. North Antelope/Rochelle Complex was not required to conduct NO₂ dispersion modeling in their most recent permit. This is because WDEQ determined in 1997 that NO₂ levels in the PRB do not threaten the ambient air standard. However, North Antelope/Rochelle Complex is participating in the regional NO₂ monitoring network. NO₂ monitoring results through 1996 are shown on Table 3-3 and the 2001 monitoring results are given in Table 3-4. Monitoring results for 1997 through 2001 are available through WDEQ/AQD. The agency is relying on those monitoring data and emission inventories in permit applications to demonstrate compliance with the annual NO₂ ambient air standard (Table 3-1).

Section 4.1.4.1 provides a discussion of short-term NO₂ concentrations in areas of public exposure. There is no NAAQS that regulates short-term NO₂ levels. There have been no reported events of public exposure to NO₂ from blasting activities at the North Antelope/Rochelle Complex through 2001. The mine has, however, employed measures to control/limit public exposure to intermittent, short-term (blasting) releases as

Figure 4-1

Figure 4-2

discussed in Section 3.5 of this document.

Air Quality Impacts from Proposed Action and Alternatives

The impacts to air quality from mining the NARO North and South LBA Tracts have been inferred from the impacts at the currently permitted mining operation. Twenty-four-hour impacts have been estimated from recent monitoring and emission control activities. This section deals with how the air quality impacts of mining the LBA tracts as proposed would differ from the currently permitted impacts of mining the existing leases at the North Antelope Rochelle Complex. There have been no exceedances of the 24-hour or annual ambient air standards at the North Antelope/Rochelle Complex through 2001. None are expected from mining the LBA tracts, as discussed below.

The NARO North and South LBA Tracts would be mined as an integral part of the North Antelope/Rochelle Complex. The impacts to air quality under the No Action Alternative would be the same as those currently permitted. The impacts to air quality under the Proposed Action, Alternative 2, or Alternative 3 would be expected to increase. Coal production without the NARO North and NARO South LBA Tracts is projected to average around 75 mmtpy. With the NARO North and NARO South LBA Tracts, coal production is anticipated to average around 90 mmtpy. Coal thickness in the LBA tracts is similar to the current lease areas, however, the average overburden thickness in the

LBA tracts is greater (approximately 10 percent) than within the current lease. As a result, an increase in emissions is anticipated from increased production, increased overburden movement, and increased blast frequency. The overburden haul distance and related emissions are not expected to change, however, the coal haul lengths would be anticipated to increase as mining progresses farther from crushing facilities, resulting in a corresponding increase in coal haulage emissions. Material movement would continue to utilize draglines, shovels, and trucks in overburden and shovels and trucks in coal. Near-pit crushers and overland conveyors would continue to be utilized resulting in reduced coal haulage emissions. A facilities expansion is planned according to the current air quality permit, however, expansion of the facilities is not dependent on acquisition of the LBA tracts. There are no plans to change blasting procedures or blast sizes if the LBA tracts are leased and mined. Current BACT measures for particulates and for NO₂ would continue to be employed.

The additional coal from the LBA tracts would allow mining operations to continue for a longer period of time, ranging from two to 4.5 additional years depending upon the action alternative that is selected.

In summary, increases in emissions from current levels are expected if the NARO North and South LBA Tracts are mined; however, air quality impacts from mining the NARO North and South LBA Tracts by the applicant should be within daily and annual NAAQS limits. Modeling for

the current North Antelope/Rochelle Complex permit predicted no exceedances of the annual PM₁₀ NAAQS at a 105 mmtpy production rate and there have been no exceedances of the 24-hour PM₁₀ NAAQS. The anticipated average coal production levels of 90 mmtpy are below the currently permitted levels, which were used in the modeling.

4.1.4.3 Little Thunder LBA Tract

Air Quality Impacts from Currently Permitted Operations

WDEQ/AQD issued air quality permit MD-417 for the Black Thunder Mine on July 1, 1999. This air quality permit reflects analyses based on a maximum coal production of 100 mmtpy as well as permitted production from neighboring mines and permitted sources in close proximity to the mine. Material movement utilizes draglines, shovels and trucks in overburden, and shovels, trucks, and conveyors in coal.

Particulate emission inventories for the mining activities at Black Thunder Mine were prepared for all years in the currently anticipated life of the mine. Two years, 2002 and 2026, were then selected for worst-case dispersion modeling of PM₁₀. Dispersion modeling was performed for projected mining at Black Thunder Mine and emissions from other existing and permitted sources in the area including North Rochelle and Jacobs Ranch Mines, Two Elk power generating station and the ENCOAL Liquids from Coal and power generating facility. Area and line sources were modeled using the FDM

and the ISCLT3 Model was used for point surfaces. In accordance with WDEQ policy for modeling coal mining impacts, a PM₁₀ concentration of 15 µg/m³ was added to all modeled emissions to account for background fugitive dust. The resulting particulate levels were then compared to the average annual PM₁₀ standard of 50 µg/m³ to determine compliance with the annual NAAQS. This constitutes a demonstration of compliance with the “long-term” or annual NAAQS.

The long-term modeling indicated that currently projected mining activities, in conjunction with other existing and permitted activities in the area, would be in compliance with the annual PM₁₀ ambient air standard for the life of the mine. Year 2002 was expected to have the highest combined impacts from all three mines, largely due to the close proximity of Black Thunder Mine’s North and West pits and Jacob Ranch Mine’s pit to the respective ambient air boundaries. The highest PM₁₀ level modeled in 2002 was 34.96 µg/m³. Year 2026 was selected as the second year for dispersion modeling. Particulate emissions in this year were the highest in the emission inventory and Black Thunder’s mining activity was near the ambient air boundary. The annual coal production was also at the maximum permitted production level of 100 million tons. The dispersion model showed a maximum concentration of 34.58 µg/m³ for 2026. The locations of the maximum-modeled PM₁₀ concentrations are shown on Figures 4-3 and 4-4.

Figure 4-3

Figure 4-4

In Wyoming, monitoring results have been used in lieu of short-term (24-hour) modeling for assessing short-term coal mining-related impacts in the PRB. WDEQ has chosen this procedure in accordance with an agreement between EPA and the State. That agreement recognizes that appropriate models do not exist to accurately predict 24-hour impacts.

The validity of using this permit analysis for predicting impacts from the LBA tract can be established by a comparison with current conditions at the mine. There were no exceedances of the PM₁₀ 24-hour NAAQS at Black Thunder Mine through 2001. During 2002 there was one exceedance of the PM₁₀ 24-hour NAAQS at one of the Black Thunder Mine's air quality monitoring sites. This exceedance occurred during a period when winds reached at least 25 mph for a one-hour period. The exceedance may be the result of increased background dust levels combined with specific mine activities during high wind conditions. In addition to the BACT measures discussed in Section 3.5 of this document, the mine has increased its monitoring frequency and has worked with WDEQ/AQD to develop and implement plans to reduce emissions on high wind days. Actions that the mine is implementing include elimination of unnecessary roads, periodic application of magnesium chloride and surfactants to roads, reducing the dump height of the draglines, and increasing efforts for timely reclamation of disturbed areas. The one exceedance of the PM₁₀ 24-hour standard did not constitute a violation of the NAAQS.

A violation would require a second exceedance in one year. There have been no exceedances of the PM₁₀ annual NAAQS.

As discussed in Section 3.5, NO₂ is produced by some of the emission-producing activities in the vicinity of the LBA tract. Black Thunder Mine was not required to conduct NO₂ dispersion modeling in their most recent permit. This is because WDEQ determined in 1997 that NO₂ levels in the PRB do not threaten the ambient standard. However, Black Thunder Mine is participating in the regional NO₂ monitoring network. NO₂ monitoring results through 1996 are shown on Table 3-3 and the 2001 monitoring results are shown in Table 3-4. Monitoring results for 1997 through 2001 are available through WDEQ/AQD. The agency is relying on those monitoring data and emission inventories in permit applications to demonstrate compliance with the annual NO₂ ambient air standard (Table 3-1).

Section 4.1.4.1 provides a discussion of short-term NO₂ concentrations in areas of public exposure. There is no NAAQS that regulates short-term NO₂ levels. Black Thunder Mine received several reports of public exposure to NO₂ from blasting prior to 2001. Measures were developed to control/limit public exposure to intermittent, short-term (blasting) releases as discussed in Section 3.5. Black Thunder Mine has also experimented with procedures and materials designed to reduce the production of NO₂ from blasting. No reports of public exposure to NO₂ have been received since early 2001.

Air Quality Impacts from Proposed Action and Alternatives

The annual impacts to air quality from mining the Little Thunder LBA Tract have been inferred from the modeled impacts at the currently permitted mining operation. Twenty-four-hour impacts have been estimated from recent monitoring and emission control activities. This section deals with how the air quality impacts of mining the LBA tract differ from the currently permitted impacts of mining the existing coal leases at the Black Thunder Mine. One 24-hour PM_{10} exceedance has occurred and Black Thunder Mine is investigating the exceedance of the 24-hour standard in cooperation with the WDEQ/AQD and remedies are being developed and implemented. These are expected to reduce emissions from the mine to within the 24-hour NAAQS limit. There have been no exceedances of the annual PM_{10} standard, and none are expected from mining the LBA tract, as discussed below.

Recent meteorology could be a significant contributor to the 24-hour exceedance that was measured at one of the Black Thunder Mine's air quality monitoring sites in 2002. Three years of drought conditions coupled with stronger winds may be transporting more dust from upwind sources, resulting in a higher background dust level than in more normal meteorological conditions. The meteorology for the period December 2001 through February 2002 shows abnormally high average wind speeds at the neighboring North Rochelle Mine. During this period, average wind speeds were nearly 50

percent and 35 percent higher than the same period in the previous two years when average speeds of 10.0 and 12.23 mph, respectively, were recorded. It is very likely that a similar increase in wind speeds has been experienced at the Black Thunder Mine.

The No Action Alternative is identical to the currently permitted operation; therefore, the impacts to air quality under Alternative 1 would be the same as those currently permitted. The Proposed Action, Alternative 2, and Alternative 3 all involve mining the LBA tract as an integral part of the Black Thunder Mine. The only differences between the Alternatives are in size of the lease area and timing of lease sales/mining.

If the Little Thunder LBA Tract is mined as proposed under the Proposed Action and Alternatives 2 and 3, a net increase in total emissions of particulates and NO_2 as compared to the currently permitted operation would be expected. Maximum coal production is anticipated to be 68.5 mmtpy regardless of whether or not the Little Thunder LBA Tract is acquired. Emissions from the coal extraction-related processes should actually decrease on an annual basis although they would be extended for an additional eight to 10.7 years. The decrease would occur because as the coal seam thickness increases in the LBA tract, the operation would advance through the property more slowly. This would decrease the acres disturbed annually, cause coal haul distances to increase more slowly, and require fewer blasts per ton of coal extracted. However, the

increasing overburden-to-coal ratio of the LBA tract is expected to more than offset these decreases. With a 46 percent increase in overburden thickness, overburden extraction and haulage would generate more emissions per ton of coal mined than are modeled in the current permit.

Coal removal would continue to be performed with shovels and trucks. Additional near-pit crusher and conveyor systems would be constructed if the LBA tract is acquired. This would serve to keep coal haul distances similar to haul distances without the LBA tract. The overburden haul distance and related emissions are not expected to change because the method of mining would not change. Overburden movement would continue to utilize draglines, shovels, and trucks. There are no plans to change blasting procedures or blast sizes associated with the mining of this LBA tract. In addition, current BACT measures for particulates and for NO₂ would continue to be employed.

In summary, emissions associated with mining the Little Thunder LBA Tract are expected to increase over those modeled in the current air permit. Black Thunder Mine in conjunction with WDEQ/AQD is developing improvements in emission control activities to remedy current elevated levels of emissions. The mine anticipates that these improvements in emission control activities would allow permitting the LBA tract at a maximum production of 100 mmtpy. In the event that compliance cannot be demonstrated in a permit for 100 mmtpy, a lower annual production rate and/or

further expansion of emission control activities at the mine would have to be evaluated for compliance prior to approval of mining operations on the Little Thunder LBA Tract.

4.1.4.4 West Roundup LBA Tract

Air Quality Impacts from Currently Permitted Operations

WDEQ/AQD issued air quality permit MD-454 for the North Rochelle Mine on May 5, 2000. This air quality permit reflects analyses based on a maximum coal production of 35 mmtpy as well as permitted production from neighboring mines and permitted sources in close proximity to the mine. Material movement utilizes draglines, shovels and trucks in overburden, and shovels, trucks, and conveyors in coal.

Particulate emission inventories for the mining activities at North Rochelle Mine were prepared for all years in the currently anticipated life of the mine. Two years, 2002 and 2012, were then selected for worst-case dispersion modeling of PM₁₀. Dispersion modeling was performed for projected mining at North Rochelle Mine and emissions from other existing and permitted sources in the area including Black Thunder and Jacobs Ranch Mines, Two Elk power generating station, and the ENCOAL Liquids from Coal and power generating facility. Area and line sources were modeled using the FDM and the ISCLT3 Model was used for point sources. In accordance with WDEQ policy for modeling coal mining impacts, a PM₁₀ concentration of 15 µg/m³ was added to all modeled

emissions to account for background fugitive dust. The resulting particulate levels were then compared to the average annual PM_{10} standard of $50 \mu\text{g}/\text{m}^3$ to determine compliance with the annual NAAQS. This constitutes a demonstration of compliance with the “long-term” or annual NAAQS.

The long-term modeling indicated that currently projected mining activities, in conjunction with other existing and permitted activities in the area, would be in compliance with the annual PM_{10} ambient air standard for the life of the mine. Year 2002 was expected to have the highest combined impacts from all three mines, largely due to the close proximity of Black Thunder Mine’s South Pit and North Rochelle Mine’s Pit 1. The highest PM_{10} level modeled in 2002 was $33.9 \mu\text{g}/\text{m}^3$. Year 2012 was selected as the second year for dispersion modeling. Particulate emissions in this year were nearly identical to the peak year (2005) in the emission inventory and North Rochelle’s mining activity was near the ambient air boundary. The annual coal production was also at the maximum permitted production level of 35 million tons. The dispersion model showed a maximum concentration of $42.7 \mu\text{g}/\text{m}^3$ for 2012. The locations of the maximum-modeled PM_{10} concentrations are shown on Figures 4-5 and 4-6.

In Wyoming, monitoring results have been used in lieu of short-term (24-hour) modeling for assessing short-term coal mining-related impacts in the PRB. WDEQ has chosen this procedure in accordance with an agreement between EPA and the

State. That agreement recognizes that appropriate models do not exist to accurately predict 24-hour impacts.

The validity of using this permit analysis for predicting impacts from the LBA tract can be established by a comparison with current conditions at the mine. There were no exceedances of the PM_{10} 24-hour NAAQS at North Rochelle Mine through 2000. During 2001 and early 2002, there have been a total of 10 exceedances of the PM_{10} 24-hour NAAQS at North Rochelle Mine’s air quality monitoring sites. All of these exceedances occurred during periods when winds reached at least 25 mph for a one-hour period.

Two of these exceedances appear to be directly related to dust generated from an unpaved county road that was relocated to within 500 ft of one of the monitors. Because the road relocation occurred after the monitor was in place, the WDEQ/AQD has requested that a new monitor location be developed further from the road. In addition, the mine has treated the road with chemical stabilizers to reduce dust.

The remaining exceedances appear to be the result of increased background dust levels and mine site wind erosion during high wind conditions. In addition to the BACT measures discussed in Section 3.5, the mine has increased its monitoring frequency and has worked with WDEQ/AQD to develop an ongoing compliance plan for controlling particulates. Part of the compliance plan involves determining the causes of the exceedances and possible

Figure 4-5

Figure 4-6

solutions. Specific measures implemented at the North Rochelle Mine so far include chemical stabilization of disturbed ground, surface roughening through creation of windrows, and mulching and crimping activities. These measures are being implemented on disturbed acres susceptible to wind scouring including stockpiles, areas stripped for mine advance, and areas being brought to final grade. In addition, the mine is inter-seeding areas where the recent drought has hindered revegetation success.

As discussed in Section 3.5 of this document, NO₂ is produced by some of the emission-producing activities in the vicinity of the LBA tract. North Rochelle Mine was not required to conduct NO₂ dispersion modeling in their most recent permit. This is because WDEQ determined in 1997 that NO₂ levels in the PRB do not threaten the ambient standard. However, North Rochelle Mine is participating in the regional NO₂ monitoring network. NO₂ monitoring results through 1996 are shown on Table 3-3 and the 2001 monitoring results are given in Table 3-4. Monitoring results for 1997 through 2001 are available through WDEQ/AQD. The agency is relying on those monitoring data and emission inventories in permit applications to demonstrate compliance with the annual NO₂ ambient air standard (Table 3-1).

Section 4.1.4.1 provides a discussion of short-term NO₂ concentrations in areas of public exposure. There is no NAAQS that regulated short-term NO₂ levels. There have been no reported events of public exposure to NO₂ from

blasting activities at the North Rochelle Mine through 2001. The mine has, however, employed measures to control/limit public exposure to intermittent, short-term (blasting) releases as discussed in Section 3.5.

Air Quality Impacts from Proposed Action and Alternatives

The annual impacts to air quality from mining the West Roundup LBA Tract have been inferred from the modeled impacts at the currently permitted mining operation. Twenty-four-hour impacts have been estimated from recent monitoring and emission control activities. Several 24-hour PM₁₀ exceedances have occurred and North Rochelle Mine is investigating exceedances of the 24-hour standard in cooperation with the WDEQ/AQD and remedies are being developed and implemented. These are expected to reduce emissions from the mine to within the 24-hour NAAQS limit. There have been no exceedances of the annual PM₁₀ standard, and none are expected from mining the LBA tract, as discussed below.

Recent meteorology could be a significant contributor to the 24-hour exceedances experienced. Three years of drought conditions coupled with stronger winds may be transporting more dust from upwind sources, resulting in a higher background dust level than in more normal meteorological conditions. The meteorology for the period December 2001 through February 2002 shows abnormally high average wind speeds. During this period, average wind speeds of 16.4 mph

were recorded at the North Rochelle Mine meteorological site. This is nearly 50 percent and 35 percent higher than the same period in the previous two years when average speeds of 10.0 and 12.23 mph, respectively, were recorded.

The No Action Alternative is identical to the currently permitted operation; therefore, the impacts to air quality under Alternative 1 would be the same as those currently permitted. The Proposed Action, Alternative 2, and Alternative 3 all involve mining the LBA tract as an integral part of the North Rochelle Mine. The only differences are in size of the lease area.

The Proposed Action and Alternatives 2 and 3 are expected to result in a net increase in total emissions of particulates and NO₂ as compared to the currently permitted operation. Coal production is anticipated to be approximately 35 mmtpy regardless of whether or not the West Roundup LBA Tract is acquired. Emissions from the coal extraction-related processes should actually decrease on an annual basis although they would be extended for an additional 4.5 to 6.7 years. The decrease would occur because as the coal seam thickness increases in the LBA tract, the operation would advance through the property more slowly. This would decrease the acres disturbed annually, cause coal haul distances to increase more slowly, and require fewer blasts per ton of coal extracted. However, the increasing overburden-to-coal ratio of the LBA tract is expected to more than offset these decreases. With a nearly 50 percent increase in overburden thickness,

overburden extraction and haulage would generate more emissions per ton of coal mined than are modeled in the current permit.

The overburden haul distance and related emissions are not expected to change. Material movement would continue to utilize draglines, shovels and trucks in overburden, and shovels and trucks in coal. Near-pit crushers and overland conveyors would continue to be utilized resulting in reduced coal haulage emissions. There are no plans to change blasting procedures or blast sizes associated with the mining of this LBA tract. In addition, current BACT measures for particulates and for NO₂ would continue to be employed.

In summary, emissions associated with mining the West Roundup LBA Tract are expected to increase over those modeled in the current air permit. North Rochelle Mine in conjunction with WDEQ/AQD is developing improvements in emission control activities to remedy current elevated levels of emissions. These improvements may not be enough to allow permitting the LBA tract at a maximum production of 35 mmtpy. It is likely, however, that a permit can be obtained with a lower annual production rate and/or further expansion of emission control activities at the mine.

4.1.4.5 West Antelope LBA Tract

Air Quality Impacts from Currently Permitted Operations

WDEQ/AQD issued air quality permit MD-616 for the Antelope Mine on

April 30, 2001. This air quality permit reflects analyses based on a maximum coal production of 32 mmtpy. Material movement utilizes draglines, shovels and trucks in overburden, and shovels, trucks, and conveyors in coal.

Particulate emission inventories for the mining activities at Antelope Mine were prepared for all years in the currently anticipated life of the mine. Two years, 2006 and 2016, were then selected for worst-case dispersion modeling of PM_{10} . Dispersion modeling was performed for projected mining at Antelope Mine. Area and line sources were modeled using the FDM and the ISCLT3 Model was used for point sources. In accordance with WDEQ policy for modeling coal mining impacts, a PM_{10} concentration of $15 \mu\text{g}/\text{m}^3$ was added to all modeled emissions to account for background fugitive dust. The resulting particulate levels were then compared to the average annual PM_{10} standard of $50 \mu\text{g}/\text{m}^3$ to determine compliance with the annual NAAQS. This constitutes a demonstration of compliance with the “long-term” or annual NAAQS.

Long-term modeling indicated the currently projected mine activities will be in compliance with the annual PM_{10} ambient air standard for the life of the mine. The worst-case years were selected on having the highest PM_{10} emissions in the emissions inventory. The dispersion model showed a maximum concentration of $47.3 \mu\text{g}/\text{m}^3$ in 2006 and $49.2 \mu\text{g}/\text{m}^3$ in 2016. Coal production in both years was the maximum permitted production level of 32 million tons. The locations of the maximum-

modeled PM_{10} concentrations are shown on Figures 4-7 and 4-8.

In Wyoming, monitoring results have been used in lieu of short-term (24-hour) modeling for assessing short-term coal mining-related impacts in the PRB. WDEQ has chosen this procedure in accordance with an agreement between EPA and the State. That agreement recognizes that appropriate models do not exist to accurately predict 24-hour impacts.

The validity of using this permit analysis for predicting impacts from the LBA tract can be established by a comparison with current conditions at the mine. There have been no exceedances of the PM_{10} 24-hour NAAQS at Antelope Mine through 2001. It is unlikely that operations at the Antelope Mine have made a major contribution ($> \text{one } \mu\text{g}/\text{m}^3$) to the recent exceedances experienced at other mines in the General Analysis Area. However, they are complying with the increased monitoring frequency and cooperating with WDEQ/AQD to try to determine the causes of PM_{10} 24-hour exceedances at other locations. BACT measures being utilized to control particulate emissions at Antelope Mine are described in Section 3.5 of this document.

As discussed in Section 3.5, NO_2 is produced by some of the emission-producing activities in the vicinity of the LBA tract. Antelope Mine was not required to conduct NO_2 dispersion modeling in their most recent permit. This is because WDEQ determined in 1997 that NO_2 levels in the PRB do not threaten the ambient air

Figure 4-7

Figure 4-8

standard. However, Antelope Mine is participating in the regional NO₂ monitoring network. NO₂ monitoring results through 1996 are shown on Table 3-3 and the 2001 monitoring results are given in Table 3-4. Monitoring results for 1997 through 2001 are available through WDEQ/AQD. The agency is relying on those monitoring data and emission inventories in permit applications to demonstrate compliance with the annual NO₂ ambient air standard (Table 3-1).

Section 4.1.4.1 provides a discussion of short-term NO₂ concentrations in areas of public exposure. There is no NAAQS that regulates short-term NO₂ levels. There have been no reported events of public exposure to NO₂ from blasting activities at the Antelope Mine through 2001. The mine has, however, employed measures to control/limit public exposure to intermittent, short-term (blasting) releases as discussed in Section 3.5 of this document.

Air Quality Impacts from Proposed Action and Alternatives

The impacts to air quality from mining the West Antelope LBA Tract have been inferred from the impacts at the currently permitted mining operation. Twenty-four-hour impacts have been estimated from recent monitoring and emission control activities. This section deals with how the air quality impacts of mining the LBA tract differ from the currently permitted impacts. There have been no exceedances of the 24-hour or annual ambient air standards at the Antelope Mine through 2001. None

are expected from mining the LBA tract as discussed below.

The West Antelope LBA Tract would be mined as an integral part of the Antelope Mine. The impacts to air quality under the No Action Alternative would be the same as those currently permitted. The impacts to air quality under the Proposed Action or Alternative 2 or 3 are described below. Coal production is anticipated to increase to a maximum rate of 32 mmtpy, then fall off during the mine's later years with or without the West Antelope LBA Tract. If the mine acquires the additional coal in the LBA tract, they would produce at a rate of 32 mmtpy for a longer period of time but the life of mine would not be extended. As a result, the increased emissions due to coal and overburden removal operations (i.e., haulage, blasting, etc.) at the 32 mmtpy production rate would occur for a longer period of time than is shown in the current approved air quality permit. The overburden haul distance and related emissions are not expected to change, however, the average overburden thickness in the LBA tract is greater than within the current lease (approximately a 12 percent increase). Thus, an increase in emissions would be anticipated from increased overburden movement and blast frequency. This may be moderated somewhat because the coal thickness in the LBA tract is somewhat greater than in the current lease areas. This would decrease the acres disturbed annually, cause coal haul distances to increase more slowly, and require fewer blasts per ton of coal extracted.

Material movement would continue to utilize draglines, shovels, and trucks in overburden, and shovels and trucks in coal. Near-pit crushers and overland conveyors would continue to be utilized resulting in reduced coal haulage emissions. Facilities shown in the current air quality permit would not change as a result of proposed mining of the LBA tract. There are no plans to change blasting procedures or blast sizes associated with the mining of the LBA tract. In addition, current BACT measures for particulates and for NO₂ would continue to be employed.

In summary, if the Antelope Mine acquires and mines the West Antelope LBA Tract, increases in emissions from current levels are expected due to an increase in the time the mine would produce at a rate of 32 mmtpy and an increase in overburden thickness. The increases would be moderated somewhat by a slower rate of advance through the tract due to the greater coal thickness in the LBA tract. Modeling for the current Antelope Mine permit showed no exceedances of the annual PM₁₀ NAAQS at a 32 mmtpy production rate and there have been no exceedances of the 24-hour PM₁₀ NAAQS. Therefore, air quality impacts that result from mining the West Antelope LBA Tract by the applicant should also be within daily and annual NAAQS limits.

4.1.5 Water Resources

Surface Water

Changes in runoff characteristics and sediment discharges would occur during mining of each of the LBA

tracts as a result of the destruction and reconstruction of drainage channels as mining progresses. Erosion rates could be high on the disturbed areas because of vegetation removal. However, both state and federal regulations require that all surface runoff from mined lands be treated as necessary to meet effluent standards. Generally, the surface runoff sediment is deposited in ponds or other sediment control devices inside the permit area.

Since the LBA tracts would be mined as extensions of existing mines under the Proposed Actions or action alternatives, there would not be a major change in the size of area that is disturbed and not reclaimed at any given time as a result of leasing these tracts. WDEQ/LQD would also require monitoring programs to assure that ponds would always have adequate space reserved for sediment accumulation.

The presence of disturbed areas creates a potential that sediment produced by large storms (i.e., greater than the 10-year, 24-hour storm) could potentially adversely impact areas downstream of the mining operations. This potential for adverse downstream impacts would be extended if the LBA tracts are leased.

The loss of soil structure would act to increase runoff rates on the LBA tracts in reclaimed areas. However, the general decrease in average slope in reclaimed areas, as discussed in Section 4.1.1, would tend to counteract the potential for an increase in runoff. Soil structure would gradually reform over time, and vegetation (after successful

reclamation) would provide erosion protection from raindrop impact, retard surface flows, and control runoff at approximately premining levels.

After mining and reclamation are complete, surface water flow, quality, and sediment discharge from the LBA tracts would approximate premining conditions. The impacts described above would be similar for the Proposed Actions and action alternatives, and they are similar to the expected impacts for currently permitted mining operations. Direct and indirect impacts to the surface water system resulting from mining the five LBA tracts would add to the cumulative impacts that will occur due to mining existing leases. These impacts are discussed in Section 4.5.5. Following is a description of surface water impacts from the leasing and subsequent mining of each of the LBA tracts under the Proposed Action or Alternative 2 or 3.

NARO North and South LBA Tracts

The NARO North LBA Tract may encounter significant runoff in Porcupine Creek, which is ephemeral to intermittent in the vicinity of the tract. A section of Porcupine Creek is currently diverted around active pits in the North Antelope/Rochelle Complex. During mining, hydrologic control within the NARO North LBA Tract would likely consist of diverting Porcupine Creek around the tract and diverting its ephemeral tributaries or containing them in flood control reservoirs.

Due to its location in the headwater area of ephemeral Antelope Creek

tributaries, and due to the fact that much of the tract drains internally to a closed basin, runoff within the NARO South LBA Tract would not be expected to be significant. During mining, hydrologic control would most likely consist of allowing runoff to accrue to the mine pit, or to flood control reservoirs, where it would be treated and discharged according to the standards of WDEQ/WQD.

Little Thunder LBA Tract

The Little Thunder LBA Tract may encounter significant runoff in Little Thunder Creek and North Prong Little Thunder Creek. As such, hydrologic control during mining would most likely consist of containing these ephemeral draws in flood control reservoirs or diverting flows around active pits.

West Roundup LBA Tract

The West Roundup LBA Tract is located near the headwaters of Trussler Creek and Olson Draw, and runoff within the tract would not be expected to be significant. Hydrologic control during mining would most likely consist of containing these ephemeral draws in flood control reservoirs, diverting flows around active pits, or allowing runoff to accrue to the mine pit, where it would be treated and discharged according to the standards of WDEQ/WQD.

West Antelope LBA Tract

The West Antelope LBA Tract may encounter significant runoff in Spring Creek and Antelope Creek. According to ACC's West Antelope LBA Tract Lease Application (ACC 2000), ACC

would not plan to disturb Antelope Creek and buffer zone adjacent to Antelope Creek during mining, but would plan to divert a portion of Spring Creek around the open pit area if they acquire the tract.

Groundwater

Surface coal mining impacts the groundwater resource quantity in two ways: 1) the coal aquifers and any overburden aquifers are removed and replaced with unconsolidated backfill and 2) water levels in the coal and overburden aquifers adjacent to the mines are depressed as a result of seepage and dewatering into the open pits in the area of coal and overburden removal. If the NARO North, NARO South, Little Thunder, West Roundup, and West Antelope LBA Tracts are leased, the area of coal removal and reclamation would increase, and the area of impacts to groundwater quantity would increase. The area subject to lower water levels would be increased roughly in proportion to the increase in area affected by mining.

Mining each of the LBA tracts would remove shallow aquifers and replace the separate aquifer units with backfill composed of an unlayered mixture of the shale, siltstone, and sand that makes up the existing Wasatch Formation overburden and Fort Union Formation interburden. Impacts to the local groundwater systems resulting from mining each of the tracts would include completely dewatering the coal, overburden, and interburden within the area of coal removal, and enlarging the area of drawdown caused by coal and overburden removal. The extent that

drawdowns propagate away from the mine pits is a function of the water-bearing properties of the aquifer materials. In materials with high transmissivity and low storativity, drawdowns extend further from the pit face than in materials with lower transmissivity and higher storage. In general, due to the geologic makeup of the Wasatch Formation overburden (discontinuous lenticular sandstones in a matrix of siltstone and shale), overburden drawdowns do not extend great distances from the active mine pits (Hydro-Engineering 1997, 1998, 1999, 2000). Because of the regional continuity and higher transmissivity within the Wyodak coal seam, drawdowns propagate much further in the coal aquifer than in the overburden. Drawdowns in the coal seam are a function of distance from the pit as well as geologic and hydrologic barriers and boundaries such as crop lines, fracture zones, and recharge sources.

Some private permitted water wells will be impacted (either directly by removal of the well or indirectly by water level drawdown) by approved mining operations occurring at the applicant and adjacent mines and additional water wells would be likely to be affected if the LBA tracts are leased. In compliance with SMCRA and Wyoming regulations, mine operators are required to provide the owner of a water right whose water source is interrupted, discontinued, or diminished by mining with water of equivalent quantity and quality; this mitigation is thus part of the action alternatives. The most probable source of replacement water would be one of the aquifers underlying the coal. The subcoal Fort Union aquifers

are not removed or disturbed by coal mining, so they are not directly impacted by coal mining activity.

As part of the permitting process, the mine operator would be required to update the list of potentially impacted wells and predict impacts to these and other water-supply wells within the five-ft drawdown contour. The operator would be required to commit to replacing these water supplies with water of equivalent quality and quantity if they are affected by mining.

The hydraulic properties of the backfill aquifer reported in the adjacent mines' permit documents are comparable to the Wasatch Formation overburden and Wyodak coal. The data available indicate that the hydraulic conductivity of the backfill would be greater than or equal to premining coal values, suggesting that wells completed in the backfill would provide yields greater than or equal to premining coal wells.

Mining and reclamation also impacts groundwater quality; the TDS concentration in the water resaturating the backfill is generally higher than the TDS concentration in the groundwater before mining. This is due to the exposure of fresh overburden surfaces to groundwater that moves through the backfill. Research conducted by the Montana Bureau of Mines and Geology on the coal fields of the northern PRB (Van Voast and Reiten 1988) indicates that upon initial saturation, mine backfill is generally high in TDS and contains soluble salts of calcium, magnesium and sodium sulfates. As the backfill

is resaturated, the soluble salts are leached by groundwater inflow and TDS concentrations tend to decrease with time, indicating that the long term groundwater quality in mined and off-site lands would not be compromised (Van Voast and Reiten 1988).

Using data compiled from ten surface coal mines in the eastern PRB, Martin et al. (1988) concluded that backfill groundwater quality improves markedly after the backfill is leached with one pore volume of water. The same conclusions were reached by Van Voast and Reiten (1988) after analyzing data from the Decker and Colstrip Mine areas in the northern PRB. Postmining groundwaters are therefore expected to be of better quality after one pore volume of water moves through the backfill than what is observed in the backfill today. In general, the mine backfill groundwater TDS can be expected to range from 3,000 - 6,000 mg/L, similar to the premining Wasatch Formation aquifer, and meet Wyoming Class III standards for use as stock water.

Direct and indirect impacts to the groundwater system resulting from mining the five LBA tracts included in this analysis would add to the cumulative impacts that will occur due to mining existing leases. These impacts are discussed in Section 4.5.5. The probable groundwater impacts from the leasing and subsequent mining of each of the LBA tracts under the Proposed Action or Alternative 2 or 3 are described in the following paragraphs.

NARO North and South LBA Tracts

Mining the NARO North and NARO South LBA tracts would remove shallow aquifers on an additional 5,590 acres (Proposed Action configuration for NARO North and NARO South), 6,275 acres (Proposed Action configuration for NARO North and Alternative 2 configuration for NARO South), or 4,863 acres (Proposed Action configuration for NARO North and Alternative 3 configuration for NARO South) and replace the separate aquifer units with backfill composed of an unlayered mixture of the existing Wasatch Formation overburden and Fort Union Formation interburden.

Overburden monitor wells for the existing North Antelope/Rochelle Complex that were farther than 3,000 ft from the active pits recorded less than seven ft of drawdown from 1980 to 1999. No substantial water level changes were observed from 1999 to 2000 in 15 overburden wells monitored by the North Antelope/Rochelle Complex (Hydro-Engineering 2000). Monitoring of the existing mining operations has indicated that water level drawdowns have propagated much farther in the Wyodak coal seam aquifer than in the overburden. Coal drawdowns from 1980 to 1995 were generally in excess of five ft within four miles of the active pits at the North Antelope/Rochelle Complex (Hydro-Engineering 1996a). In 1999, PRCC monitored water levels in 37 monitor wells completed in the Wyodak coal seam and the maximum drawdown measured at that time was approximately 115 ft in a well located roughly 1,600 ft west of the active pit

(Hydro-Engineering 2000). The maximum drawdown measured in 2001 was 123 ft at a well located less than 500 ft west of the active pit (PRCC 2001). The extent and magnitude of drawdown in the coal seam aquifer have been greatest in the areas west and north of the mine. Drawdowns recorded in monitor wells located within one mile west of the active pit are generally between 50 to 100 ft. Water levels and maps showing drawdowns in the vicinity of the pit are included in the annual report for the North Antelope/Rochelle Complex which is sent to WDEQ/LQD each year.

PRCC used the MODFLOW model to predict the extent of water level drawdown in the Wyodak coal seam as a result of mining the existing leases at North Antelope/Rochelle Complex. The results of the groundwater modeling are reported in Appendix D6, Addendum D6-G of the North Antelope/Rochelle Complex 569-T5 permit document (PRCC 1999b). The predicted extent of drawdown (five ft contour) over the life of the mine if the NARO North and NARO South LBA Tracts are mined is shown on Figure 4-9. This prediction is approximate and based on extrapolation of PRCC's earlier predictions by extending the drawdowns westward and northward by the dimensions of the NARO North and South LBA Tracts. More precise predictions of the extent of drawdowns would be required in order to amend the NARO North and South LBA Tracts into the WDEQ/LQD permit area, if PRCC acquires the tracts.

Figure 4-9

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In November 2001, the Wyoming SEO records indicated a total of 539 permitted water wells are located within three miles of the NARO North LBA Tract and 615 permitted water wells are located within three miles of the NARO South LBA Tract. The majority (956) are owned by coal mining companies and are used for groundwater monitoring and water supply. The other 198 non mine-related wells are apportioned into the following use categories:

- 65 Monitoring and miscellaneous
- 64 livestock
- 32 livestock and CBM development
- 12 livestock and domestic
- 11 miscellaneous
- 4 industrial
- 4 CBM development
- 3 livestock, miscellaneous and CBM development
- 2 livestock and miscellaneous
- 1 livestock and irrigation

Three of these permitted water wells are located within the expanded five-

ft drawdown contour with completion depths that indicate they produce water from the Wyodak coal seam (this excludes wells constructed for monitoring, mine dewatering or CBM production). These wells are shown in Table 4-7. During the permitting process, the mine operator would be required to update the list of potentially impacted wells and predict impacts to these and other water-supply wells within the five-ft drawdown contour. The operator would be required to commit to replacing these water supplies with water of equivalent quality and quantity if they are affected by mining.

PRCC has three water supply wells completed in aquifers below the coal. If the LBA tracts are leased by the applicant, water would be produced from these wells for a longer period of time, but PRCC would not require additional sub-coal wells to mine the LBA tracts.

Groundwater quality within the backfill aquifer at the NARO North

Table 4-7. Water Supply Wells Possibly Subject to Drawdown if NARO North and South LBA Tracts are Mined.

SEO Permit Number	Applicant	Use	Yield (gpm)	Well Depth (ft)	Depth to Water (ft)
P25606P	Paul & Edith Ruth Wilkinson	Stock, Domestic	3	220	100
P12754P	USFS	Stock	4	122	unknown
P44330W	USFS	Stock	3	163	94

Note: Wells in this table are believed from their completion depths to be completed in the Wyodak coal seam, and are within the additional area of five ft or more drawdown caused by mining the NARO North and South LBA Tracts. Wells impacted by the No Action Alternative are already addressed in the state mine permit document.

and South LBA Tracts would be expected to be similar to groundwater quality measured in existing wells completed in the backfill at North Antelope/Rochelle Complex. To date, nine wells have been installed to monitor water levels and water quality in backfill at the North Antelope/Rochelle Complex. In October 1999, TDS concentrations in the nine monitoring wells ranged from 780 to 14,200 mg/L (Hydro-Engineering 2000) with a geometric mean of 3,070 mg/L. TDS concentrations observed in the North Antelope/Rochelle Complex backfill are generally higher than those found in the undisturbed Wasatch Formation overburden or Wyodak coal aquifers.

The hydraulic properties of the backfill aquifer at the NARO North and South LBA Tracts would be expected to be similar to the hydraulic properties measured in existing wells completed in the backfill at North Antelope/Rochelle Complex. The backfill aquifer has been tested at four wells, and the average hydraulic conductivity of 36 ft/day exceeds the average hydraulic conductivity (9.5 ft/day) reported for the Wyodak coal seam in the vicinity of the North Antelope/Rochelle Complex.

Little Thunder LBA Tract

Mining the LBA tract would remove shallow aquifers on an additional 5,424 acres (Proposed Action configuration), 6,577 acres (Alternative 2 configuration), 1,382 acres (Alternative 3, North tract configuration) or 4,018 acres (Alternative 3, South tract

configuration) and replace the separate aquifer units with backfill composed of an unlayered mixture of the existing Wasatch Formation overburden and Fort Union Formation interburden.

Overburden water levels have been monitored and recorded by Black Thunder Mine since 1980 at eleven monitor wells (Hydro-Engineering 2000). Data recorded during that period do not indicate mining has necessarily caused water levels in the overburden to be depressed in proportion to distance and direction from the active pits or in time since mining began. The maximum drawdown measured to date in the overburden is approximately 39 ft at a monitor well located about 0.5 miles west of the active pit. Impacts to overburden water levels recorded to date by other monitor wells located within 1.5 miles of the pit have ranged from a decrease of 19 ft to an increase of 30 ft, with some areas basically unchanged. Because of the varied nature of the aquifer units within the Wasatch Formation overburden, water level drawdowns are variable as well.

Water level drawdowns have propagated much farther and in a more consistent manner in the Wyodak coal seam aquifer than in the overburden. Coal drawdowns from 1980 to 1995 were generally in excess of five ft within five miles west and one mile north of the active pit at the Black Thunder Mine (Hydro-Engineering 1996a). Since 1995, coal monitor wells located over two miles west of the active pits recorded an increased rate of drawdown as a result of dewatering associated with

CBM production. Coal water levels recorded by monitor wells located between two and 4.5 miles west of the pit declined between 21 and 67 ft from 1995 to 1999. During that same time period, coal water levels less than two miles west of the active Black Thunder Mine pits declined between 10 and 28 ft. In 1999, TBCC monitored water levels in 10 monitor wells completed in the Wyodak coal seam and the maximum drawdown measured at that time was approximately 80 ft in a well located roughly three miles west the active pit (Hydro-Engineering 2000). Coal monitor wells within 0.5 mile west of the pit have recorded an overall decline of about 60 ft. Water levels and maps showing drawdowns in the vicinity of the pit are included in the annual report that the Black Thunder Mine submits to WDEQ/LQD each year.

TBCC used the MODFLOW model to predict the extent of water level drawdown in the Wyodak coal seam as a result of mining the existing leases at Black Thunder Mine. The results of the groundwater modeling which was updated in July 1999 to predict impacts associated with the development of the Thundercloud Amendment Area, are presented in Addendum MP-3.3.4 of the Black Thunder Mine 233-T6 permit document (TBCC 2000a). The predicted extent of drawdown (five ft contour) over the life of the mine if the Little Thunder LBA Tract is mined is shown on Figure 4-10. This prediction is approximate and based on extrapolation of TBCC's earlier predictions by extending the drawdowns westward and northward by the dimensions of the Little

Thunder LBA Tract. More precise predictions of the extent of drawdowns would be required in order to amend the Little Thunder LBA Tract into the WDEQ/LQD permit area, if ALC acquires the tract.

In November 2001, the Wyoming SEO records indicated a total of 634 permitted water wells are located within three miles of the Little Thunder LBA Tract. Of this total, 182 are owned by coal mining companies and are used for groundwater monitoring and water supply. The other 451 non mine-related wells are apportioned into the following use categories:

- 233 CBM development only
- 116 CBM development and livestock
- 38 monitoring and miscellaneous
- 37 livestock only
- 10 livestock and domestic
- 5 CBM development and miscellaneous
- 5 monitoring, livestock and miscellaneous
- 3 livestock, industrial and miscellaneous
- 2 reservoir supply and miscellaneous
- 2 CBM development, livestock and miscellaneous

Two of these permitted water wells are located within the expanded five-ft drawdown contour with completion depths that indicate they produce water from the Wyodak coal seam (this excludes wells constructed for monitoring, mine dewatering or CBM production). These wells are shown in Table 4-8. During the permitting process, the mine operator would be

Figure 4-10

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required to update the list of potentially impacted wells and predict impacts to these and other water-supply wells within the five-ft drawdown contour. The operator would be required to commit to replacing these water supplies with water of equivalent quality and quantity if they are affected by mining.

TBCC has two water supply wells completed in aquifers below the coal. If the LBA tract is lease by the applicant, water would be produced from these wells for a longer period of time, but TBCC would not require additional sub-coal wells to mine the LBA tract.

Groundwater quality within the backfill aquifer at the Little Thunder LBA Tract would be expected to be similar to groundwater quality measured in existing wells completed in the backfill at Black Thunder Mine. To date, six wells have been installed to monitor water levels and water quality in the backfill at Black Thunder Mine. In October 1999, TDS concentrations in five of the backfill monitoring wells (one well can not be

sampled due to a lack of saturation) ranged from 1,090 to 5,440 mg/L (Hydro-Engineering 2000) with a geometric mean of 2,140 mg/L. TDS concentrations observed in the Black Thunder Mine backfill are generally higher than those found in the undisturbed Wasatch Formation overburden or Wyodak coal aquifers.

The hydraulic properties of the backfill aquifer at the Little Thunder LBA Tract would be expected to be similar to the hydraulic properties measured in existing wells completed in the backfill at Black Thunder Mine. The hydraulic conductivities of 0.12 ft/day and 0.86 ft/day determined by testing two of the backfill wells are lower than the hydraulic conductivity (1.2 ft/day) reported for the Wyodak coal seam within the Little Thunder LBA Tract.

West Roundup LBA Tract

Mining the LBA tract would remove shallow aquifers on an additional 3,161 acres (Proposed Action configuration), 3,787 acres (Alternative 2 configuration), 3,943 acres (Alternative 2 plus lease WYW-

Table 4-8. Water Supply Wells Possibly Subject to Drawdown if Little Thunder LBA Tract is Mined.

SEO Permit Number	Applicant	Use	Yield (gpm)	Well Depth (ft)	Depth to Water (ft)
P13289P	Durham Meat Co.	Stock	unknown	108	66
P92738W	James R. & Irene Stuart	Stock	unknown	100	40

Note: Wells in this table are believed from their completion depths to be completed in the Wyodak coal seam, and are within the additional area of five ft or more drawdown caused by mining the Little Thunder LBA Tract. Wells impacted by the No Action Alternative are already addressed in the state mine permit document.

127221 modification configuration), 4,184 acres (Alternative 3 configuration), or 4,340 acres (Alternative 3 plus lease WYW-127221 modification configuration), and replace the separate aquifer units with backfill composed of an unlayered mixture of the existing Wasatch Formation overburden and Fort Union Formation interburden.

Overburden water levels have been monitored and recorded by North Rochelle Mine since 1981 at five monitor wells (Hydro-Engineering 2000). Data recorded during that period do not indicate mining has necessarily caused water levels in the overburden to be depressed in proportion to distance and direction unknown from the active pits or in time since mining began. The maximum drawdown measured to date in the overburden is approximately 14 ft at a monitor well located nearly one mile east of the active pit. Another overburden monitor well located approximately 1,500 ft west of the active pit has recorded an overall drawdown of 10 ft, 4.5 ft of that decline occurred from 1998 to 1999 (Hydro-Engineering 2000). No substantial water level changes were observed during 1998 to 1999 at the other three overburden wells monitored by TCC. Because of the varied nature of the aquifer units within the Wasatch Formation overburden, water level drawdowns are variable as well.

Water level drawdowns have propagated much farther and in a more consistent manner in the Wyodak coal seam aquifer than in the overburden. Coal drawdowns from 1980 to 1995 were generally in excess

of 20 ft within one mile of the active pit at North Rochelle Mine (Hydro-Engineering 1996a). TCC monitored water levels at five wells completed in the coal from 1980 to 1995. The mining operation then removed two coal wells, leaving three coal monitoring wells from 1995 to 1998. In 1999, TCC monitored and recorded water levels in two Wyodak coal wells after a third was removed by mining. From 1998 to 1999, the two remaining coal monitor wells recorded drawdowns of 8.08 and 29.99 ft and both wells are located approximately a half-mile west of the active pit (Hydro-Engineering 2000). Water levels and maps showing drawdowns in the vicinity of the pit are included in the annual report filed by the North Rochelle Mine with WDEQ/LQD each year.

TCC used the MODFLOW model to predict the extent of water level drawdown in the Wyodak coal seam as a result of mining the existing leases at North Rochelle Mine. The results of the groundwater modeling, which was updated in January 2000 to predict impacts associated with the development of the North Roundup Amendment, are presented in Addendum MP-E of the North Rochelle Mine 550-T5 permit document (TCC 2000a). The predicted extent of drawdown (five ft contour) over the life of the mine if the West Roundup LBA Tract is mined is shown on Figure 4-11. This prediction is approximate and based on extrapolation of TCC's earlier predictions by extending the drawdowns westward and northward by the dimensions of the West Roundup LBA Tract. More precise predictions of the extent of

Figure 4-11

drawdowns would be required in order to amend the West Roundup LBA Tract into the WDEQ/LQD permit area, if the North Rochelle Mine acquires the West Roundup LBA Tract.

In November 2001, the Wyoming SEO records indicated a total of 441 permitted water wells are located within three miles of the West Roundup LBA Tract. Of this total, 221 are owned by coal mining companies and are used for groundwater monitoring and water supply. The other 220 non mine-related wells are apportioned into the following use categories:

- 90 CBM development only
- 50 monitoring and miscellaneous
- 38 livestock only
- 27 CBM development and livestock
- 5 monitoring, livestock and miscellaneous
- 8 monitoring only
- 3 industrial
- 2 domestic and livestock
- 2 CBM development, livestock and miscellaneous

Six of these permitted water wells are located within the expanded five-ft drawdown contour with completion depths that indicate they produce water from the Wyodak coal seam (this excludes wells constructed for monitoring, mine dewatering or CBM production). These wells are shown on Table 4-9. During the permitting process, the mine operator would be required to update the list of potentially impacted wells and predict impacts to these and other water-supply wells within the five-ft

drawdown contour. The operator would be required to commit to replacing these water supplies with water of equivalent quality and quantity if they are affected by mining.

TCC has two water supply wells completed in aquifers below the coal. If the LBA tract is lease by the applicant, water would be produced from these wells for a longer period of time, but TCC would not require additional sub-coal wells to mine the LBA tract.

Groundwater quality within the backfill aquifer at the West Roundup LBA Tract would be expected to be similar to groundwater quality measured in existing wells completed in the backfill at nearby mines. Due to the absence of saturated backfill at North Rochelle Mine, no site-specific data are available yet for the quality of groundwater within the mine's backfill. TDS concentrations observed in the backfill at nearby mines are generally higher than those found in the undisturbed Wasatch Formation overburden or Wyodak coal aquifer. At the Black Thunder Mine, which is located north of and adjacent to the North Rochelle Mine, October 1999 TDS concentrations of groundwater from the backfill were varied and ranged from 1,090 to 5,440 mg/L (Hydro-Engineering 2000) with a geometric mean of 2,140 mg/L.

The hydraulic properties of the backfill aquifer at the West Roundup LBA Tract would be expected to be similar to the hydraulic properties measured in existing wells completed in the backfill at nearby mines.

Table 4-9. Water Supply Wells Possibly Subject to Drawdown if West Roundup LBA Tract is Mined.

SEO Permit Number	Applicant	Use	Yield (gpm)	Well Depth (ft)	Depth to Water (ft)
P12757P	USFS	Stock	4	165	unknown
P101801W	Bridle Bit Ranch Company	Stock	20	264	80
P25608P	Paul & Edith Ruth Wilkinson	Stock	4	110	flowing
P5848W	Paul Wilkinson	Stock	3	140	0
P29746W	USFS	Stock	10	175	30
P25120W	Atlantic Richfield Company	Monitoring, Miscellaneous	0	142	97

Note: Wells in this table are believed from their completion depths to be completed in the Wyodak coal seam, and are within the additional area of five ft or more drawdown caused by mining the West Roundup Tract. Wells impacted by the No Action Alternative are already addressed in the state mine permit document.

Again, due to the minimal areal extent of backfill and consequently a lack of saturation at North Rochelle Mine to date, no site-specific data are available for the hydraulic properties of the mine's backfill. At Black Thunder Mine, the backfill has been tested at two wells, and the hydraulic conductivities of 0.12 ft/day and 0.86 ft/day are slightly lower than the hydraulic conductivity (1.2 ft/day) reported for the Wyodak coal seam within the nearby Little Thunder LBA Tract.

West Antelope LBA Tract

Mining the LBA tract would remove shallow aquifers on an additional 3,200 acres (Proposed Action configuration), 3,500 acres (Alternative 2 configuration), or 2,467 acres (Alternative 3 configuration) and replace the separate aquifer units with backfill composed of an unlayered mixture of the existing

Wasatch Formation overburden and Fort Union Formation interburden.

Of the three overburden wells that are currently monitored by ACC, no substantial water level declines were observed from 1979 to 2001 (ACC 2001). One of the three overburden monitor wells exhibited a water level decline of approximately six ft in 1999, probably due to an active pit encroaching to within 0.5 mile of the well. Of the three interburden wells that are currently monitored by ACC, one well has exhibited about six ft of overall drawdown, one well has recorded no drawdown, and the other well has recorded roughly a two ft increase in water level from 1979 to 2001 (ACC 2001). Two underburden wells are currently being monitored and have recorded between 35 and 40 ft of drawdown. Decreases in water levels in underburden monitoring wells are thought by ACC to be caused by depressurization

associated with dewatering of the overlying coal seams.

Water level drawdowns have propagated much farther in the Wyodak/Anderson and Canyon coal seam aquifer than in the overburden. Coal drawdowns from 1980 to 1995 were generally in excess of five ft within four miles of the active pits at the Antelope Mine (Hydro-Engineering 1996a). In 2000 and 2001, ACC monitored water levels in 12 monitor wells completed in the Anderson coal seam and nine monitor wells in the Canyon coal seam. The maximum drawdown measured at that time in an Anderson monitor well was about 32 ft. That well is located approximately 3,500 ft northwest of the active pit. The maximum drawdown measured to date in the Canyon coal seam is about 100 ft. at a monitor well located within 1,000 ft of the active pit (ACC 2001). Prior to 1993, mining occurred in relatively dry portions of the Anderson coal seam and little to no drawdown occurred within that aquifer. The water level in the Canyon coal seam has shown a drawdown trend in most monitor wells starting in 1988, apparently due to mining activities to the north of the Antelope Mine. The downward trend has accelerated from 1988 to the present as a result of mining a fully saturated Canyon coal seam in the northeastern part of the Antelope Mine. Those Canyon coal monitor wells within 0.5 mile north and west of the active pits have recorded an overall decline of about 80 to 90 ft. Drawdowns in both seams have resulted not only from mining, but also from a series of dewatering wells that have been used to lower water levels in advance of the

pit since 1993. Water levels and maps showing drawdowns in the vicinity of the pit are included in the annual report for the Antelope Mine filed by ACC with WDEQ/LQD each year.

ACC used the MODFLOW model to predict the extent of water level drawdown in the Anderson and Canyon coal seam aquifers as a result of mining the existing leases at Antelope Mine. The results of the groundwater modeling are reported in the Mine Plan, Section MP5, Addendum MP-C of the Antelope Mine 525-T6 permit document (ACC 1998). The predicted extent of drawdown (five ft contour) in the Anderson-Canyon coal seam over the life of the mine if the Antelope Mine acquires the West Antelope LBA Tract is shown on Figure 4-12. This prediction is approximate and is based on extrapolation of ACC's earlier predictions by extending the drawdowns westward and northward by the dimensions of the West Antelope LBA Tract. More precise predictions of the extent of drawdowns would be required in order to amend the West Antelope LBA Tract into the WDEQ/LQD permit area, if the Antelope Mine acquires the West Antelope LBA Tract.

In November 2001, the Wyoming SEO records indicated a total of 276 permitted water wells are located within three miles of the West Antelope LBA Tract. The majority (198) are owned by coal mining companies and are used for groundwater monitoring, dewatering and water supply. The other 78 non

Figure 4-12

mine-related wells are apportioned into the following use categories:

- 33 livestock
- 16 livestock and CBM development
- 10 monitoring or miscellaneous
- 8 livestock or domestic
- 5 CBM development
- 2 livestock and miscellaneous
- 1 livestock and reservoir
- 1 industrial
- 1 livestock, miscellaneous and CBM development
- 1 domestic

Six of these permitted water wells are located within the expanded five-ft drawdown contour with completion depths that indicate they produce water from the Anderson or Canyon coal seam (this excludes wells constructed for monitoring, mine dewatering or CBM production). These wells are shown on Table 4-10.

During the permitting process, the mine operator would be required to update the list of potentially impacted wells and predict impacts to these and other water-supply wells within the five-ft drawdown contour. The operator would be required to commit to replacing these water supplies with water of equivalent quality and quantity if they are affected by mining.

ACC has one water supply well completed in aquifers below the coal. If the LBA tract is lease by the applicant, water would be produced from this well for a longer period of time, but ACC would not require additional sub-coal wells to mine the LBA tract.

Groundwater quality within the backfill aquifer at the West Antelope LBA Tract would be expected to be similar to groundwater quality measured in existing wells completed in the backfill at Antelope Mine. To date, seven wells have been installed to monitor water levels and water quality in backfill at the Antelope Mine. Four of these backfill monitoring wells are located in the southern part of the mine and have not yet been sampled due to a lack of saturation. Three backfill monitoring wells that were added to ACC's monitoring program in 2000 are located in the northeastern part of the mine and had sufficient saturation to be sampled in 2001. TDS concentrations in these three monitoring wells ranged from 1,990 to 5,120 mg/L in August 2001 (ACC 2001).

The hydraulic properties of the backfill aquifer at the West Antelope LBA Tract would be expected to be similar to the hydraulic properties measured in existing wells completed in the backfill at nearby mines. To date, no site-specific data are available for the hydraulic properties of the mine's backfill. The hydraulic properties measured in existing wells completed in the backfill at North Antelope/Rochelle Complex, located northeast of the Antelope Mine, are variable but in general comparable to the Wasatch Formation overburden and Wyodak coal. At North Antelope/Rochelle Complex, the backfill aquifer has been tested at four wells, and the average hydraulic conductivity is 36 ft/day, which exceeds the average hydraulic conductivity (9.5 ft/day) reported for the Wyodak coal seam in the vicinity

4.0 Environmental Consequences

Table 4-10. Water Supply Wells Possibly Subject to Drawdown if West Antelope LBA Tract is Mined.

SEO Permit Number	Applicant	Use	Yield (gpm)	Well Depth (ft)	Depth to Water (ft)
P23600P	Patricia L. Isenberger	Stock	7	300	100
P50638W	Patricia L. Isenberger	Stock	15	210	35
P76179W	WY State Highway Dept.	Monitoring, Miscellaneous	0	300	33
P109953W	Patricia L. Isenberger Litton	Miscellaneous	1	350	60
P5612P	Patricia L. Isenberger Litton	Stock	1	350	60
P23601P	Patricia L. Isenberger	Stock	7	250	unknown

Note: Wells in this table are believed from their completion depths to be completed in the Canyon or Anderson coal seam, and are within the additional area of five ft or more drawdown caused by mining the West Antelope Tract. Wells impacted by the No Action Alternative are already addressed in the state mine permit document.

of the North Antelope/Rochelle Complex. The data available indicate that the hydraulic conductivity of the backfill would be greater than or equal to premining coal values, suggesting that wells completed in the backfill would provide yields greater than or equal to premining coal wells.

4.1.6 Alluvial Valley Floors

Impacts to designated AVFs are generally not permitted if the AVF is determined to be significant to agriculture. AVFs that are not significant to agriculture can be disturbed during mining, but they must be restored as part of the reclamation process. In order to restore the AVF, the physical and hydrologic characteristics of the AVF must be determined. AVF investigations conducted within the General Analysis Area have identified AVFs that occur along Porcupine Creek, Antelope Creek, Little Thunder

Creek, and North Prong Little Thunder Creek downstream of the LBA tracts. Within the General Analysis Area, one flood irrigated hay meadow near the confluence of Porcupine Creek and Antelope Creek has been determined by the WDEQ/LQD to be significant to agriculture.

The NARO North and Little Thunder LBA Tracts, have been evaluated and declared non-AVF by WDEQ/LQD. The NARO South LBA Tract, West Roundup LBA Tract and portions of the West Antelope LBA Tract have not yet been formally evaluated for the presence of AVFs.

No unconsolidated stream laid deposits are found within the NARO South LBA Tract; therefore, it is unlikely an AVF declaration would be made.

Based on previous non-AVF declarations made on Olson Draw

downstream of the West Roundup LBA Tract, it is unlikely that this channel would receive an AVF declaration upstream on the LBA tract where the drainage is smaller and AVF characteristics are negligible.

Antelope Creek within and extending two miles upstream from the existing Antelope Mine permit boundary has been declared an AVF by WDEQ/LQD, and a portion of this declared AVF is within the West Antelope LBA Tract. ACC's approved mining and reclamation plan avoids disturbing Antelope Creek and an adjacent designated buffer zone. Therefore, portions of the Antelope Creek valley within the West Antelope LBA Tract would not be mined, if the Antelope Mine acquires the tract.

Spring Creek within and extending two miles upstream from the existing Antelope Mine permit boundary has also been investigated for the presence of an AVF by ACC, although no specific declarations have been made by the WDEQ/LQD. If ACC acquires the West Antelope LBA Tract, those portions of the tract and surrounding area that would be amended into the Antelope Mine permit that have not had specific declarations of the presence or absence of AVFs would be investigated as part of the mine permitting process. The WDEQ/LQD has determined that the declared and potential AVFs within the current Antelope Mine permit boundary are not significant to agriculture (ACC, State Decision Document 2001). With the exception of an unsuccessful attempt at flood irrigation on Spring Creek, there is no present or

historical record of agricultural use, other than undeveloped rangeland, of the stream laid deposits within the West Antelope LBA Tract. If WDEQ determines that an AVF is present on the tract, it is reasonable to assume that mining would be permitted in those areas because the lack of agricultural development in this area precludes a determination of significance to agriculture.

Streamflows in Spring Creek would be diverted around the active mining areas in a temporary diversion channel. Consequently, disruptions to streamflows that might supply AVFs on Antelope Creek downstream of the Antelope Mine would not be expected to be substantial.

Streamflows in the other LBA tracts would be diverted around the active mining areas in temporary diversion ditches or captured in flood control reservoirs above the pit. If flood control impoundments are used, it would be necessary to evacuate them following major runoff events to provide storage volume for the next flood. Consequently, disruptions to streamflows that might supply downstream AVFs are expected to be negligible. Groundwater intercepted by the mine pits would be routed through settling ponds to meet state and federal quality criteria, and the pond discharges would likely increase the frequency and amount of flow in these streams, thereby increasing surface water supplies to downstream AVFs.

If the LBA tracts are mined as extensions of existing operations, the mining would extend upstream on streams already in active mine areas.

4.0 Environmental Consequences

Therefore, no direct, indirect, or cumulative impacts are anticipated to off-site AVFs through mining of any of the LBA tracts included in this analysis.

4.1.7 Wetlands

PRCC, TBCC, TCC, and ACC have completed wetland inventories identifying the acres of jurisdictional and non-jurisdictional wetlands on each of the LBA tracts as applied for and lands added under BLM alternative configurations. Table 4-11 presents the inventory results for each LBA tract. A maximum of 62.16 acres of jurisdictional and 51.58 acres of non-jurisdictional wetlands would be disturbed if each of the LBA tracts is leased and subsequently mined under the largest action alternative configuration.

Most existing wetlands on the LBA tracts would be destroyed by currently approved mining operations at the adjacent mines. The exception may be riverine wetlands associated

with Antelope Creek and wetlands association with other streams that cross the LBA tracts but would not be disturbed during currently approved mining operations. COE requires replacement of all impacted jurisdictional wetlands in accordance with Section 404 of the Clean Water Act. Replacement of functional wetlands on privately-owned surface may occur in accordance with agreements with the private landowners; privately owned surface lands are included in all five LBA tracts as applied for. During the period of time after mining and before replacement of wetlands, all wetland functions would be lost. The replaced wetlands may not duplicate the exact function and landscape features of the premine wetlands, but replacement plans would be evaluated by COE and replacement would be in accordance with the requirements of Section 404 of the Clean Water Act as determined by COE.

Table 4-11. Maximum Wetland Impacts in the NARO North and South, Little Thunder, West Roundup, and West Antelope LBA Tracts.

LBA Tract	Jurisdictional Wetlands¹ (acres)	Non-Jurisdictional Wetlands¹ (acres)
NARO North and South	18.40	28.50
Little Thunder	5.19	2.87
West Roundup	6.80	20.21
West Antelope	31.77	0.00
Total	62.16	51.58

Notes: ¹ Includes the area of each LBA tract as applied for, lands added under BLM alternatives, and the additional area that would be disturbed by mining and reclaiming the tract as part of the existing mining operation.

As a result of recent court directives, playas may no longer be identified as jurisdictional waters of the U.S. under Section 404 of the Clean Water Act. These non-jurisdictional wetland features, having significant biological and hydrological features, cover portions of the NARO North and South, Little Thunder, and West Roundup LBA Tracts. Although COE may not require their replacement as a result of the recent court directive, the applicant mines plan to continue establishing playa/depression features within the reclaimed topography if the LBA tracts are mined as extensions of existing operations. If no special segregation and placement of overburden and soils are necessary, reclamation costs do not increase if playa/depressional features are restored. However, if special handling of materials is necessary, the reclamation costs associated with restoration of playa/depressional features are generally higher on a site-specific basis.

4.1.8 Vegetation

Under the Proposed Actions, mining of the five LBA tracts would progressively remove the native vegetation on 17,375 acres on and near the LBA tracts. Vegetation removal at each LBA tract under the Proposed Actions and action alternatives is presented as the additional disturbance areas in Tables 2-1 through 2-4.

Short-term impacts associated with the removal of vegetation from the LBA tracts would include increased soil erosion and habitat loss for wildlife and livestock. Potential long-

term impacts include loss of habitat for some wildlife species as a result of reduced plant species diversity, particularly big sagebrush, on reclaimed lands. However, grassland-dependent wildlife species and livestock would benefit from the increased grass cover and production.

Reclamation, including revegetation of these lands, would occur contemporaneously with mining on adjacent lands, i.e., reclamation would begin once an area is mined. Estimates of the time elapsed from topsoil stripping through reseeding of any given area range from two to four years. This would be longer for areas occupied by stockpiles, haulroads, sediment-control structures, and other mine facilities. Some roads and facilities would not be reclaimed until the end of mining. No new life-of-mine facilities would be located on any of the LBA tracts under the Proposed Actions or Alternatives 2 or 3, in which each LBA tract would be mined as an extension of an existing mine.

Grazing restrictions prior to mining and during reclamation would remove up to 100 percent of the LBA areas from livestock grazing. This reduction in vegetative production would not seriously affect livestock production in the region, and long-term productivity on the reclaimed land would return to premining levels within several years following seeding with the approved final seed mixture. Wildlife use of the area would not be significantly restricted throughout the operations.

Reestablished vegetation would be dominated by species mandated in

the reclamation seed mixtures (to be approved by WDEQ). The majority of the approved species are native to the LBA tracts. Initially, the reclaimed lands would be dominated by grassland vegetation, which would be less diverse than the premining vegetation. At least 20 percent of the area would be reclaimed to native shrubs at a density of one per square meter as required by current regulations. Estimates for the time it would take to restore shrubs to premining density levels range from 20 to 100 years. An indirect impact of this vegetative change could be decreased big game habitat carrying capacity. Following completion of reclamation (seeding with the final seed mixture) and before release of the reclamation bond (a minimum of ten years), a diverse, productive, and permanent vegetative cover would be established on the LBA tracts. The decrease in plant diversity would not seriously affect the potential productivity of the reclaimed areas, and the proposed postmining land use (wildlife habitat and rangeland) should be achieved even with the changes in vegetation composition and diversity. Private landowners (Figures 3-6 through 3-9) would have the right to manipulate the vegetation on their lands as they desire once the reclamation bond is released.

On average, approximately 3,600 to 4,000 acres would be disturbed each year that mining occurs if all five proposed lease areas are mined concurrently. This disturbance would occur regardless of which action alternatives are selected. By the time mining ceases, over 75 percent of these disturbed lands would have been reseeded. The remaining 25

percent would be reseeded during the following two to three years as the life-of-mine facilities areas are reclaimed.

The reclamation plans for the existing mines include steps to control invasion by weedy (invasive nonnative) plant species. The reclamation plans for each LBA tract would also include steps to control invasion from such species. Native vegetation from surrounding areas would gradually invade and become established on the reclaimed land.

The climatic record of the western U.S. suggests that droughts could occur periodically during the life of the mines. Such droughts would severely hamper revegetation efforts, since lack of sufficient moisture would reduce germination and could damage newly established plants. Same-aged vegetation would be more susceptible to disease than would plants of various ages. Severe thunderstorms could also adversely affect newly seeded areas. Once a stable vegetative cover is established, however, these events would have similar impacts as would occur on native vegetation.

Changes expected in the surface water network on each LBA tract as a result of mining and reclamation would affect the reestablishment of vegetation patterns on the reclaimed areas to some extent. The postmining maximum overland slope would be 20 percent in accordance with WDEQ policy. The average reclaimed overland slope on each LBA tract would not be known until WDEQ's technical review of each permit revision application is complete. No

significant changes in the average overland slope are predicted.

Following reclamation, the LBA tracts would be primarily a mixture of prairie grasslands with graminoid/forb-dominated areas. An overall reduction in species diversity, especially for the shrub component, would occur. As indicated previously, following reclamation bond release, management of the privately-owned surface areas would revert back to the private surface owners, who would have the right to manipulate the reclaimed vegetation.

Jurisdictional wetlands would fall under the jurisdiction of the COE. Detailed wetland mitigation plans would be developed at the permitting stage to ensure no net loss of jurisdictional wetlands within the General Analysis Area. Functional wetlands may be restored in accordance with the requirements of the surface landowner.

The decrease in plant diversity would not seriously affect productivity of the reclaimed areas, regardless of the alternatives selected, and the proposed postmining land use (wildlife habitat and rangeland) would be achieved even with the changes in vegetative species composition and diversity.

4.1.9 Threatened, Endangered, Proposed, and Candidate Plant Species and USFS Region 2 Sensitive Species

Refer to Appendix G.

4.1.10 Wildlife

Local wildlife populations are directly and indirectly impacted by mining. These impacts are both short-term (until successful reclamation is achieved) and long-term (persisting beyond successful completion of reclamation). The direct impacts of surface coal mining on wildlife occur during mining and are therefore short-term. They include road kills by mine-related traffic, restrictions on wildlife movement created by fences, spoil piles, and pits, and displacement of wildlife from active mining areas. Displaced animals may find equally suitable habitat that is not occupied by other animals, occupy suitable habitat that is already being used by other individuals, or occupy poorer quality habitat than that from which they were displaced. In the second and third situations, the animals may suffer from increased competition with other animals and are less likely to survive and reproduce. The indirect impacts are longer term and may include a reduction in big game carrying capacity and microhabitats on reclaimed land due to flatter topography, less diverse vegetative cover, and reduction in sagebrush density.

These impacts are currently occurring on the existing leases as mining occurs. If the LBA tracts are leased under the Proposed Actions or Alternatives 2 or 3, the areas of mining disturbance would extend onto the LBA tracts. Mining would be extended by up to 5.5 years at the North Antelope/Rochelle Complex, 10.7 years at the Black Thunder Mine, and 7.1 years at the North

Rochelle Mine. Mining of the West Antelope LBA Tract by ACC is not expected to extend the current mining life.

Under the Proposed Actions and action alternatives, big game would be displaced from portions of the LBA tracts to adjacent ranges during mining. Pronghorn would be most affected; however, none of the areas within two miles of the LBA tracts has been classified as crucial or critical pronghorn habitat. Mule deer would not be substantially impacted, given their infrequent use of these lands and the availability of suitable habitat in adjacent areas. None of the land within the General Analysis Area is considered by WGFD to be an elk use area, although elk have been observed wintering on reclaimed grasslands within the General Analysis Area in recent years. Big game displacement would be incremental, occurring over several years and allowing for gradual changes in distribution patterns. Big game residing in the adjacent areas could be impacted by increased competition with displaced animals. Noise, dust, and associated human presence would cause some localized avoidance of foraging areas adjacent to mining activities. On the existing leases, however, big game have continued to occupy areas adjacent to and within active mining operations, suggesting that some animals may become habituated to such disturbances.

Big game animals are highly mobile and can move to undisturbed areas. There would be more restrictions on big game movement on or through the tracts, however, due to the

construction of additional fences, spoil piles, and pits related to mining. During winter storms, pronghorn may not be able to negotiate these barriers. WDEQ guidelines require fencing to be designed to permit pronghorn passage to the extent possible.

Recently, the WGFD reviewed monitoring data collected on mine sites for big game species and the monitoring requirements for big game species on those mine sites. Their findings concluded that the monitoring had demonstrated the lack of impacts to big game on existing mine sites. No severe mine-caused mortalities have occurred and no long-lasting impacts on big game have been noted on existing mine sites. The WGFD therefore recommended that big game monitoring be discontinued on all existing mine sites. New mines will be required to conduct big game monitoring if located in crucial winter range or in significant migration corridors, neither of which are present within the LBA tracts within the General Analysis Area.

If the LBA tracts are leased, road kills related to mine traffic would be extended within the General Analysis Area by up to 5.5 years for the North Antelope/Rochelle Complex, 10.7 years for Black Thunder Mine, and 7.1 years for North Rochelle Mine. The life of the Antelope Mine would not be extended if the West Antelope lease is mined.

After mining and reclamation, alterations in the topography and vegetative cover, particularly the reduction in sagebrush density,

would cause a decrease in carrying capacity and diversity on the LBA tracts. Sagebrush would gradually become reestablished on the reclaimed land, but the topographic changes would be permanent.

Medium-sized mammals (such as rabbits, coyotes, and foxes) would be temporarily displaced to other habitats by mining, potentially resulting in increased competition and mortality. However, these animals would rebound on reclaimed areas, as forage is developed and small mammal prey species are recolonized. Direct losses of small mammals would be higher than for other wildlife, since the mobility of small mammals is limited and many retreat into burrows when disturbed. Therefore, populations of such prey animals as voles, mice, and prairie dogs would decline during mining. However, these animals have a high reproductive potential and tend to reinvade and adapt to reclaimed areas quickly. A research project on habitat reclamation on mined lands within the PRB for small mammals and birds concluded that reclamation objectives to encourage the recolonization of small mammal communities are being achieved (Shelley 1992).

Upland game birds known to occur within the General Analysis Area include mourning doves, wild turkey, gray partridge, sharp-tailed grouse, and sage grouse. Although mourning doves are common seasonal residents of the General Analysis Area, the primary upland game species within the area is the sage grouse. Sage grouse are yearlong residents and are found to regularly occur in suitable

habitats in the General Analysis Area. Following is a description of sage grouse occurrences within each of the LBA tracts.

NARO North and South LBA Tracts

Sage grouse are found on lands near the NARO North and South LBA Tracts; however, no historic or active sage grouse leks were observed during the 2001 survey on or within two miles of the two LBA tracts. One active sage grouse strutting ground (Kort Lek), is located near the northwest corner of the North Antelope/Rochelle Complex's current permit area. A small portion of the two-mile radius from the lek, which identifies the area in which most hens will nest, would extend onto the North Antelope/Rochelle Complex's anticipated permit amendment area. Sage grouse were not observed using the LBA tracts during the field survey; however, sage grouse, fresh tracks, and droppings have been observed on adjacent lands.

Little Thunder LBA Tract

Sage grouse currently do not appear to frequent the Little Thunder LBA Tract. No active sage grouse leks were observed during the 2001 survey on or within two miles of the LBA tract. One inactive sage grouse lek (Black Thunder Lek) was discovered within the Black Thunder Mine permit area in 1984 near the southeast corner of the Little Thunder LBA Tract. The two-mile radius around the lek extends onto the LBA tract. Annual monitoring of the Black Thunder Lek began in 1985, and no sage grouse have been observed at the lek since 1994. Sage grouse were

not observed using the LBA tract or adjacent lands during the 2001 field survey.

West Roundup LBA Tract

Sage grouse commonly occur in the vicinity of the West Roundup LBA Tract. One inactive lek (Black Thunder Lek) is located approximately 0.5 mile north of the proposed lease area, and the two-mile radius around the lek extends onto the LBA tract. Grouse have not been observed using this lek since 1994. No new leks were found and no sage grouse were observed to be within or adjacent to the LBA tract during the 2001 field survey.

West Antelope LBA Tract

Sage grouse do not appear to frequent the West Antelope LBA Tract. No sage grouse leks have been observed on or near the Antelope Mine during baseline studies (1978-1979) or during annual wildlife monitoring surveys (1982-2000), which have included most of the LBA tract under the Proposed Action and Alternative 3 and the entire area added in Alternative 2. No sage grouse have been observed within the vicinity of the Antelope Mine or West Antelope LBA wildlife study area since 1986.

Mining results in the temporary loss of nesting habitat and some disturbance to breeding activities when mining operations are within close proximity to sage grouse strutting grounds. Monitoring of sage grouse activities has indicated that the birds frequently change lek sites. It is likely that if mining activities disturb a lek, sage grouse will use an

alternate lek site for breeding activities. Currently, none of the LBA tracts include any active sage grouse leks. Should sage grouse establish a lek on any of the proposed lease areas prior to mining, the lessee would be required to take appropriate mitigation steps prior to mining. Effort would also be made to reestablish shrubs on reclaimed lands, grade reclaimed lands to create swales and depressions, and continue monitoring sage grouse activity in the area before, during, and after mining. These and other measures would be further developed within the WDEQ/LQD permit approval process, if the tracts are leased.

Mining the LBA tracts would not impact regional raptor populations; however individual birds or pairs may be impacted. Raptor species that commonly nest in the General Analysis Area are the golden eagle, ferruginous hawk, red-tailed hawk, Swainson's hawk, great horned owl, and burrowing owl. Despite the lack of suitable nesting habitat (cliffs and tall trees), numerous raptor species have been observed nesting on or near the proposed lease areas. Following is a description of raptor occurrences on each of the LBA tracts.

NARO North and South LBA Tracts

Nine active raptor nests were observed during the 2000 survey in the NARO North and South LBA Tracts. These included four ferruginous hawk nests, one red-tailed hawk nest, and four Swainson's hawk nests.

Little Thunder LBA Tract

A total of five raptor species have been identified nesting within two miles of the Little Thunder LBA Tract as proposed and the area added by Alternative 2, including the golden eagle, ferruginous hawk, red-tailed hawk, Swainson's hawk, and burrowing owl. The golden eagle, ferruginous hawk, and Swainson's hawk had intact nest sites on the LBA tract during the 2001 survey.

West Roundup LBA Tract

A total of four raptor species (golden eagle, ferruginous hawk, Swainson's hawk, and burrowing owl) have been identified nesting within the raptor survey area, which includes the West Roundup LBA Tract as proposed, areas added under Alternatives 2 and 3, and a two-mile radius. The 2001 survey recorded 28 intact nest sites within this raptor survey area, including three golden eagle nests, 17 ferruginous hawk nests, two Swainson's hawk nests, two burrowing owl nests, three Swainson's hawk/ferruginous hawk nests, and one golden eagle/ferruginous hawk nest. One intact nest (ferruginous hawk) is within the LBA tract as proposed, and one nest (ferruginous hawk) is within the area added under Alternative 3.

West Antelope LBA Tract

A total of five raptor species (golden eagle, ferruginous hawk, red-tailed hawk, great horned owl, and burrowing owl) have been identified nesting within the raptor survey area, which includes the West Antelope LBA Tract as proposed, lands added

by Alternative 2, and a two-mile radius. The 2000 survey recorded nine nests within this raptor survey area: seven nests on the LBA tract as proposed and two nests on lands added under Alternative 2. Nests on the LBA tract include two red-tailed hawk nests, one great horned owl nest, two burrowing owl nests, one golden eagle/great horned owl nest, and one red-tailed hawk/golden eagle nest. Nests on the Alternative 2 area included two ferruginous hawk nests, which have been inactive since at least 1978.

Mining activity could cause raptors to abandon nests proximate to disturbance. USFWS recommends a one-mile buffer around all ferruginous hawk nests. USFWS and WDEQ/LQD approval would be required before mining would occur within buffer zones for future or adjacent active raptor nests. Each of the four applicant mines annually monitors territorial occupancy and nest productivity on and around their existing leases. Raptor nesting activity has frequently occurred in active mining and construction areas and the four applicant mines have successfully executed state-of-the-art mitigation techniques to protect nest productivity. There is an approved raptor mitigation plan for each of the existing applicant mines. These monitoring and mitigation plans, as required by the USFWS and WDEQ/LQD, would be amended to include the NARO North and South, Little Thunder, West Roundup, and West Antelope LBA Tracts if they are leased. Mining near raptor territories would minimally impact availability of raptor forage species. At each of the applicant mines, lack of nesting

habitat, not a lack of forage area, has been determined to be the most important factor limiting raptor density. During mining, nesting habitat is created by the excavation process (highwalls), as well as through enhancement efforts (nest platforms and boxes). After mining, the reclamation plan would reestablish the ground cover necessary for the return of a suitable prey base.

Displaced songbirds would have to compete for available adjacent territories and resources when their habitats are disturbed by mining operations. Where adjacent habitat is at carrying capacity, this competition would result in some mortality. Losses would also occur when habitat disturbance coincides with egg incubation and rearing of young. Impacts of habitat loss would be short-term for grassland species, but would last longer for tree- and shrub-dependent species. Concurrent reclamation would minimize these impacts. A diverse seed mixture planted in a mosaic with a shrubland phase would provide food, cover, and edge effect. Other habitat enhancement practices include the restoration of diverse landforms, direct topsoil replacement, and the construction of brush piles, snags and rock piles. A research project on habitat reclamation on mined lands within the PRB for small mammals and birds concluded that the diversity of song birds on reclaimed areas was less than on adjacent undisturbed areas, although their overall numbers were greater (Shelley 1992).

Under current natural conditions, waterfowl and shorebird habitat on

the LBA tracts is minimal, and production of these species is very limited. Mining the LBA tracts would thus have a negligible effect on migrating and breeding waterfowl. Sedimentation ponds created during mining would provide interim habitat for these fauna. WDEQ and COE would also require mitigation of any disturbed wetlands during reclamation, which would minimize impacts. If the replaced wetlands on the LBA tracts do not duplicate the exact function and/or landscape features of the premine wetlands, waterfowl and shorebirds could be beneficially or adversely affected as a result.

No fish habitat would be impacted if the NARO North and South, Little Thunder, or West Roundup LBA Tracts are leased and mined. Fish habitat occurs on the West Antelope LBA Tract, but is limited by the intermittent nature of Antelope Creek in this area. Three fish species tolerant of intermittent stream flows were found during a 1980 survey: sand shiner, flathead minnow, and plains killifish. ACC's approved mining plan avoids disturbing Antelope Creek and an adjacent designated buffer zone. Since ACC does not plan to disturb Antelope Creek during mining, fish habitat would not be affected if the West Antelope LBA Tract is leased by the applicant mine.

The impacts discussed above would apply to each action alternative for each applicant mine. The assessment of impacts to wildlife by mining the LBA tracts would be addressed during the WGFD and WDEQ/LQD review of each mine's permit

application, and within the WDEQ/LQD permit approval process.

4.1.11 Threatened, Endangered, Proposed, and Candidate Wildlife Species and USFS Region 2 Sensitive Species

Refer to Appendix G.

4.1.12 Land Use and Recreation

The major adverse environmental consequences of the Proposed Actions and action alternatives on land use would be the reduction of livestock grazing (cattle and sheep), loss of wildlife habitat (particularly big game), and curtailment of oil and gas development during mining of the coal and reclamation. Wildlife and livestock use would be displaced while the tracts are being mined and reclaimed. Estimated disturbance areas for each LBA tract and for each alternative configuration are presented in Tables 2-1 through 2-4.

Sections 3.11 and 4.1.2 and Appendix G of this document address the total number of producing, abandoned, or shut in oil and gas (conventional and CBM) wells that presently exist on the LBA tracts under the Proposed Actions and Alternatives 2 and 3. Well location information, federal oil and gas ownership, and federal oil and gas lessee information are presented in Figures 3-10 through 3-13 and Tables 3-8 through 3-11. BLM manages federal lands on a multiple use basis, in accordance with the regulations. In response to conflicts between oil and gas and coal lease holders, BLM has issued a policy statement on conflicts between CBM and coal development (BLM

Instruction Memorandum No. 2000-081). That policy advocates optimizing the recovery of both coal and CBM resources to ensure that the public receives a reasonable return for these publicly owned resources. Optimal recovery of both coal and oil and gas resources requires negotiation and cooperation between the oil and gas lessees and the coal lessees. Currently, the Little Thunder LBA tract is the only tract within the General Analysis Area with producing CBM wells, although the other LBA tracts contain CBM wells in various stages of development (e.g., permitting, drilling, etc.). Negotiations are ongoing between the applicant mines and the existing oil and gas lessees on how to proceed with both operations if the coal tracts are leased. Royalties have been and would be lost to both the state and federal governments if conventional oil and gas wells are abandoned prematurely, if the federal CBM is not recovered prior to mining, or if federal coal is not recovered due to conflicts. State and federal governments can also lose bonus money when the costs of the agreements between the lessees are factored into the fair market value determinations.

As discussed in Section 3.11 of this document, the NARO North, Little Thunder, and West Roundup LBA Tracts include federal lands, which are administered by the USFS. As many as 4,076.4 acres of federal lands would be removed from public access if these LBA tracts were leased under the maximum tract area configurations. The loss of accessibility to federal lands is long term (during mining and reclamation), but is not permanent.

Public access to federal lands would be restored after mining and reclamation are complete.

A number of federal/non-federal lands exchanges between the USFS and private interests have been completed on the TBNG. These exchanges have helped to eliminate isolated parcels of federal lands and consolidate federal land ownership and to improve public access to federal lands in the TBNG. Some of the PRB coal mines have participated in partnerships with USFS in facilitating some of these exchanges.

Hunting on the LBA tracts would be eliminated during mining and reclamation. Pronghorn, mule deer, and elk occur on and adjacent to the LBA tracts. Sage grouse, mourning dove, waterfowl, rabbit, and coyote also inhabit these tracts. Mining the NARO North, Little Thunder, and West Roundup LBA Tracts would remove public access to federal land in pronghorn Hunt Area 27, mule deer Hunt Area 10, and elk Hunt Area 113. None of the lands included in NARO South or West Antelope LBA Tracts are managed by the USFS; thus, no federal lands would be removed from public access if either of these LBA tracts were leased.

Following reclamation, the land would be suitable for grazing and wildlife uses, which are the historic land uses. The reclamation standards required by SMCRA and Wyoming State Law meet the standards and guidelines for healthy rangelands for public lands administered by the BLM in the State of Wyoming. Following reclamation bond release, management of the privately owned

surface would revert to the private surface owner and management of the federally owned surface would revert to the federal surface managing agency (USFS).

4.1.13 Cultural Resources

All portions of the LBA tracts as applied for, lands added under BLM alternatives, and the applicant mines' anticipated permit amendment study areas were subjected to Class I and Class III cultural resource inventories in 1999 and 2001. The results of these inventories are summarized in Section 3.12.

Data recovery plans are required for all sites recommended eligible to the National Register following testing and consultation with the SHPO. Until consultation with SHPO has occurred and agreement regarding NRHP eligibility has been reached, all sites would be protected from disturbance.

Full consultation with SHPO must be completed prior to approval of the MLA mining plan. At that time, those sites determined to be unevaluated or eligible for the NRHP through consultation would receive further protection or treatment. Impacts to eligible or unevaluated cultural resources cannot be permitted. If unevaluated sites cannot be avoided, they must be evaluated prior to disturbance. If eligible sites cannot be avoided, a data recovery plan must be implemented prior to disturbance. Ineligible properties may be destroyed without further work.

The eligible sites on each LBA tract that cannot be avoided or that have

not already been subjected to data recovery action would be carried forward in the mining and reclamation plan as requiring protective stipulations until a testing, mitigation, or data recovery plan is developed to address the impacts to the sites. The lead federal and state agencies would consult with Wyoming SHPO on the development of such plans and the manner in which they are carried out.

Cultural resources adjacent to the mine areas may be impacted as a result of increased access to the areas. There may be increased vandalism and unauthorized collecting associated with recreational activity and other pursuits outside of but adjacent to mine permit areas.

4.1.14 Native American Concerns

No sites of Native American religious or cultural importance have been identified within the General Analysis Area. If such sites or localities are identified at a later date, appropriate action must be taken to address concerns related to those sites.

4.1.15 Paleontological Resources

No unique or significant paleontological resources have been identified within the NARO North and South, Little Thunder, or West Antelope LBA Tract. One fossilized bone fragment was found within the West Roundup LBA Tract study area; however, the likelihood of encountering any further significant paleontological resources during mining activities is small. Lease and permit conditions require that should previously unknown, potentially

significant paleontological sites be discovered, work in that area shall stop and measures be taken to assess and protect the site (see Appendix D).

4.1.16 Visual Resources

Most mining activities on the LBA tracts would not be visible from any major travel routes because the tracts are not close to major highways and because of the variable terrain in the General Analysis Area. However, much of the Little Thunder LBA Tract would be visible from State Highway 450, which bisects the tract. Existing mining operations at the Black Thunder and Jacobs Ranch Mines are currently visible from this highway. Portions of each LBA tract would also be visible from State Highway 59, Hilight Road, Edwards Road, Reno Road, Antelope Road, and/or Converse County Road 37. Due to existing mining activities in the five southern mines, the predominant BLM ARM class in the General Analysis Area is IV. This classification would not be altered by the leasing and subsequent mining of the five LBA tracts under any of the action alternatives. After reclamation of the LBA tracts and adjoining mines, the VRM classification would improve. No unique visual resources have been identified on or near the LBA tracts.

Reclaimed terrain would be almost indistinguishable from the surrounding undisturbed terrain. Slopes might appear smoother (less intricately dissected) than undisturbed terrain, and sagebrush would not be as abundant for several years; however, within a few years after reclamation, the mined land

would not be distinguishable from the surrounding undisturbed terrain except by someone very familiar with landforms and vegetation.

4.1.17 Noise

Noise levels on the LBA tracts would be increased considerably by mining activities such as blasting, loading, hauling, and possibly in-pit crushing. Since the LBA tracts would be mined as extensions of existing operations under the Proposed Actions or action alternatives, no rail car loading would take place on the LBA tracts. The Noise Control Act of 1972 indicates that a 24-hour equivalent level of less than 70 dBA prevents hearing loss and that a level below 55 dBA, in general, does not constitute an adverse impact. OSM prepared a noise impact report for the Caballo Rojo Mine (OSM 1980) that determined that the noise level from crushers and a conveyor would not exceed 45 dBA at a distance of 1,500 ft. Explosives would be used during mining to fragment the overburden and coal and facilitate their excavation. The air overpressure created by such blasting is estimated to be 123 dBA at the location of the blast. At a distance of approximately 1,230 ft, the intensity of this blast would be reduced to 40 dBA. Following is a description of the dwellings located near each LBA tract.

NARO North and South LBA Tracts

The nearest occupied dwelling to the NARO North and South LBA Tracts is located adjacent to the southern edge of the NARO North LBA Tract. Since this occupied dwelling is separated

from the LBA tract by a distance of less than 200 yards, significant noise impacts are expected.

Little Thunder LBA Tract

The nearest occupied dwelling to the Little Thunder LBA Tract is located approximately one mile from the western edge of the tract as proposed and 0.5 mile from the area added under Alternatives 2 and 3 (South tract). Since this occupied dwelling is at least 0.5 mile (approximately 2,640 ft) from the LBA tract under any configuration, there should be no major noise impacts.

West Roundup LBA Tract

The nearest occupied dwelling to the West Roundup LBA Tract is located just over three miles from the southern edge of the tract. No major noise impacts are expected for this dwelling.

West Antelope LBA Tract

The nearest occupied dwelling to the West Antelope LBA Tract is located approximately one mile from the western edge of the tract. No major noise impacts are expected for this dwelling.

Because of the remoteness of the LBA tracts and because mining is already ongoing in the area, noise would have few off-site impacts. Wildlife in the immediate vicinity of mining may be adversely affected; however, observations at surface coal mines in the area indicate that wildlife have generally adapted to increased noise associated with coal mining activity. After mining and reclamation are

completed, noise would return to premining levels.

4.1.18 Transportation Facilities

No new or reconstructed transportation facilities would be required under the Proposed Action or action alternatives. Essentially all of the coal mined on the LBA tracts would be transported by the existing rail system. Vehicular traffic to and from the mines would continue at existing or slightly higher levels for an extended period of time, depending on which LBA tracts are leased and which alternatives are selected.

Active pipelines and power transmission lines currently cross the LBA tracts. Any relocation of these pipelines and utility lines would be handled according to specific agreements between the coal lessee and the pipeline and utility owners if the need arises. The Wyoming Department of Transportation routinely monitors traffic volumes on area highways, and if traffic exceeds design standards improvements are made. BNSF & UP have upgraded and will continue to upgrade their rail capacities to handle the increasing coal volume projected from the PRB, with or without the leasing of the proposed SPRB LBA Tracts. Likewise, the DM&E Railroad is proposing an expansion into the SPRB area which is not dependent on leasing the tracts evaluated in this EIS.

4.1.19 Socioeconomics

Socioeconomic impacts resulting from the leasing and subsequent mining of the LBA tracts would include increasing federal, state, and local

revenues, extending the lives of the affected mines, and increasing employment.

Increases in federal and state revenues generated by the leasing and mining of the LBA tracts would depend on which alternatives are selected and the sale price of the coal. Although spot prices in 2001 were often higher than recent previous years, spot prices in 2002 have returned to previous levels and WSGS is predicting that coal prices will remain relatively constant over the next five years (WSGS 2001). A conservatively low estimate for coal prices over the lives of the leases is \$5.00 per ton.

The federal government would collect a royalty at the time the coal is sold in the amount of 12.5 percent of the sale price. In addition, the federal government receives a bonus payment at the time the federal coal is leased. Bonus payments on the federal coal leases issued in the PRB since 1990 have ranged from 11.1 cents per ton to 70.6 cents per ton and have averaged 26 cents per ton. Additional federal fees include the AML reclamation fee (35 cents per ton sold), and the Black Lung Disability Trust Fund fee (four percent of the sales price). Royalty and bonus bid payments are divided equally with the State of Wyoming, while half of Wyoming's AML contributions are earmarked for later use in the state. Projected federal revenues for each LBA tract are presented in Tables 4-12 through 4-15 and Figure 4-13, assuming an average coal price of \$5.00 per ton recovered and a bonus payment on the leased (in-place) coal of 26 cents per ton. If the five LBA

4.0 Environmental Consequences

tracts were leased and mined under the Proposed Actions, cumulative federal revenues would be about \$1.1 billion.

According to a study done by the University of Wyoming (UW 1994), the State of Wyoming received about \$1.10 per ton from the sale of PRB coal produced in 1991. The taxes and royalties included in this calculation were severance taxes, ad valorem taxes, sales and use taxes, and the state's share of federal royalty payments on production. Although severance tax rates have been reduced from 10.5 percent to seven percent since 1991, Section 3.18 demonstrates that Wyoming revenues remain at approximately \$1.10 per ton due to increased bonus bid revenues. Projected state revenues for each LBA tract are presented in Tables 4-12 through 4-15 and Figure 4-13. If the five LBA tracts were leased and mined under the Proposed Actions, cumulative state revenues would be about \$1.5 billion.

As indicated by Tables 4-12 through 4-15, leasing and subsequently mining the LBA tracts would extend the life of each mine by 0 to 11 years, depending on which alternatives are selected. In addition, the leases

would result in the need for 0 to 176 additional employees at each mine, with a cumulative increase of up to 186 employees. The February 2002 unemployment in Campbell and Converse Counties totaled 1,075 (Wyoming Department of Employment 2002a). It is likely that the additional employees would be available from the existing workforce in Campbell and Converse Counties. No additional demands on the existing infrastructure or services in these communities would be expected because no influx of new residents would be needed to fill new jobs. The economic stability of the communities of Douglas, Wright, and Gillette would benefit by having the current North Antelope/Rochelle Complex, Black Thunder, North Rochelle, and Antelope Mine employees living in their communities employed for up to 11 additional years.

Issues relating to the social, cultural, and economic wellbeing and health of minorities and low-income groups are termed Environmental Justice issues. In reviewing the impacts of the Proposed Actions and Alternatives 2 and 3 for each LBA tract on socioeconomic resources, surface water and groundwater quality, air quality, hazardous materials, or other

Table 4-12. Projected Socioeconomic Impacts from Leasing the NARO North and South LBA Tracts under the Proposed Action or Action Alternatives.

Item	Proposed Action	Alternative 2	Alternative 3
State Revenues	\$ 557.6 mm	\$ 675.3 mm	\$ 478.4 mm
Federal Revenues	\$ 421.8 mm	\$ 514.4 mm	\$ 359.4 mm
Increased Mine Life	4 yrs	5.5 yrs	3 yrs
Additional Employees	10	10	10

Table 4-13. Projected Socioeconomic Impacts from Leasing the Little Thunder LBA Tract under the Proposed Action or Action Alternatives.

Item	Proposed Action	Alternative 2	Alternative 3 (North Tract)	Alternative 3 (South Tract)
State Revenues	\$ 484.0 mm	\$ 608.3 mm	\$ 123.1 mm	\$ 485.2 mm
Federal Revenues	\$ 364.8 mm	\$ 470.6 mm	\$ 97.2 mm	\$ 373.6 mm
Increased Mine Life	8 yrs	10.7 yrs	0.3 yrs	8 yrs
Additional Employees	0	0	0	0

Table 4-14. Projected Socioeconomic Impacts from Leasing the West Roundup LBA Tract under the Proposed Action or Action Alternatives.

Item	Proposed Action	Alternative 2	Alternative 2 Plus Lease WYW-127221 Modification	Alternative 3	Alternative 3 Plus Lease WYW-127221 Modification
State Revenues	\$ 171.5 mm	\$ 222.3 mm	\$ 235.2 mm	\$ 271.5 mm	\$ 284.4 mm
Federal Revenues	\$ 129.7 mm	\$ 168.1 mm	\$ 177.9 mm	\$ 205.3 mm	\$ 215.1 mm
Increased Mine Life	4.5 yrs	5.8 yrs	6.1 yrs	6.7 yrs	7.1 yrs
Additional Employees	176	176	176	176	176

Table 4-15. Projected Socioeconomic Impacts from Leasing the West Antelope LBA Tract under the Proposed Action or Action Alternatives.

Item	Proposed Action	Alternative 2	Alternative 3
State Revenues	\$ 251.2 mm	\$ 279.7 mm	\$ 187.4 mm
Federal Revenues	\$ 195.2 mm	\$ 216.7 mm	\$ 143.4 mm
Increased Mine Life	0 yrs	0 yrs	0 yrs
Additional Employees	0	0	0

Figure 4-13

elements of the human environment in this chapter, it was determined that potentially adverse impacts do not disproportionately affect Native American tribes, minority groups, or low-income groups.

With regard to Environmental Justice issues affecting Native American tribes or groups, the General Analysis Area contains no tribal lands or Native American communities, and no treaty rights or Native American trust resources are known to exist for this area.

Implementing any of the alternatives would have no effects on Environmental Justice issues, including the social, cultural, and economic wellbeing and health of minorities and low-income groups within the General Analysis Area.

4.1.20 Hazardous and Solid Waste

If the applicant mines acquire the five LBA tracts, the wastes that would be generated in the course of mining the tracts would be similar to those currently being generated by the existing mining operations. The procedures that are used for handling hazardous and solid waste at the existing mines are described in Chapter 2. Wastes generated by mining the LBA tracts would be handled in accordance with the existing regulations using the procedures currently in use at the North Antelope/Rochelle Complex, Black Thunder, North Rochelle, and Antelope Mines, as described in Chapter 2.

4.2 No Action Alternative

There are five No Action Alternatives, one for each LBA tract. Under the No Action Alternative for each LBA tract, the coal lease application for that tract would be rejected and the area included in that tract would not be offered for lease at this time. If a decision is made to reject an application for an LBA tract included in this analysis, the tract could be nominated for lease again in the future but, for the purposes of this analysis, the No Action Alternative assumes that a tract would never be mined if the decision is to reject the application at this time. If an application is rejected for a tract, the approved mining operations for the existing applicant mine would not be changed.

If the No Action alternative is selected for any of the tracts included in this analysis, the impacts described on the preceding pages and in Table 2-5 to topography and physiography, geology and minerals, soils, air quality, water resources, alluvial valley floors, wetlands, vegetation, wildlife, threatened, endangered and candidate species, land use and recreation, cultural resources, Native American concerns, paleontological resources, visual resources, noise, transportation, and socioeconomics would occur on the existing adjacent coal leases under the No Action Alternative, but coal removal would not occur on the rejected LBA tract.

The general nature and magnitude of cumulative impacts as summarized in Table 2-5, which would occur from implementation of all five of the Proposed Actions or respective

Alternatives 2 or 3, would not be substantially different under one or more of the No Action Alternatives.

Under the No Action Alternatives for the NARO North and NARO South LBA Tracts, coal removal and associated disturbance and impact would not occur on 5,590, 6,275, or 4,863 acres adjacent to the existing North Antelope/Rochelle Complex under the Proposed Action, Alternative 2, or Alternative 3, respectively. Portions of the NARO North and South LBA Tracts adjacent to the existing North Antelope/Rochelle Complex would be disturbed to recover the coal in the existing leases. The economic benefits that would be derived from mining the NARO North and South LBA Tracts during an additional 5.5 years of mining would be lost.

Under the No Action Alternative for the Little Thunder LBA Tract, coal removal and associated disturbance and impact would not occur on 5,424 or 6,577 acres adjacent to the existing Black Thunder Mine under the Proposed Action or Alternative 2 and Alternative 3 (North and South tracts), respectively. Portions of the Little Thunder LBA Tract adjacent to the existing Black Thunder Mine would be disturbed to recover the coal in the existing leases. The economic benefits that would be derived from mining the Little Thunder LBA Tract during an additional 10.7 years of mining would be lost.

Under the No Action Alternative for the West Roundup LBA Tract, coal removal and associated disturbance and impact would not occur on 3,161, 3,161, or 3,591 acres adjacent

to the North Rochelle Mine under the Proposed Action, Alternative 2 (with or without Lease WYW-127221 modification), or Alternative 3 (with or without Lease WYW-127221 modification), respectively. Portions of the West Roundup LBA Tract adjacent to the existing North Rochelle Mine would be disturbed to recover the coal in the existing leases. The economic benefits that would be derived from mining the West Roundup LBA Tract during an additional 7.1 years of mining would be lost.

Under the No Action Alternative for the West Antelope LBA Tract, coal removal and associated disturbance and impact would not occur on 3,200, 3,500, or 2,467 acres in adjacent to the existing Antelope Mine under the Proposed Action, Alternative 2, or Alternative 3, respectively. Portions of the West Antelope LBA Tract adjacent to the existing Antelope Mine would be disturbed to recover the coal in the existing leases. The economic benefits that would be derived from mining the West Antelope LBA Tract would be lost.

If a decision is made not to lease one or more of the five LBA tracts at this time, they could be leased and mined as maintenance leases in the future, while the existing adjacent mines are in operation. If they are not leased while the existing adjacent mines are in operation, they may or may not be leased in the future.

4.3 Regulatory Compliance, Mitigation, and Monitoring

In the case of surface coal mining, SMCRA and state law require mitigation and monitoring designed to ensure that reclamation standards are met following mining. Measures that are required by regulation are considered to be part of the Proposed Actions and the alternatives considered in this EIS for the NARO North, NARO South, Little Thunder, West Roundup, and West Antelope LBA Tracts. These requirements, mitigation plans, and monitoring plans are in place for the No Action Alternative, as part of the current approved mining and reclamation plans for the existing North Antelope/Rochelle Complex, Black Thunder, North Rochelle, and Antelope Mines. These requirements, mitigation plans, and monitoring plans would be included in the mining and reclamation plan revision that would be required for each respective LBA tract that is leased. This mining and reclamation plan revision would have to be approved before mining could occur on each tract that is leased, regardless of who acquires the tract. The major mitigation measures and monitoring measures that are required by state or federal regulation are summarized in Table 4-16. More specific information about some of these mitigation and monitoring measures and their results at the North Antelope/Rochelle Complex, Black Thunder, North Rochelle, and Antelope Mines are described in the following sections of this document:

- Section 3.5.5, control measures for particulate emissions;
- Section 3.5.6, control measures for blasting emissions;
- Section 4.1.2, handling of unsuitable overburden material and backfill monitoring plans;
- 4.1.3, structures to control soil erosion;
- Section 4.1.4, air quality monitoring and modeling practices and results and application of BACT for mitigation of air quality impacts;
- Section 4.1.5, surface water hydrologic control measures;
- Section 4.1.5, groundwater quantity and quality monitoring measures and results;
- groundwater drawdown modeling requirements;
- Section 4.1.5, mitigation for interruption, discontinuation, or diminishment of existing water well rights by mining operations;
- Section 4.1.6, restoration of AVFs impacted by mining;
- Section 4.1.7, identification and replacements of wetlands impacted by mining;
- mandated reclamation seed mixtures;
- Section 4.1.8, plans for control of invasive, nonnative plant species;
- Section 4.1.10, fencing designed to permit pronghorn passage;
- Section 4.1.10, big game monitoring results and requirements;
- Section 4.1.10, notification and mitigation measures to protect active raptor nests and nest productivity;

Table 4-16. Regulatory Compliance, Mitigation and Monitoring Measures required under each Proposed Action, Alternative 1 (No Action), Alternative 2, or Alternative 3.

Resource	Regulatory Compliance or Mitigation Required by Stipulations or Required by State or Federal Law¹	Monitoring¹
Topography & Physiography	Restoring to approximate original contour or other approved topographic configuration	LQD checks as-built vs. approved topography with each annual report
Geology & Minerals	Identifying & selectively placing or mixing chemically or physically unsuitable overburden materials to minimize adverse effects to vegetation or groundwater	LQD requires monitoring in advance of mining to detect unsuitable overburden
Soil	Salvaging soil suitable to support plant growth for use in reclamation; Protecting soil stockpiles from disturbance and erosional influences; Selectively placing at least 4 ft of suitable overburden on the graded spoil surface below replaced topsoil to meet guidelines for vegetation root zones	Monitoring vegetation growth on reclaimed areas to determine need for soil amendments; Sampling regraded overburden for compliance with root zone criteria
Air Quality	Dispersion modeling of mining plans for annual average particulate pollution impacts on ambient air; Using particulate pollution control technologies; Using work practices designed to minimize fugitive particulate emissions; Using EPA- or state-mandated BACT, including: Fabric filtration or wet scrubbing of coal storage silo and conveyor vents, Watering or using chemical dust suppression on haul roads and exposed soils, Containment of truck dumps and primary crushers, Covering of conveyors, Prompt revegetation of exposed soils	On-site air quality monitoring for PM ₁₀ ; Off-site ambient monitoring for PM ₁₀ ; On-site compliance inspections
Surface Water	Building and maintaining sediment control ponds or other devices during mining; Restoring approximate original drainage patterns during reclamation; Restoring stock ponds and playas during reclamation	Monitoring storage capacity in sediment ponds; Monitoring quality of discharges; Monitoring streamflows and water quality
Groundwater Quantity	Evaluating cumulative impacts to water quantity associated with proposed mining; Replacing existing water rights that are interrupted, discontinued, or diminished by mining with water of equivalent quantity	Monitoring wells track water levels in overburden, coal, interburden, underburden, & backfill

¹ These requirements, mitigation plans, and monitoring plans are in place for the existing North Antelope/Rochelle Complex, Black Thunder, North Rochelle and Antelope Mines in their current approved mining and reclamation plans (the No Action Alternatives). If the NARO North, NARO South, Little Thunder, West Roundup or West Antelope LBA Tracts are leased, these requirements, mitigation plans, and monitoring plans would be part of a mining plan revision covering the NARO North, NARO South, Little Thunder, West Roundup or West Antelope LBA Tracts that must be approved before mining can occur on the tract under the Proposed Action, Alternative 2 or 3.

Table 4-16. Regulatory Compliance, Mitigation and Monitoring Measures required under each Proposed Action, Alternative 1 (No Action), Alternative 2, or Alternative 3. (Continued)

Resource	Regulatory Compliance or Mitigation Required by Stipulations or Required by State or Federal Law¹	Monitoring¹
Groundwater Quality	Evaluating cumulative impacts to water quality associated with proposed mining; Replacing existing water rights that are interrupted, discontinued, or diminished by mining with water of equivalent quality	Monitoring wells track water quality in overburden, coal, interburden, underburden, & backfill
Alluvial Valley Floors	Identifying all AVFs that would be affected by mining; Determining significance to agriculture of all identified AVFs affected by mining (WDEQ); Protecting downstream AVFs during mining; Restoring essential hydrologic function of all AVFs affected by mining	Monitoring to determine restoration of essential hydrologic functions of any declared AVF
Wetlands	Identifying all wetlands that would be affected by mining; Identifying jurisdictional wetlands (COE); Replacing all jurisdictional wetlands that would be disturbed by mining; Replacing functional wetlands as required by surface managing agency or surface land owner	Monitoring of reclaimed wetlands using same procedures used to identify premining jurisdictional wetlands
Vegetation	Permanently revegetating reclaimed areas according to a comprehensive revegetation plan using approved permanent reclamation seed mixtures consisting predominantly of species native to the area; Reclaiming 20 percent of reclaimed area with native shrubs at a density of one per square meter; Controlling erosion on reclaimed lands prior to seeding with final seed mixture using mulching, cover crops, or other approved measures; Chemically and mechanically controlling weed infestation; Direct hauling of topsoil; Selectively planting shrubs in riparian areas; Planting sagebrush; Creating depressions and rock piles; Using special planting procedures around rock piles; Posting reclamation bond covering the cost of reclamation	Monitoring of revegetation growth & diversity until release of final reclamation bond (minimum 10 years); Monitoring of erosion to determine need for corrective action during establishment of vegetation; Use of controlled grazing during revegetation evaluation to determine suitability for postmining land uses

¹ These requirements, mitigation plans, and monitoring plans are in place for the existing North Antelope/Rochelle Complex, Black Thunder, North Rochelle and Antelope Mines in their current approved mining and reclamation plans (the No Action Alternatives). If the NARO North, NARO South, Little Thunder, West Roundup or West Antelope LBA Tracts are leased, these requirements, mitigation plans, and monitoring plans would be part of a mining plan revision covering the NARO North, NARO South, Little Thunder, West Roundup or West Antelope LBA Tracts that must be approved before mining can occur on the tract under the Proposed Action, Alternative 2 or 3.

Table 4-16. Regulatory Compliance, Mitigation and Monitoring Measures required under each Proposed Action, Alternative 1 (No Action), Alternative 2, or Alternative 3. (Continued)

Resource	Regulatory Compliance or Mitigation Required by Stipulations or Required by State or Federal Law ¹	Monitoring ¹
Wildlife	Restoring premining topography to the maximum extent possible; Planting a diverse mixture of grasses, forbs and shrubs in configurations beneficial to wildlife; Designing fences to permit wildlife passage; Raptor-proofing power transmission poles; Creating artificial raptor nest sites; Increasing habitat diversity by creating rock clusters and shallow depressions on reclaimed land; Cottonwood plantings along reclaimed drainages; Replacing drainages, wetlands and AVFs disturbed by mining; Reducing vehicle speed limits to minimize mortality; Instructing employees not to harass or disturb wildlife; Preparing raptor mitigation plans	Baseline & annual wildlife monitoring surveys; Monitoring for Migratory Birds of Management Concern
Threatened, Endangered, Proposed, & Candidate Species	Avoiding bald eagle disturbance; Restoring bald eagle foraging areas disturbed by mining; Restoring mountain plover habitat disturbed by mining; Using raptor safe power lines; Surveying for Ute ladies' tresses; Surveying for mountain plover; Searching for black-footed ferrets if prairie dogs move onto tract	Baseline and annual wildlife monitoring surveys
Land Use	Suitably restoring reclaimed area for historic uses (grazing and wildlife)	Monitoring of controlled grazing prior to bond release evaluation
Cultural Resources	Conducting Class I & III surveys to identify cultural properties on all state and federal lands and on private lands affected by federal undertakings; Consulting with SHPO to evaluate eligibility of cultural properties for the NRHP; Avoiding or recovering data from significant cultural properties identified by surveys, according to an approved plan; Notifying appropriate federal personnel if historic or prehistoric materials are uncovered during mining operations; Instructing employees of the importance of and regulatory obligations to protect cultural resources	Monitoring of mining activities during topsoil stripping; Cessation of activities and notification of authorities if unidentified sites are encountered during topsoil removal

¹ These requirements, mitigation plans, and monitoring plans are in place for the existing North Antelope/Rochelle Complex, Black Thunder, North Rochelle and Antelope Mines in their current approved mining and reclamation plans (the No Action Alternatives). If the NARO North, NARO South, Little Thunder, West Roundup or West Antelope LBA Tracts are leased, these requirements, mitigation plans, and monitoring plans would be part of a mining plan revision covering the NARO North, NARO South, Little Thunder, West Roundup or West Antelope LBA Tracts that must be approved before mining can occur on the tract under the Proposed Action, Alternative 2 or 3.

Table 4-16. Regulatory Compliance, Mitigation and Monitoring Measures required under each Proposed Action, Alternative 1 (No Action), Alternative 2, or Alternative 3. (Continued)

Resource	Regulatory Compliance or Mitigation Required by Stipulations or Required by State or Federal Law¹	Monitoring¹
Native American Concerns	Notifying Native American tribes with known interest in this area of leasing action and request for help in identifying potentially significant religious or cultural sites	No specific monitoring program
Paleontological Resources	Notifying appropriate federal personnel if potentially significant paleontological sites are discovered during mining	No specific monitoring program
Visual Resources	Restoring landscape character during reclamation through return to approximate original contour and revegetation with native species	No specific monitoring program
Noise	Protecting employees from hearing loss	MSHA inspections
Transportation Facilities	Relocating existing pipelines, if necessary, in accordance with specific agreement between pipeline owner and coal lessee	No specific monitoring program
Socioeconomics	Paying royalty and taxes as required by federal, state, and local regulations	Surveying and reporting to document volume of coal removed
Hazardous & Solid Waste	Disposing of solid waste and sewage within permit boundaries according to approved plans; Storing and recycling waste oil; Maintaining of files containing Material Safety Data Sheets for all chemicals, compounds, and/or substances used during course of mining; Ensuring that all production, use, storage, transport, and disposal of hazardous materials is in accordance with applicable existing or hereafter promulgated federal, state, and government requirements; Complying with emergency reporting requirements for releases of hazardous materials as established in CERCLA, as amended; Preparing and implementing spill prevention control and countermeasure plans, spill response plans, inventories of hazardous chemical categories pursuant to Section 312 of SARA, as amended; Preparing emergency response plans	No specific monitoring other than required by these other regulations and response plans

¹ These requirements, mitigation plans, and monitoring plans are in place for the existing North Antelope/Rochelle Complex, Black Thunder, North Rochelle and Antelope Mines in their current approved mining and reclamation plans (the No Action Alternatives). If the NARO North, NARO South, Little Thunder, West Roundup or West Antelope LBA Tracts are leased, these requirements, mitigation plans, and monitoring plans would be part of a mining plan revision covering the NARO North, NARO South, Little Thunder, West Roundup or West Antelope LBA Tracts that must be approved before mining can occur on the tract under the Proposed Action, Alternative 2 or 3.

- Section 4.1.10, mitigation measures to minimize habitat loss impacts to songbirds;
- Section 4.1.13, protection of cultural resources that are recommended eligible for or of undetermined eligibility for the NRHP; and
- Appendix G, protection of threatened, endangered, proposed, and candidate species.

If impacts are identified during the leasing process that are not mitigated by existing required mitigation measures, BLM can include additional mitigation measures, in the form of stipulations on the new lease, within the limits of its regulatory authority. In general, the levels of mitigation and monitoring required for surface coal mining by SMCRA and Wyoming state law are more extensive than those required for other surface disturbing activities; however, concerns are periodically identified that are not monitored or mitigated under existing procedures.

An example of this type of issue is the concern about the release of NO_x from blasting, and the resulting formation of low-lying orange clouds that can be carried outside the mine permit areas by wind. After this was identified as a potential health concern in the area of the Wyoming PRB surface coal mines, a monitoring program measuring NO₂ concentrations in areas accessible to the public near PRB coal mining operations was conducted in 1999 (see discussion in Section 4.1.4). In addition, WDEQ has directed some PRB mines to take steps designed to mitigate the effects of NO₂ emissions occurring from

overburden blasting. The steps that may be required include: public notifications (in the form of warning signs along public roadways for example); temporary closure of public roadways near a mine during and after a blast; establishment of safe set-back distances from blasting areas; prohibiting blasting when wind direction is toward a neighbor; prohibiting blasting during temperature inversions; establishment of monitoring plans; estimation of NO₂ concentrations; and development of blasting procedures that will protect public safety and health.

After reviewing the required mitigation and monitoring in the current North Antelope/Rochelle Complex, Black Thunder, North Rochelle, and Antelope Mine's Mining and Reclamation Permits and the historical monitoring results in the North Antelope/Rochelle Complex, Black Thunder, North Rochelle, and Antelope Mine's annual mine reports to the WDEQ, the BLM has not identified additional special stipulations that should be added to the BLM lease or areas where additional or increased monitoring measures are recommended.

4.4 Residual Impacts

Residual impacts are unavoidable impacts that cannot be mitigated and would therefore remain following mining and reclamation.

4.4.1 Topography and Physiography

Topographic moderation is a permanent consequence of mining. The indirect impacts of topographic

moderation on wildlife habitat diversity would also be considered permanent.

4.4.2 Geology and Minerals

Geology from the base of the coal to the surface would be subject to significant, permanent change. CBM resources not recovered prior to mining would be vented to the atmosphere and permanently lost.

4.4.3 Soils

Existing soils would be mixed and redistributed, and soil-forming processes would be disturbed by mining. This would result in long-term alteration of soil characteristics.

4.4.4 Air Quality

No residual impacts to air quality would occur following mining.

4.4.5 Water Resources

The area of coal and overburden removal and replacement of overburden and associated groundwater drawdowns would be increased under the action alternatives compared with the area of coal and overburden removal and overburden replacement and associated groundwater drawdowns if one or more of the five LBA tracts is not leased and mined. The postmining backfill may take in excess of 100 years to reach equilibrium water levels and water quality. Less time would be required near the mining boundaries. Water level and water quality in the backfill would be suitable to provide water to

wells for livestock use, but would be different from premining conditions.

4.4.6 Alluvial Valley Floors

No residual impacts to AVFs would occur following mining.

4.4.7 Wetlands

Replaced wetlands (jurisdictional or functional) may not duplicate the exact function and landscape features of the premining wetland, but all wetland replacement plans would be approved by COE.

4.4.8 Vegetation

Reclaimed vegetative communities may never completely match the surrounding native plant community.

4.4.9 Wildlife

Although the LBA tracts would be reclaimed to be as near original condition as possible, there would be some residual wildlife impacts. The topographic moderation would result in a permanent loss of habitat diversity and a potential decrease in slope-dependent shrub communities. This would reduce the carrying capacity of the land for shrub-dependent species.

4.4.10 Threatened, Endangered, Proposed, and Candidate Species and USFS Region 2 Sensitive Species

No residual impacts to T&E, proposed, or candidate species are expected. No residual impacts to USFS Region 2 Sensitive Species are expected.

4.4.11 Land Use and Recreation

No residual impacts to land use and recreation are expected.

4.4.12 Cultural Resources

Cultural sites that are determined to be eligible for the NRHP would be avoided if possible. Eligible sites that cannot be avoided would be destroyed by surface coal mining after data from those sites is recovered. Sites that are not eligible for the NRHP would be lost.

4.4.13 Native American Concerns

No residual impacts to Native American concerns have been identified.

4.4.14 Paleontological Resources

No residual impacts to significant paleontological resources are expected.

4.4.15 Visual Resources

No residual impacts to visual resources are expected.

4.4.16 Noise

No residual impacts to noise are expected.

4.4.17 Transportation Facilities

No residual impacts to transportation facilities are expected.

4.4.18 Socioeconomics

No residual impacts to socioeconomics are expected.

4.5 Cumulative Impacts

Cumulative impacts result from the incremental impacts of an action added to other past, present, and reasonably foreseeable future actions, regardless of who is responsible for such actions. Cumulative impacts can result from individually minor, but collectively significant, actions occurring over time.

This section briefly summarizes the cumulative impacts that are occurring as a result of existing development in the area of the North Antelope/Rochelle Complex, Black Thunder Mine, North Rochelle Mine, and Antelope Mine and considers how those impacts would change if the NARO North and South, Little Thunder, West Roundup, and West Antelope LBA Tracts are leased and mined as proposed and if other proposed development in the area occurs.

Since decertification of the Powder River Federal Coal Region in 1990, the Wyoming State Office of the BLM has held 15 competitive coal lease sales and issued 11 new federal coal leases containing approximately 3.178 billion tons of coal using the LBA process (Table 1-1). In 1992 and 1993, this leasing process underwent the scrutiny of two appeals to the Interior Board of Land Appeals and one audit by the General Accounting Office.

The Wyoming BLM has pending applications for nine additional maintenance tracts for existing mines containing about 2.3 billion tons of coal (Table 1-2). All of the pending applications have been reviewed and

recommended for processing by the PRRCT.

BLM completed one exchange in the PRB in 2000, authorized by Public Law 95-554. Under this exchange, EOG resources (formerly Belco) received a federal lease for a 106-million ton portion of the Hay Creek Tract adjacent to the Buckskin Mine in exchange for the rights to a 170-million ton coal lease near Buffalo, Wyoming that is unmineable due to construction of Interstate Highway 90 (BLM 1999b). A coal exchange proposed by Pittsburg and Midway Coal Mining Company is also currently being evaluated. As proposed, federal coal in Sheridan County, Wyoming would be exchanged for privately owned lands and minerals in Lincoln, Carbon, and Sheridan Counties, Wyoming.

Four regional EISs evaluating surface coal development in the PRB in Wyoming were previously prepared. They are:

Final Environmental Impact Statement, Eastern Powder River Basin of Wyoming, BLM, October 1974;

Final Environmental Impact Statement, Proposed Development of Coal Resources in the Eastern Powder River Basin of Wyoming, BLM, March 1979;

Final Powder River Regional Coal Environmental Impact Statement, BLM, December, 1981; and

Draft Environmental Impact Statement for Round II Coal Lease Sale in the Powder River Region, BLM, January 1984.

Since 1989, coal production in the PRB has increased by an average of 6.8 percent per year. The increasing state production is primarily due to increasing sales of low-sulfur, low-cost PRB coal to electric utilities who must comply with Phase I requirements of Title III of the 1990 Clean Air Act Amendments. Electric utilities account for 97 percent of Wyoming's coal sales. In 2001, approximately 30 percent of the coal mined in the United States came from the PRB.

The currently operational mines in Campbell and northern Converse Counties are shown in Figure 1-1. Their current status and ownership are shown in Table 4-17. There have been numerous changes in mine ownership during the last decade, and this has resulted in mine consolidations and mine closings within the basin.

The mines are located just west of the outcrop of the Wyodak coal, where the coal is at the shallowest depth. The mines in Campbell and Converse Counties currently produce over 96 percent of the coal produced in Wyoming each year. Table 4-18 summarizes predicted coal mining activity (from the 1979 and 1981 regional EISs) with actual activity that has occurred since the EISs were prepared.

Campbell and Converse Counties' oil production decreased to 14.3 million barrels of oil in 2001 from 32.8 million barrels in 1992, a 56.4 percent decrease. Oil production throughout Wyoming is expected to continue to decline, since exploration and production drilling has been very

Table 4-17. Status of Wyoming PRB Coal Mines.

2002 Mine	1994 Mine Operator	Coal Production ¹		2001 Mine Operator	Coal Production ¹		Status/Comments
		1993 Actual ²	1994 Permitted ⁴		2001 Actual ³	2002 Permitted ⁴	
Buckskin	SMC (Zeigler)	11.18	24.0	Vulcan Capital Mgmt	19.18	27.5	Active
Clovis Point	Kerr-McGee	0.00	4.0	Wyodak Resources	0.00	0.0	Mine shut down/leases relinquished or sold; facilities sold; Wyodak has AQD permit; part of Wyodak Mine
Dry Fork	Phillips/WFA	3.28	15.0	WFA	4.03	15.0	Active
Eagle Butte	Cyprus-Amax	16.70	29.6	RAG American	24.83	35.0	Active
Fort Union	Fort Union Ltd	0.06	9.3	Kennecott/KFx	0.00	9.4	Inactive
Rawhide	Carter (Exxon)	9.86	24.0	Peabody	0.00	24.0	Reopening
Wyodak	Wyodak Resources	3.03	10.0	Wyodak Resources	3.52	12.0	Active
NORTHERN MINE GROUP TOTALS		44.11	115.9		51.56	122.9	
Belle Ayr	Cyprus-Amax	15.59	25.0	RAG American	11.75	45.0	Active
Caballo	Carter (Exxon)/ Western Energy	15.42	40.0	Peabody	27.12	40.0	Active/Caballo Mine + former Rocky Butte & West Rocky Butte leases
Cordero-Rojo Complex	Kennecott/ Drummond	21.01	44.0	Kennecott	43.49	65.0	Active/Cordero + Caballo Rojo Mines
Coal Creek	ARCO	0.11	18.0	Arch	0.00	18.0	Standby
CENTRAL MINE GROUP TOTALS		52.13	127.0		82.36	168.0	
Antelope	Kennecott	7.29	12.0	Kennecott	24.64	30.0	Active
Black Thunder	ARCO	34.32	36.0	Arch	67.63	100.0	Active
Jacobs Ranch	Kerr-McGee	18.39	25.0	Kennecott	29.33	50.0	Active
N. Antelope/ Rochelle Complex	Peabody	32.94	50.0	Peabody	74.78	85-105.0	Active/North Antelope Mine + Rochelle Mine
N. Rochelle	SMC (Zeigler)	0.02	8.0	Vulcan Capital Mgmt	23.87	35.0	Active/facilities constructed in 1998-99
SOUTHERN MINE GROUP TOTALS		92.96	131.0		220.25	300-320.0	
TOTALS FOR 3 MINE GROUPS		189.2	373.9		354.17	590.9-610.9	

¹ Actual production (million tons) on left, permitted production (million tons) on right.

² Source: Wyoming State Geological Survey *GEO-NOTES*, August 1994.

³ Source: Wyoming State Inspector of Mines *ANNUAL REPORT* for 2001.

⁴ Source: Judy Shamley, WDEQ/AQD, personal communication March 28, 2002. Figures are permitted capacity as of October 1, 2000.

Table 4-18. Coal Production and Development Levels, Campbell and Converse Counties, Wyoming.

	Coal Production (Million Tons)	Number of Active Coal Mines	Number of Existing Power Plants	Number of Active Coal Enhancement Facilities	Direct Coal Employment	Average Price-NE Wyoming
1979 Predictions for 1990	174.3	15	2	1	3,889	na
1981 Predictions for 1990	318.4	37	3	1	11,900	na
Actual 1990	162.6	18	3	1	2,862	\$6.86
Actual 1995	246.5	19	4	1	3,177	\$5.60
Actual 1996	261.1	18	4	2	3,274	\$5.40
Actual 1997	264.1	18	4	2	3,164	\$5.03
Actual 1998	297.5	16	4	2	3,348	\$4.73
Actual 1999	320.3	15 ¹	4	2	3,362	\$4.57
Actual 2000	323.1	12	4	2	3,335	\$4.93
Actual 2001	354.1	15	4	0	3,636	\$5.08
Existing Power Plants:	PP&L Dave Johnston, PP&L Wyodak, Black Hills Power and Light Simpson #1, Black Hills Power and Light Simpson #2, and Black Hills Power and Light’s two natural gas power plants (40Mw each) at Wyodak site.					
Proposed New Power Plants:	Reasonably Foreseeable: NAPG Two Elk, Black Hills Corporation Wygen I, and Black Hills Corporation Wygen II. Not Reasonably Foreseeable: NAPG Two Elk Unit Two and NAPG Middle Bear.					
Existing Coal Enhancement:	SGI International ENCOAL Plant - Buckskin Mine (inactive), KFx K-Fuels Coal Pellet Plant - Fort Union Mine (inactive), and Wyodak Eartheo (inactive).					
¹ Includes the Dave Johnston Mine, which is not included in Table 4-17.						
Sources:	1979 and 1981 BLM PRB Regional EISs, Wyoming State Geological Survey GEO-NOTES-1996-2001, and Wyoming State Inspector of Mines Annual Reports, 1990-2001. Donald R. McKenzie, WDEQ/LQD, personal communication March 29, 2002.					

weak and old oil fields with declining production produce most of Wyoming's oil (WSGS 2002a).

Natural gas production has been increasing, particularly in Campbell County, due to the development of shallow CBM resources west of the coal mines. CBM exploration and development is currently ongoing throughout the PRB in Wyoming.

Since the early 1990s, the BLM has completed numerous EAs and three EISs analyzing CBM projects. The latest of these is the *Draft Environmental Impact Statement and Draft Planning Amendment for the Powder River Basin Oil and Gas Project*, which was completed in January 2002. The project area for this EIS includes almost eight million acres of mixed federal, state, and private lands within the Wyoming portion of the PRB. This EIS analyzes the cumulative impacts of reasonably foreseeable CBM and conventional oil and gas development. It will be used to update the BLM planning documents in the area of proposed CBM development. The impacts of drilling, completing, operating, and reclaiming almost 39,400 new federal, state, and private CBM wells in addition to the roughly 12,100 federal, state, and private CBM wells already drilled or permitted for the project area. The draft EIS also analyzes the impacts of developing 3,200 new conventional oil and gas wells, as well as constructing, operating, and reclaiming various ancillary facilities needed to support the new CBM and conventional wells, including roads, pipelines for gathering gas and produced water, electrical utilities, and compressors

(BLM 2002a). A final EIS is in preparation. CBM resources were not being developed when the regional coal EISs (BLM 1974, 1979, 1981, and 1984) were prepared.

CBM wells can be drilled on private and state oil and gas leases after approval by the WOGCC and the Wyoming SEO. BLM must analyze the individual and cumulative environmental impacts of all drilling (federal, state, and private), as required by NEPA, before CBM drilling on the federal oil and gas leases can be authorized. BLM does not authorize drilling on state or private leases but must consider the impacts from those wells in their NEPA analyses. In many areas of the PRB the coal estate is federally owned, but the oil and gas estate is privately owned. A June 7, 1999 Supreme Court decision (98-830) assigned the rights to develop CBM on a piece of land to the owner of the oil and gas estate.

Other mineral development levels in the Wyoming PRB are currently lower than predicted in the regional EISs. In the 1970s, significant uranium development was anticipated in southwest Campbell County and northwest Converse County. This development did not materialize because the price of uranium dropped in the early 1980s. There are currently two *in situ* uranium operations in Converse County, but no mines and no mills. There were three active *in situ* operations in the PRB in 1999, but one of them, located in southeastern Johnson County, has since ceased operations. The spot market price of uranium has increased from a low of \$7.10 per

pound of yellowcake on December 13, 2000 to \$9.90 per pound in late February 18, 2002 (WSGS 2002b).

Scoria is quarried for use as road surfacing material, primarily by coal mines but also by a few excavation and construction firms. Bentonite is mined in parts of the Wyoming PRB, but not in Campbell or Converse Counties.

The five LBA tracts included in this EIS are situated within a nearly continuous corridor of five coal mines in southern Campbell and northern Converse Counties, Wyoming (Figures 1-1 and 3-1). This southern mine corridor is approximately 24 miles long and eight miles wide. Production of coal in this southern mine group began in 1977 at the Black Thunder Mine. The current maximum permitted production rate for these five mines is 300 to 320 mmtpy (Table 4-17). Nine maintenance leases, including approximately 25,935 acres of federal coal, have been issued to mines in this southern group since decertification (Jacobs Ranch, West Black Thunder, North Antelope/Rochelle, Antelope, North Rochelle, Powder River, Thundercloud, Horse Creek and North Jacobs Ranch--see Table 1-1).

CBM wells have been drilled around all five mines in the southern mine corridor. CBM drilling and production is expected to continue in the areas around the coal mines, and on the LBAs. Due to the proximity of the coal mining and CBM production operations, cumulative impacts to groundwater, surface water, air quality and wildlife have occurred and are likely to continue as more CBM

resources are developed adjacent to existing surface coal mines. These impacts are included in the following cumulative impact discussion for these resources.

In addition to the ongoing coal mining and leasing and the CBM development, there are other projects which are in progress or have been proposed in the Wyoming PRB. These projects include the Wygen I 90-Mw coal-fired power plant currently under construction by Black Hills Corporation near the Wyodak Mine east of Gillette; the Two Elk 300-Mw coal-fired power plant proposed for construction by NAPG east of the Black Thunder Mine; the Wygen II 500-Mw coal-fired power plant that would be built near Wyodak Mine east of Gillette by Black Hills Corporation; the proposed DM&E rail line; the Two Elk Unit Two 500-Mw coal-fired power plant, which NAPG also proposes to build east of the Black Thunder Mine; construction and operation by NAPG of another 500-Mw coal-fired power plant, the Middle Bear facility, near the Cordero-Rajo Mining Complex; and the ENCOAL coal enhancement facility, which was proposed for construction at the North Rochelle Mine but has been indefinitely delayed.

Some of these projects have advanced farther along in their respective planning and permitting processes than others and are therefore more likely to be completed in the foreseeable future. At this time, based on the status of their planning and permitting efforts, the Black Hills Corporation Wygen I and Wygen II coal-fired power plants, the NAPG

Two Elk coal-fired power plant, and the proposed DM&E rail line are considered reasonably foreseeable developments based on the status of their planning and permitting efforts. The NAPG Two Elk Unit Two coal-fired power plant and the NAPG Middle Bear coal-fired power plant are proposals which are not reasonably foreseeable at this time, and the ENCOAL coal enhancement facility is indefinitely postponed.

The two NAPG Two Elk plants and the DM&E railroad project, due to their locations, could have directly overlapping impacts with the impacts of mining the five proposed SPRB LBA Tracts.

The proposed Wygen I and II plants would be located at the Black Hills Corporation energy complex near Gillette, and the proposed NAPG Middle Bear plant would be located at the Cordero Rojo Complex. The impacts of mining the five proposed SPRB LBA Tracts would not be expected to directly overlap with the impacts of building and operating these power plants.

The planned NAPG Two Elk power plant would be a coal-fired power plant located east of Black Thunder Mine and would generate 310-Mw. The plant would burn low-Btu “waste coal” and coal fines from nearby mines as well as sub-bituminous coal in a pulverized coal boiler. The ability to burn low Btu waste coal and fines would allow the Two Elk plant to recover fuel values that might otherwise be lost and thereby generate electric power more efficiently than existing coal-fired plants. Coal and waste coal would be

transported from area mines to the power plant by direct truck haul on unpaved roads, and ash would be returned to the mines by enclosed, four-wheel off-highway trucks. According to NAPG, the project has all of the permits needed except for ROW permission from the USFS to provide access for a transmission line to the power plant (Gillette News-Record 2002a). Construction has been delayed while NAPG has been attempting to secure a partner to share the cost of constructing the plant. NAPG’s most recent estimates are that the project would employ a temporary construction workforce of up to 700 persons and a permanent workforce of 50. Construction could begin in 2002 (Casper Star Tribune 2002).

The Black Hills Corporation Wygen I power plant, which is now under construction, will be a 90-Mw coal-fired power plant located near Gillette, Wyoming. According to a September 27, 2000 press release, the plant would burn approximately 500,000 tons of low-sulfur coal annually. The coal could be mined at the adjacent Wyodak Mine. The plant is expected to be operational by early 2003 (Gillette News-Record 2002c). Black Hills Corporation estimates that the project will employ about 300 people during the construction period.

Black Hills Energy Capital, Inc., the independent power subsidiary of Black Hills Corporation, initiated the permitting process to build the 500-Mw Wygen II power plant in 2002. The proposed plant would adjoin its other generating plant (Wygen I) near Gillette. It would be similar in

features to the existing 360-Mw Wyodak power plant at the same location. Construction could begin on the Wygen II plant in 2003 (Gillette News-Record 2002c), and it could be operational by mid-2005 (Black Hills Corporation 2001).

The Surface Transportation Board preliminarily approved the DM&E Railroad expansion plan (to build 280 miles of new track in the PRB and to rehabilitate approximately 600 miles of track across South Dakota and Minnesota) on December 11, 1998. The approval was made pending the completion of an analysis of the environmental impacts of the project. The Surface Transportation Board released the DEIS for public comment in September 2000, and the FEIS for the DM&E PRB Expansion Project was issued November 19, 2001. On January 30, 2002 the Surface Transportation Board announced its final approval for the DM&E PRB Expansion Project, subject to a number of environmental mitigation conditions and the requirement that DM&E use an environmentally preferable route that avoids sensitive areas along the Cheyenne River. DM&E's originally proposed route in Wyoming generally followed along the Cheyenne River valley.

DM&E had originally proposed to start construction in 1999 and complete the new railroad line in 2001; however, final approval and construction could not take place until after the environmental analysis was completed. DM&E must still obtain permits or approvals from other agencies including the BLM, USFS, and COE, and several lawsuits were filed against the proposal

following the Surface Transportation Board's approval of the project (WSGS 2002b).

NAPG has also announced plans to build the Two Elk Unit Two power plant, a 500-Mw facility, near the Two Elk plant adjacent to the Black Thunder Mine and the Middle Bear power plant, also a 500-Mw facility, next to the Cordero-Rojo Complex (Casper Star-Tribune 2001). The Two Elk Unit Two plant, like the Two Elk plant, would burn "waste coal" from nearby mines, while the Middle Bear plant would burn commercial-grade coal from nearby mines. If all the necessary permits and funding can be secured, NAPG originally anticipated that construction of the Two Elk Unit Two plant, which would burn about three million tons of coal per year, would occur from 2006 to 2009, and construction of the Middle Bear plant would occur from 2003 to 2006. These NAPG-proposed power plants would employ up to 1,500 temporary construction workers each (Pederson Planning Consultants 2001).

The rate of reclamation is one aspect of the surface coal mining operations where the actual levels reached in 1990 and 1995 did not meet the levels predicted for 1990 and 1995 in the regional EISs. According to the "Annual Evaluation Summary Report for the Coal Regulatory Program Administered by the Land Quality Division of the Wyoming Department of Environmental Quality for Evaluation Year 2001" (OSM 2002), in 1997, the Casper Field Office of OSM and WDEQ/LQD reviewed four mine sites in Wyoming for compliance with contemporaneous reclamation requirements and compared on-the-

ground reclamation with the approved reclamation plan in the respective permit for each of those mines. In that review, OSM and WDEQ/LQD found that the mine permits they reviewed did not set clear and concise time schedules and requirements for contemporaneous reclamation. In response to those findings, WDEQ/LQD agreed to review required reclamation schedules in all permits and revise the annual reporting format to include information about contemporaneous reclamation progress. In 2001, contemporaneous reclamation was evaluated at four randomly assigned mines. According to the OSM report cited above, the 2001 evaluation of contemporaneous reclamation “showed that reclamation was following mining disturbance at a reasonable rate. The reclamation rate at all four mines was at least 90 percent for the areas disturbed for the previous twelve months. In addition, the standards for measuring reclamation contained in the four permits were reasonably clear and concise.” However, OSM’s 2001 annual evaluation summary report also indicated that different conditions were found during inspections of other mine sites and indicated that some problems with contemporaneous reclamation standards still persist at certain mines.

OSM tracks the ratio of acres of permanent reclamation each year to acres of net disturbance available for reclamation each year. Areas not available for reclamation include things such as stockpiles, active pits, access roads, haul roads, railroad ROWs, coal preparation and loading

sites, offices, shops, sediment ponds, and other long-term approved uses. For the 2001 evaluation year, there was a four percent increase in annual acres of reclamation and a 31 percent decrease in annual acres of newly disturbed lands in Wyoming. The ratio of reclamation to net disturbance for the 2001 evaluation year was 1.43. When the ratio is greater than 1.0, the reclamation is greater than the net disturbance. Since 1990, the ratio of reclamation to net disturbance has ranged from a low of 0.40 in 1997 to a high of 1.43 in 2001 (OSM 2002).

Some of the factors that affect achievement of contemporaneous reclamation standards include changing strip ratios which create material surpluses or deficits, using stockpiles to provide material to fill final pit voids or to store new pit boxcut material, changing the direction of mining pits to conform to lease configuration, changing plans to accommodate production growth, and changes in technology or mining method.

Currently, WDEQ/LQD suggests to operators that only large, contiguous areas such as drainage basins be considered for bond release, with the assurance that the area will not be disturbed in the future. Because many mine plans cross a drainage basin several times during the life of mine, final reclamation of some drainage basins may not occur until late in the life of mine.

4.5.1 Topography and Physiography

Following surface coal mining and reclamation, topography will be

modified in an elongated corridor east of and paralleling Highway 59 from just north of Gillette, south for about 75 miles. The topography in the PRB is characterized by relatively flat or rolling topography. After reclamation, these characteristics will be emphasized in the reclaimed area. In general, in the mining corridor, premining features that were more topographically unique (e.g., steeper hills, gullies, and rock outcrops) will be smoothed. As indicated in Section 4.1.1, the premining topography of the LBA tracts is relatively flat to gently rolling, and the expected postmining topography for these tracts is expected to be similar to the premining topography. The carrying capacity for big game may be lower in the mining corridor as a result of the overall reduction in topographic diversity following reclamation. Big game ranges are generally large and extend outside of the mining corridor. Also, mining activities are, in general, not located in habitats defined as crucial; no crucial habitat is included in any of the LBA tracts considered in this EIS. The overall flattening and lowering of the topography would result in increased infiltration of surface water and reduced peak flows from the drainages. These changes would be limited because the streams typically flow from west to east across the area rather than north to south along the entire corridor. Therefore, only a small part of each stream's drainage area would be disturbed (see Section 4.5.5). There would be no substantial cumulative impacts to topography and physiography due to the proximity of CBM development and the proposed railroad line and power plants to the coal mining operations in this area because the

construction and operation of those projects would cause minimal topographic and/or physiographic changes.

4.5.2 Geology and Minerals

The PRB coalfield encompasses an area of about 12,000 square miles. Finley and Goolsby (2000) estimate that there are approximately 587 billion tons of coal in beds thicker than 20 ft and deeper than 200 ft in the basin. The remaining strippable Wyodak coal reserves (with 200 ft or less of overburden) are estimated at 15.5 billion short tons (WSGS 2002b). Converse County has a total area of 4,050 square miles of which slightly less than one percent is within current mine permit boundaries. Campbell County has a total area of about 4,760 square miles, of which approximately four percent is within current mine permit boundaries. Coal mining in this area currently disturbs about 3,000 acres annually. Mining and reclamation rates are expected to continue to increase through the year 2015. In the PRB, the coal reserves currently leased represent a small percentage of the total coal reserves but a large percentage of the shallowest (hence the most economical to recover) coal reserves. Within the southern group of five mines, approximately 47,500 acres of federal coal are currently leased. This is about a 75 percent increase over the 27,160 acres of federal coal that were leased in the southern group of mines in 1990, prior to decertification. Under the Proposed Actions, approximately 13,365 additional acres of federal coal would be leased, which would represent a 28 percent increase in the

area of leased federal coal in the southern group of five mines. The area of disturbance associated with mining these leases, which would be greater than the leases themselves, is discussed in other parts of this analysis (e.g., Section 4.5.3).

Coal and CBM are non-renewable resources that form as organic matter decays and undergoes chemical changes over geologic time. The CBM and coal resources that are removed to generate heat and power would not be available for use in the future. No potential damages to the coal resulting from removal of the CBM and water prior to mining have been identified. The CBM operators generally do not completely dewater the coal beds to produce the CBM because that could damage fractures in the coal and limit CBM production. Construction of the proposed railroad line and power plants would not impact the geology or mineral resources in the area, so there would be no overlapping impacts related to these projects.

4.5.3 Soils

The five existing southern mines would disturb approximately 66,582 acres throughout their combined lives (they would disturb approximately 2,000 acres annually during active mining at the currently planned mining rates). The annual disturbance rate would remain at approximately 2,000 acres if the NARO North, NARO South, Little Thunder, West Roundup, and West Antelope LBA Tracts are leased. If all five LBA tracts are leased and mined under the Proposed Actions, the disturbance area in the southern

group of mines would increase to approximately 83,957 acres. This would represent an additional 26.1 percent increase in disturbance. Assuming 10 years from initial disturbance to utilization of parcels of reclaimed land by domestic livestock, approximately 20,000 acres (16.2 percent disturbed by Jacobs Ranch Mine, 31.0 percent by North Antelope/Rochelle Complex, 28.5 percent by Black Thunder Mine, 10.0 percent by North Rochelle Mine, and 14.3 percent by Antelope Mine) would be unavailable for such use at any given time during active mining. The replaced topsoil would support a stable and productive native vegetation community adequate in quantity and quality to support planned postmining land uses (i.e., rangeland and wildlife habitat).

Additional, although less extensive, soil disturbance would be associated with the proposed CBM development west of the mines, and with construction of the proposed power plants and railroad line.

4.5.4 Air Quality and Climate

The EPA CALPUFF dispersion model was used with meteorological data generated by the MM5 (mesoscale model) and CALMET models to perform air pollutant dispersion modeling to quantify potential PM₁₀ and SO₂ impacts related to proposed oil and gas development, including CBM development, in the PRB in northeastern Wyoming and southeastern Montana. The modeling was conducted to analyze potential air quality impacts from the oil and gas development alternatives being considered in the Wyoming *Final EIS*

and Draft Planning Amendment for the Powder River Basin Oil and Gas Project (BLM 2003) and the Montana Final Statewide Oil and Gas EIS and Proposed Amendment of the Powder River and Billings RMPs (BLM in press). These documents will be referred to as the “Wyoming PRB Oil and Gas Project EIS” and the “Montana Statewide EIS,” respectively, in the following discussion. The Wyoming Project Area for this air quality analysis includes Campbell, Sheridan, Johnson, and northern Converse Counties. The Montana Project Area for this air quality analysis includes all of Carter, Powder River, Big Horn, Yellowstone, Carbon, Stillwater, Sweetgrass, Wheatland, Golden Valley, Musselshell, and Treasure Counties and portions of Rosebud and Custer Counties. The General Analysis Area for this EIS (the South PRB Coal EIS) is located in southern Campbell and northern Converse Counties, Wyoming, which lies near the southeast corner of the Wyoming Project Area.

Surface coal mining operations in Montana and Wyoming were included in the air quality impact assessment as non-project sources (other reasonably foreseeable emission sources). Coal-related data supplied by the Wyoming and Montana BLM offices for the analysis include estimated coal production volume (based on coal demand forecasts), annual acreage disturbance, and approximate location of mining activity for active mines (based on the currently approved mining and reclamation plan for each mine) in Wyoming and Montana during the years when the overlapping impacts

of oil and gas development and other development were estimated to be the greatest.

Construction emissions related to the proposed oil and gas development would occur during potential road and well pad construction, well drilling, and well completion testing. During well completion testing, natural gas may be flared and exhausted. Since the burned natural gas is “sweet” (does not contain sulfur compounds), no objectionable odors are likely to occur.

Maximum potential near-field particulate matter emissions from traffic on unpaved roads and during well pad construction were used to predict the maximum 24-hour and annual average PM₁₀ concentrations. Maximum air pollutant emissions from each well would be temporary (i.e., occurring during a short construction period) and would occur in isolation, without significantly interacting with adjacent well locations. During construction, particulate matter emissions from well pad and resource road construction would be minimized by application of water. The control efficiency of the dust suppression was computed at 50 percent during construction. During production and maintenance, the oil and gas operators would not routinely employ dust abatement procedures on roads within the Wyoming PRB Oil and Gas Project EIS Project Area.

This analysis was prepared solely under the requirements of NEPA to assess and disclose reasonably foreseeable impacts to the public and BLM and USFS decision makers. The

air quality impact assessment was based on the best available engineering data and assumptions, meteorology data, and dispersion modeling procedures, as well as professional and scientific judgment. However, where specific data or procedures were not available, reasonable assumptions were incorporated. For example, the air quality impact assessment for Alternative 1 of the Wyoming PRB Oil and Gas Project EIS assumed that all CBM wells would go into production (no dry holes), then operate at full production levels (no shut-ins) for about 7 years, with an overall 20 year LOP. Potential direct project, indirect, and cumulative air quality impacts were analyzed to predict maximum potential near-field ambient air pollutant concentrations and potential HAP impacts, as well as to determine maximum far-field ambient air pollutant concentrations, visibility, and atmospheric deposition (acid rain) impacts. The methodologies used to predict and interpret potential air quality impacts are described in Appendix E.

Air pollution impacts are limited by state, tribal, and federal regulations, standards, and implementation plans established under the CAA and administered by the applicable air quality regulatory agencies (including WDEQ/AQD or the EPA). Although not applicable to the oil and gas development alternatives that were analyzed, the Departments of Environmental Quality for Montana, South Dakota, and Nebraska have similar jurisdiction over potential air pollutant emission sources in their respective states, which can have a cumulative impact with WDEQ/AQD

approved sources. Air quality regulations require proposed new, or modified existing air pollutant emission sources (including CBM compression facilities) undergo a permitting review before their construction can begin. Therefore, the applicable air quality regulatory agencies have the primary authority and responsibility to review permit applications and to require emission permits, fees, and control devices, prior to construction and/or operations related to oil and gas development.

The U.S. Congress (through the CAA Section 116) also authorized local, state, and tribal air quality regulatory agencies to establish air pollution control requirements more (but not less) stringent than federal requirements. As discussed in Chapter 1, BLM would not authorize mining by issuing leases for tracts considered in this EIS, but the impacts of mining the coal are considered because it is a logical consequence of issuing a lease. The NARO North, NARO South, Little Thunder, West Roundup, and West Antelope LBA Tracts were applied for by existing mines with air quality permits that have been approved by WDEQ/AQD. If an LBA tract is leased as a maintenance tract to an existing mine, that mine would have to modify its existing approved air quality permit and that modified permit would have to be approved before the LBA tract could be mined. Additional site-specific air quality analysis would be performed, and additional emission control measures (including a BACT analysis and determination) may be required by the applicable air quality regulatory

agencies to ensure protection of air quality.

In cases where BLM does authorize operations, such as approving a permit to drill an oil and gas well, under both FLPMA and the CAA, BLM cannot authorize any activity which does not comply with all applicable local, state, tribal, and federal air quality laws, statutes, regulations, standards, and implementation plans. An extensive air quality impact assessment technical support document was prepared to analyze potential impacts from the development alternatives, as well as other reasonably foreseeable emission sources, and is available for review (Argonne 2002).

The significance criteria for potential air quality impacts include state, tribal, and federally enforced legal requirements to ensure air pollutant concentrations will remain within specific allowable levels. These requirements include the NAAQS and WAAQS which set maximum limits for several air pollutants, and PSD increments which limit the incremental increase of certain air pollutants (including NO₂, PM₁₀, and SO₂) above legally defined baseline concentration levels. These legal limits were presented in Table 3-1.

Where legal limits have not been established, BLM uses the best available scientific information to identify thresholds of significant impacts. Thresholds have been identified for HAP exposure, incremental cancer risks, potential atmospheric deposition impacts to sensitive lakes, and a “just noticeable change” in potential visibility impacts.

4.5.4.1 Impacts Common to All Alternatives

The air quality impact analysis used market demand predictions in order to estimate levels of coal production in the PRB for modeling purposes. There is enough coal leased to the existing mines in the PRB to supply this market demand during the time of maximum CBM development activity in the PRB, which is the time when the maximum overlapping impacts to air quality would occur. As a result, the cumulative impacts predicted by the PRB air quality impact assessment would be the same under the Proposed Action and all of the Alternatives for leasing or not leasing federal coal considered in this EIS. Under the No-Action Alternatives (Alternative 1- not leasing the coal included in one or more of the LBA tracts) considered in this EIS, the currently approved mining operations on the existing leases would proceed as permitted. Under the Proposed Actions and Action Alternatives considered in this EIS, the mining operations would move onto the newly leased tracts and the period of time that the mines would be in operation would be extended or the period of maximum anticipated coal production at the existing mines (which are the currently approved rates at those mines) would be extended.

As discussed in Chapter 3, the major air pollutants emitted from surface coal mining activities are fugitive dust and tailpipe emissions from large mining equipment. Activities such as blasting, loading, and hauling of overburden and coal and the large areas of disturbed land all produce

dust. Stationary or point sources are associated with coal crushing, storage, and handling facilities. In general, particulate matter (PM₁₀) is the major significant pollutant from coal mine point sources. The measures that are being used to control air pollutant emissions from existing approved mining operations, which are also described in Chapter 3, include baghouse dust collection systems, PECs, or atomizers/foggers, paving mine access roads, applying water and chemical dust suppressants on all haul roads used by trucks and/or scrapers, limiting haul truck speeds, limiting material drop heights for shovels and draglines (bucket to truck bed or backfill), utilizing permanent and temporary revegetation of disturbed areas to minimize wind erosion, and utilizing stilling sheds at coal truck dumps. In addition, some of the mines are participating in the control of fugitive emissions from some nearby unpaved county roads by applying dust suppressants. These measures would be applied under all of the alternatives being considered in this EIS.

Air quality impacts related to oil and gas development would occur during construction (due to potential surface disturbance by earth-moving equipment, vehicle traffic fugitive dust, well testing, as well as drilling rig and vehicle engine exhaust) and production (including non-CBM well production equipment, booster [field] and pipeline [sales] compression engine exhausts). The amount of air pollutant emissions during construction would be controlled by watering disturbed soils and by air pollutant emission limitations

imposed by applicable air quality regulatory agencies. Maximum construction impacts from fugitive dust (24 hour PM₁₀) are estimated to be 55 µg/m³, about one third of the applicable WAAQS. Actual air quality impacts depend on the amount, duration, location, and emission characteristics of potential emissions sources, as well as meteorological conditions (wind speed and direction, precipitation, relative humidity, etc.).

The HAP impact analysis was based on a maximum assumed six-unit reciprocating compressor engine station, applicable for all proposed Wyoming PRB Oil and Gas Project EIS Alternatives, as described in Appendix E. Since neither the WDEQ-AQD nor EPA have established HAP standards, predicted 8-hour HAP concentrations were compared to a range of 8-hour state maximum Acceptable Ambient Concentration Levels (EPA 1997a). Formaldehyde was the only HAP predicted to exceed even the lowest threshold level. The maximum predicted cumulative 8-hour formaldehyde impact was 11.9 µg/m³, which is within the threshold range of 4.5 µg/m³ (Pinnellas County Air Pollution Control Board, Florida) to 71 µg/m³ (State of Nevada, Division of Environmental Protection, Air Quality Control). The maximum formaldehyde concentration was predicted to occur at 85 meters (less than 300 ft) adjacent to a compressor station; as the distance from the emission source increases, the predicted concentrations decrease rapidly.

Further analysis was conducted to determine the possible incremental cancer-risk over a 70 year lifetime for

an MLE to residents, and to an MEI, such as compressor station workers. These cancer risks were calculated based on the maximum predicted annual concentrations, EPA's unit risk factors for carcinogenic compounds (EPA 1997b), and an adjustment for time spent at home or on the job. This analysis assumed that residential exposure would be 20 years (well over the national nine year average duration a family lives at a residence) and worker exposure would be 20 years (the full LOP). In addition, it was assumed that family members would be exposed to the maximum formaldehyde concentrations 64 percent of the day, and to one fourth of this concentration for the remaining 36 percent of the day.

The resulting incremental cancer risks were calculated to be 1.6×10^{-6} (MLE) and 2.2×10^{-6} (MEI). Both of these values fall near the lower end of the 1 to 100×10^{-6} threshold. The MLE and MEI cancer risks would fall below this threshold at 310 and 460 meters away from the emission source, respectively. This distance would be even less for smaller compressor stations.

When reviewing the predicted near- and far-field impacts, it is important to understand that assumptions were made regarding potential resource development, emissions, meteorology, atmospheric transport and chemistry, and atmospheric deposition. For example, there is uncertainty regarding ultimate development (number of wells, equipment to be used, specific locations of wells, etc).

The following assumptions were used in the analysis:

- Total predicted short-term air pollutant impact concentrations were assumed to be the sum of the assumed background concentration, plus the predicted maximum cumulative modeled concentrations, which may occur under different meteorological conditions.
- Assumed background air pollution concentrations were assumed to occur throughout the 20-year LOP at all locations in the region, even though monitoring is primarily conducted in urban or industrial areas, rather than rural areas. The uniform background PM_{10} levels for each state are assumed to be representative of the background conditions for the entire modeled area of the PRB, based on monitoring data gathered throughout northeastern Wyoming and southeastern Montana.
- The maximum predicted air quality impacts occur only in the vicinity of the anticipated emission sources. Actual impacts would likely be less at distances beyond the predicted points of maximum impact.
- All emission sources were assumed to operate at their reasonably foreseeable maximum emission rates simultaneously throughout the LOP. Given the number of sources included in this analysis, the co-probability of such a scenario actually occurring over an entire year (or even 24-hours) is small.

- In developing the emissions inventory and model, there is uncertainty regarding ultimate development (i.e., number of wells, equipment to be used, specific locations, etc.) Most (90 percent) proposed CBM wells and 30 percent of conventional wells were assumed to be fully operational and remain operating (no shut-ins) throughout the LOP.
- The total proposed booster (field) and pipeline (sales) compression engines were assumed to operate at their rated capacities continuously throughout the LOP (no phased increases or reductions). In reality, compression equipment would be added or removed incrementally as required by the well field operation, compressor engines would operate below full horsepower ratings, and it is unlikely all compressor stations would operate at maximum levels simultaneously.
- The HAP analyses assumed a 9,900 horsepower, six-unit, reciprocating compressor engine station would operate at full load and at maximum emission levels continuously throughout the LOP.
- The emissions inventory and model use peak years of construction and peak years of operations, which would not occur throughout the entire development region at the same time. However, it is possible that conditions close to this could occur in some isolated areas.
- The emissions inventory and model assumed a NO_x emission rate for compressor engines of 1.5 g/hp-hr in Montana and 1.0 g/hp-hr in Wyoming. Since BACT is decided on a case-by-case basis, actual emission rates could be decided to be less or more than this level by the Departments of Environmental Quality in Wyoming or Montana, and on Indian lands by EPA, for field and sales compressor engines. Actual NO_x emission rates may range from 0.7 to 2 g/hp-hr.
- There are no applicable local, state, tribal or federal acid deposition standards. In the absence of applicable standards, the acid deposition analysis assumed that a “limit of acceptable change” is: a 10 percent change in ANC for lakes with a background ANC greater than 25 µeq/L; or a 1 µeq/L change in ANC for lakes with a background ANC less than 25 µeq/L, and would be a reasonably foreseeable significant adverse impact. Further, the atmospheric deposition impact analysis assumed no other ecosystem components would affect lake chemistry for a full year (assuming no chemical buffering due to interaction with vegetation or soil materials).
- The visibility impact analysis assumed that a 1.0 dv “just noticeable change” would be a reasonably foreseeable significant adverse impact, although there are no applicable local, state, tribal or federal regulatory visibility standards. However, some FLMs

are using 0.5 dv as a screening threshold for significance.

- Mitigation measures are included in the emissions inventory and model that may not be achievable in all circumstances. However, actual mitigation decided by the developers and local and state authorities may be greater or less than those assumed in the analysis. For example, maintaining a construction road speed limit of 15 mph may be reasonable in a construction zone but difficult to enforce elsewhere. Full (100 percent) mitigation of fugitive dust from disturbed lands may not be achievable. Further, 50 percent reduction in fugitive emissions is assumed based on construction road wetting on the unimproved access road to the pad and at the pad, but this level of effectiveness is characterized as the maximum possible. Wetting was assumed for maintenance traffic, which is not likely to occur, but this is considered to be a small effect because of limited traffic.
- Induced or secondary growth related to increases in VMT (believed to be on the order of 10 percent overall) is not included in the emissions inventory and model. Not all fugitive dust emissions (including county and other collector roads) have been included in the emissions inventory and model.
- Fugitive dust emissions from roads are treated as area sources rather than line sources in the model, which may thereby reduce

or increase the predicted ambient concentrations at maximum concentration receptor points near the source, depending on the inputs to the model (meteorology, terrain, etc.). By not placing modeled receptors close to emission sources (e.g., wells and roads), the model may not capture higher ambient concentrations near these sources. A more refined, regulatory model may yield higher concentrations at locations near fugitive dust sources.

- For comparisons to the PSD Class I and II increments, the emissions inventory and model included only CBM and non-project sources. Other existing increment consuming sources such as Campbell County coal mines were not included in this comparison, as the air quality analysis does not represent a regulatory PSD increment consumption analysis. A regulatory PSD increment consumption analysis needs to identify and consider all PSD increment consuming sources to determine the level of PSD Class II increment consumption. Monitoring data in Wyoming has indicated an upward trend in PM₁₀ concentrations in Campbell County since 1999, which coincides with CBM development but is also exacerbated by prolonged drought in the region.

Given these assumptions, the predicted impacts represent an estimate of potential air quality impacts.

4.0 Environmental Consequences

It is important to note that before actual coal or oil and gas development could occur, the applicable air quality regulatory agencies (including the state, tribe or EPA) would review specific air pollutant emissions pre-construction permit applications that examine source-specific air quality impacts. As part of these permits (depending on source size), the air quality regulatory agencies could require additional air quality impacts analyses or mitigation measures. Thus, before development occurs, additional site-specific air quality analyses would be performed to ensure protection of air quality.

4.5.4.2 Impacts from Temporary Generation

The exact number of temporary natural gas and diesel generators for gas pipeline compressor stations cannot be predicted, but at any one time there may be as many as 400 portable diesel generators and 70 portable gas generators operating. Typical emission factors (in g/hp-hr) for these generators are shown in Table 4-19. Table 4-20 shows the potential ground-level concentrations resulting from operation of these temporary generators.

4.5.4.3 Predicted Air Quality Impacts

The Wyoming PRB Oil and Gas Project EIS evaluates four alternatives. Alternative 1 is the Proposed Action, which assumes that there would be 39,400 new CBM wells in the Wyoming PRB by 2012 in addition to the 12,000 existing wells. The Proposed Action also assumes drilling of an estimated 3,200 conventional oil and gas wells in the same time period. Alternatives 2a and 2b evaluate alternate emission levels and water handling scenarios. Under Alternative 3 (the No Action Alternative), drilling would not occur on federal oil and gas leases but would continue on state and private oil and gas leases. BLM estimates that approximately 15,500 new CBM wells would be developed on state and private lands by 2012 under this alternative, in addition to the 12,000 existing wells. For the purposes of this EIS, the range of potential impacts predicted by the cumulative air quality analysis for all the three oil and gas Action Alternatives are shown in the following tables, as well as the potential impacts predicted under the No Action Alternative. Please refer to the Wyoming PRB Oil and Gas Project Final EIS (BLM 2003)

Table 4-19. Emission Factors for Temporary Generation for Oil and Gas Pipeline Compressors.

Pollutant	Emission Factor Range (g/hp-hr)
CO	0.3 to 2.0
NO _x	0.7 to 1.5
PM _{2.5}	0.03 to 0.07
SO ₂	0.002
VOCs	0.5 to 1.0
Formaldehyde	0.05 to 0.2

Table 4-20. Near-Field Concentrations from a Single Temporary Generator for Oil and Gas Pipeline Compressors.

Pollutant	Averaging Time	Concentration Range ($\mu\text{g}/\text{m}^3$)	WAAQS ($\mu\text{g}/\text{m}^3$)
CO	1-hour	55.3 to 403.1	40,000
	8-hour	33.2 to 242.9	10,000
NO ₂	Annual	1.9 to 7.5	100
PM _{2.5}	24-hour	1.5 to 5.3	65
	Annual	0.1 to 0.4	15
SO ₂	3-hour	0.2 to 0.4	1,300
	24-hour	0.09 to 0.3	260
	Annual	0.007 to 0.013	60

to see the individual results for each oil and gas action alternative.

4.5.4.3.1 Wyoming PRB Oil and Gas Project EIS Alternatives 1, 2a, and 2b

Under all three oil and gas Action Alternatives, potential direct project air quality impacts would not violate any local, state, tribal, or federal air quality standards under Alternative 1.

Based on extensive air quality modeling of potential direct project air quality impacts (Argonne 2002), localized short-term increases in CO, NO_x, PM₁₀, and SO₂ concentrations would occur, but all maximum concentrations are expected to be below applicable NAAQS and WAAQS. All maximum near-field direct project NO₂, PM₁₀, and SO₂ concentrations are expected to be below applicable PSD Class II increments (Table 4-21), and all maximum far-field direct project concentrations are expected to be below applicable PSD Class I increments (Appendix E).

Although potential direct project impacts to even the most sensitive

far-field lakes would not be significant, a “just noticeable change” in visibility was predicted to occur at from nine to 11 mandatory federal Class I areas, ranging up to five days at the Washakie Wilderness Area. The maximum potential direct project visibility impacts were predicted to occur on from 14 to 20 days per year on the Crow Indian Reservation. A detailed description of the air quality impact analysis is presented in Appendix E.

4.5.4.3.2 Wyoming PRB Oil and Gas Project EIS Alternative 3

Potential direct project air quality impacts would not violate any local, state, tribal, or federal air quality standards under Alternative 3 of the Wyoming PRB Oil and Gas Project EIS, the No-Action Alternative. Based on extensive air quality modeling of potential direct project air quality impacts (Argonne 2002), localized, short-term increases in CO, NO_x, PM₁₀, and SO₂ concentrations would occur, but all maximum concentrations are expected to be below applicable NAAQS and WAAQS.

Table 4-21. Range of Predicted Maximum Potential Near-Field Impacts under Alternatives 1, 2A, and 2B of the Wyoming PRB Oil and Gas Project EIS (with Montana Alternative E).

Pollutant	Averaging Time	Project ($\mu\text{g}/\text{m}^3$)	Non-Project ($\mu\text{g}/\text{m}^3$) ²	Cumulative ($\mu\text{g}/\text{m}^3$)	PSD Class II ($\mu\text{g}/\text{m}^3$)	Background ($\mu\text{g}/\text{m}^3$)	Total ($\mu\text{g}/\text{m}^3$)	WAAQS ($\mu\text{g}/\text{m}^3$)	NAAQS ($\mu\text{g}/\text{m}^3$)
NO ₂	Annual	6 to 8	3	9 to 10	25	17	26 to 28	100	100
SO ₂	Annual	#1	#1	1	20	3	4	60	80
	24-hour	2	2	3	91	8	11	260	365
	3-hour	3	5	5	512	8	13	1,300	1,300
PM ₁₀	Annual	3	1	4	17	17	21	50	50
	24-hour	15 to 20	9	25 to 31	30	42	67 to 73	150	150
PM _{2.5}	Annual	1 to 2	1	2		8	10	15	15
	24-hour	11 to 16	9	12 to 24		19	38 to 43	65	65
CO	8-hour	77 to 156	124	132 to 156		1,500	1,624 to 1,656	10,000	10,000
	1-hour	157 to 223	142	170 to 224		3,500	3,670 to 3,724	40,000	40,000

¹ The contributions from each source represent maxima and do not necessarily occur at the same location. Therefore, the total concentrations will not always equal the sum of the monitored background, Project, and Non-Project concentrations.

² Non-Project sources include CBM sources in Montana and surface coal mining operations in Wyoming and Montana.

All maximum near-field direct project NO₂, PM₁₀, and SO₂ concentrations are expected to be below applicable PSD Class II increments (Table 4-22), and all maximum far-field direct project concentrations are expected to be below applicable PSD Class I increments (Appendix E).

Although potential direct project impacts to even the most sensitive far-field lakes would not be significant, a “just noticeable change” in visibility was predicted to occur one day per year at the mandatory federal Class I Bridger, Fitzpatrick, and Washakie Wilderness Areas. The maximum potential direct project visibility impacts were predicted to occur on 10 days per year on the Crow Indian Reservation. A detailed description of the air quality impact analysis is presented in Appendix E.

4.5.4.4 Cumulative Impacts

Based on a separate assessment predicting potential far-field cumulative air quality impacts (Argonne 2002), the EPA CALMET/CALPUFF dispersion model system was used to predict maximum potential air quality impacts at downwind mandatory federal PSD Class I areas, and other sensitive receptors, to: 1) determine if the WAAQS, NAAQS or PSD Class I increments might be exceeded; 2) calculate potential nitrate and sulfate atmospheric deposition (and their related impacts) in sensitive lakes; and 3) predict potential impacts to visibility (regional haze).

Meteorological information was assembled to characterize atmospheric transport and dispersion

from several data sources, including: 1) four kilometer gridded wind field values derived from the MM5 (mesoscale model) with continuous four-dimensional data assimilation; and 2) hourly surface observations (wind speed, wind direction, temperature, cloud cover, ceiling height, surface pressure, relative humidity, and precipitation).

For each Wyoming PRB Oil and Gas Project EIS Alternative, potential air pollutant project sources were combined with non-project sources to determine the total potential cumulative air quality impacts. This included potential cumulative sources from the Montana Statewide EIS sources. The range of potential cumulative impacts correspond to including either the Montana Alternative A (low) or the Montana Alternative B/C/E (high) emission sources. Coal mining operations in Wyoming and Montana were included as non-project sources.

As described above, potential CO and NO_x emissions from reasonably foreseeable booster (field) and pipeline (sales) compressor stations, as well as PM_{2.5}, PM₁₀, and SO₂ emissions from construction equipment, were analyzed to predict potential maximum near-field PSD Class II impacts, as well as potential far-field impacts at 29 mandatory federal PSD Class I and other sensitive areas located in Wyoming, Montana, North and South Dakota, and Nebraska (Argonne 2002). Total concentrations are expected to be in compliance with applicable WAAQS and NAAQS (Appendix E). Table 4-23 presents the maximum predicted air pollutant

Table 4-22. Predicted Maximum Potential Near-Field Impacts under Alternative 3 of the Wyoming PRB Oil and Gas Project EIS (with Montana Alternative E).

Pollutant	Average Time	Project ($\mu\text{g}/\text{m}^3$)²	Non-Project ($\mu\text{g}/\text{m}^3$)²	Cumulative ($\mu\text{g}/\text{m}^3$)	PSD Class II ($\mu\text{g}/\text{m}^3$)	Background ($\mu\text{g}/\text{m}^3$)	Total ($\mu\text{g}/\text{m}^3$)	WAAQS ($\mu\text{g}/\text{m}^3$)	NAAQS ($\mu\text{g}/\text{m}^3$)
NO ₂	Annual	3	3	6	25	17	23	100	100
SO ₂	Annual	#1	#1	#1	20	3	3	60	80
	24-hour	1	2	2	91	8	10	260	365
	3-hour	1	5	5	512	8	13	1,300	1,300
PM ₁₀	Annual	1	1	2	17	17	19	50	50
	24-hour	7	9	16	30	42	58	150	150
PM _{2.5}	Annual	#1	0.7	1		8	9	15	15
	24-hour	6	9	13		19	32	65	65
CO	8-hour	183	124	183		1,500	1,683	10,000	10,000
	1-hour	261	142	261		3,500	3,761	40,000	40,000

¹ The contributions from each source represent maxima and do not necessarily occur at the same location. Therefore, the total concentrations will not always equal the sum of the monitored background, Project, and Non-Project concentrations.

² Non-Project sources include CBM sources in Montana and surface coal mines in Wyoming and Montana.

concentrations at specified PSD Class I areas.

Under all four Alternatives (1, 2A, 2B, and 3) considered in the Wyoming PRB Oil and Gas Project EIS, potential non-project and cumulative annual NO₂ concentrations (ranging from 4.1 to 4.2 µg/m³) were predicted to be above the PSD Class I increment (2.5 µg/m³) within the Northern Cheyenne Reservation. Under all four Wyoming PRB Oil and Gas Project EIS Alternatives, potential project and cumulative 24-hour PM₁₀ concentrations (ranging from 10.7 to 12.8 µg/m³) were above the PSD Class I increment (8.0 µg/m³) within the Northern Cheyenne Reservation. Under Wyoming PRB Oil and Gas Project EIS Alternatives 1, 2A, and 2B, cumulative 24-hour PM₁₀

concentrations (ranging from 8.5 to 9.2 µg/m³) were also predicted to be above the PSD Class I increment (8.0 µg/m³) within the Washakie Wilderness Area. These impacts would be the same under all of the coal leasing alternatives considered in this EIS. As described in Appendix E, other PSD Class I areas had predicted far-field impacts below applicable increments. All PSD Class II areas had predicted far-field impacts below applicable PSD increments. This NEPA analysis compares potential air quality impacts from the proposed Wyoming PRB Oil and Gas Project EIS Alternatives to applicable ambient air quality standards and PSD increments, but comparisons to the PSD Class I and II increments are intended to evaluate a threshold of concern for potential impacts, and do

Table 4-23. Maximum Predicted PSD Class I Area Cumulative Far-Field Impacts (in µg/m³) under Wyoming PRB Oil and Gas Project EIS Alternative 1 (Proposed Action) and all South PRB Coal EIS Alternatives.

Pollutant	Averaging Period	Class I Area	Maximum Modeled Concentration (Cumulative)	PSD Class I Increment
NO ₂	Annual	Northern Cheyenne Reservation	4.2	2.5
PM ₁₀	24-hour	Northern Cheyenne Reservation	12.8	8
	Annual	Northern Cheyenne Reservation	1.7	4
SO ₂	3-hour	Northern Cheyenne Reservation	5.1	25
	24-hour	Absaroka-Beartooth Wilderness	2.4	5
	Annual	Northern Cheyenne Reservation	0.3	2

Source: Argonne 2002

not represent a regulatory PSD Increment Consumption Analysis. Even though most of the development activities would occur within areas designated PSD Class II, the potential impacts on regional Class I areas are to be evaluated. For a new source review air quality permit application for a major source, the applicable air quality regulatory agencies may require a regulatory PSD increment analysis. More stringent emission controls beyond BACT may be stipulated in the air quality permits if impacts are predicted to be greater than the PSD Class I or Class II increments.

Several lakes within four USFS designated wilderness areas were identified as being sensitive to atmospheric deposition and for which the most recent and complete data have been collected. The USFS has also identified the following LAC regarding potential changes in lake chemistry: no more than a 10 percent change in ANC for those water bodies where the existing ANC is at or above 25 µeq/L; and no more than a one µeq/L change for those extremely sensitive water bodies where the existing ANC is below 25 µeq/L.

Based on a Rocky Mountain Region USFS screening method (USFS 2000), Table 4-24 demonstrates that potential impacts to most sensitive lakes would be below applicable significance thresholds. However, under all four Wyoming PRB Oil and Gas Project EIS Alternatives (1, 2A, 2B, and 3), potential non-project ANC impacts (1.3 µeq/L) were predicted to exceed the 1.0 µeq/L impact threshold at the very sensitive Upper Frozen Lake within the PSD Class I

Bridger Wilderness Area. Cumulative ANC impacts ranged from 1.5 to 1.8 µeq/L. From 13 to nearly 28 percent of these impacts are due to direct contributions from Wyoming PRB Oil and Gas Project EIS Alternatives 1, 2A, 2B, and 3 alone. In addition, under Wyoming PRB Oil and Gas Project EIS Alternative 1, cumulative ANC impacts were predicted to exceed the 10 percent impact threshold (up to 10.4 percent) at Florence Lake within the PSD Class II Cloud Peak Wilderness Area. Nearly 30 percent of these impacts are due to direct contributions from Wyoming PRB Oil and Gas Project EIS Alternative 1. Potential impacts at all other sensitive lakes (and under all Wyoming PRB Oil and Gas Project EIS Alternatives) were below the ANC threshold levels. No sensitive lakes were identified by either the NPS or USFWS.

Since the development of the project and non-project air pollutant emission sources constitute many small sources spread out over a very large area, discrete visible plumes are not likely to affect the mandatory federal PSD Class I areas, but the potential for cumulative visibility impacts (increased regional haze) is a concern. Regional haze degradation is caused by fine particles and gases scattering and absorbing light. Potential changes to regional haze are calculated in terms of a perceptible “just noticeable change” (1.0 dv) in visibility when compared to background conditions.

A 1.0 dv change is considered a small but noticeable change in haziness as described in the Preamble to the EPA Regional Haze Regulations (*Federal Register*, Vol. 64 No. 126, dated July

Table 4-24. Predicted Total Cumulative Change in Acid Neutralizing Capacity at Sensitive Area Lakes (percent change).

Wilderness Area	Lake	Background ANC ($\mu\text{eq/L}$)	Area (hectares)	Change (percent)	Thresholds (percent)
Bridger	Black Joe	69	890	2.2 to 2.1	10
	Deep	61	205	2.5 to 3.0	10
	Hobbs	68	293	1.3 to 1.5	10
	Upper Frozen	5.8 ^a	65	1.5 to 1.8 ^b	1 ^b
Fitzpatrick	Ross	61.4	4,455	1.8 to 2.1	10
Absaroka-Beartooth	Stepping Stone	27	26	2.3 to 2.5	10
	Twin Island	36	45	1.6 to 1.8	10
Cloud Peak	Emerald	553	293	5.0 to 6.0	10
	Florence	32.7	417	8.5 to 10.4	10
Popo Agie	Lower Saddlebag	55.5	155	3.2 to 3.8	10

Notes:

^a The background concentration is based on only six samples taken on four days between 1997 and 2001.

^b Since the background ANC value is less than 25 $\mu\text{eq/L}$, the potential ANC change is expressed in $\mu\text{eq/L}$, and the applicable threshold is 1.0 $\mu\text{eq/L}$.

Source: Argonne 2002

1, 1999). A 1.0 dv change is defined as about a 10 percent change in the extinction coefficient (corresponding to a two to five percent change in contrast, for a black target against a uniform sky, at the most optically sensitive distance from an observer), which is a small but noticeable change in haziness under most circumstances when viewing scenes within mandatory federal Class I areas.

It should be noted that a 1.0 dv change is not a “just noticeable change” in all cases for all scenes. Visibility changes less than 1.0 dv are likely to be perceptible in some cases, especially where the scene being viewed is highly sensitive to small amounts of pollution, such as due to preferential forward light scattering. Under other view-specific conditions, such as where the sight path to a scenic feature is less than the

maximum visual range, a change greater than 1.0 dv might be required to be a “just noticeable change”.

However, this NEPA analysis is not designed to predict specific visibility impacts for specific views in specific mandatory federal Class I areas based on specific project designs, but to characterize reasonably foreseeable visibility conditions that are representative of a fairly broad geographic region, based on reasonable emission source assumptions. This approach is consistent with both the nature of regional haze and the requirements of NEPA. At the time of a pre-construction air quality PSD permit application, the applicable air quality regulatory agency may require a much more detailed visibility impact analysis. Factors such as the magnitude of dv change, frequency, time of the year, and the

meteorological conditions during times when predicted visibility impacts are above the 1.0 dv threshold (as well as the modeling analyses assumptions) should all be considered when assessing the significance of predicted impacts.

The USFS, NPS, and USFWS have published their Final FLAG Phase I Report (*Federal Register*, Vol. 66 No. 2, dated January 3, 2001), providing “a consistent and predictable process for assessing the impacts of new and existing sources on AQRVs” including visibility. For example, the FLAG report states “A cumulative effects analysis of new growth (defined as all PSD increment-consuming sources) on visibility impairment should be performed”, and further, “If the visibility impairment from the proposed action, in combination with cumulative new source growth, is less than a change in extinction of 10 percent (1.0 dv) for all time periods, the FLMs will not likely object to the proposed action”. Although the FLAG procedures were primarily designed to provide analysis guidance to PSD permit applicants, the following analysis uses the Final FLAG Phase I Report procedures for this NEPA analysis.

Based on multiple iterations of the non-steady state CALPUFF dispersion modeling system, including the CALMET meteorological model, for four different development alternatives, potential cumulative visibility impacts estimated by the seasonal FLAG screening method exceeded the impact thresholds (including the use of FLAG and WDEQ/AQD provided background extinction values) at all 29 sensitive

areas analyzed. Therefore, potential maximum visibility impacts were estimated using the daily FLAG refined method (based on hourly optical extinction and relative humidity values measured at two IMPROVE monitoring locations) for each Class I and Class II sensitive area. Although the potential modeled impacts for each sensitive area were based on 1996 MM5 regional meteorology, these values were compared to hourly optical extinction and relative humidity data collected at two locations in the Project Area between 1989 and 1999.

For example, since the 1.0 dv threshold was predicted to be reached within the mandatory federal PSD Class I Washakie Wilderness Area based on the seasonal FLAG screening methodology, the maximum modeled cumulative impacts at that area were also compared to representative hourly optical and relative humidity values measured at Bridger Wilderness Area between 1989 and 1999 using the daily FLAG refined method (Table 4-25). The range of impacts was then summarized as the annual average number of days over the 11-year period predicted to equal or exceed a 1.0 dv “just noticeable change” (Table 4-26).

The prediction of potential visibility impacts based on the daily FLAG refined methodology using measured optical extinction conditions is intended to disclose potential air quality impacts on the affected environment to the public and decision maker before an action is taken. It is not intended to be an air quality regulatory analysis. Such

analysis would be conducted by the applicable air quality regulatory agencies.

It is important to note that before actual development could occur, the applicable air quality regulatory agencies (including the state, tribe or EPA) would review specific air pollutant emissions pre-construction permit applications that examine source-specific air quality impacts. As part of these permits (depending on source size), the air quality regulatory agencies could require additional air quality impacts analyses or mitigation measures. Thus, before development occurs, additional site-specific air quality analyses would be performed to ensure protection of air quality. For further mitigation information see Section 4.3 and Appendix E.

Coal mines develop predictive air quality dispersion models (i.e., FDM, ISCLT3) to assess the potential air quality impacts of their mining operations. Based on these predictive models conducted for PRB mines, mining operations do not have significant off-site particulate pollution impacts, even when

production and pollution from neighboring mines are considered. However, this prediction has been based on the assumptions that mining activities are sufficiently removed from the permit boundaries and that neighboring mines are not actively mining in the immediate vicinity (within 0.6 to 2.5 miles). Previous modeling (BLM 1992a) has shown that incremental particulate pollution impacts decrease to insignificant levels ($<1 \mu\text{g}/\text{m}^3 \text{PM}_{10}$ annual average) within six miles of active mining.

In cases where mines are in close proximity (within two miles), WDEQ follows a modeling protocol which accounts for all mine-generated particulate air pollutants from all nearby mines to determine impacts to ambient air quality. Known as the Mine A/Mine B modeling procedure, this model evaluates the total impacts of a given mining operation, including those impacts from and on neighboring mines. Under each Proposed Action being evaluated in this EIS, each LBA tract is within two miles of either an existing mine or another LBA tract.

Table 4-25. Predicted Visibility Impacts in the Mandatory Federal PSD Class I Washakie Wilderness Area from Direct Wyoming PRB Oil and Gas Project EIS Alternative Sources - Daily FLAG Refined Method (Average Number of Days per Year Predicted to Equal or Exceed a 1.0 dv "Just Noticeable Change").

Alternative	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
1	4	2	7	6	4	7	4	6	7	2	6
2A	2	2	6	5	4	6	4	5	5	1	4
2B	1	2	6	5	3	6	4	4	5	1	3
3	1	0	4	3	1	1	2	2	2	0	0

Note: Potential cumulative visibility impacts were predicted using daily background optical and relative humidity conditions for each of the years listed above.

Source: Argonne 2002

4.0 Environmental Consequences

Table 4-26. Predicted Visibility Impacts in Class I Areas - Daily FLAG Refined Method (Average Number of Days per Year Predicted to Equal or Exceed a 1.0 dv “Just Noticeable Change”) (Results shown are the predicted impacts under Wyoming PRB Oil and Gas Project Alternatives 1, 1A, 2B, and 3. Impacts related to coal mining under all South PRB Coal EIS Alternatives are included under “Non-Project Sources”).

Class I Area	Alt 1	Alt 2A	Alt 2B	Alt 3	Non-Project Sources	Cum Sources
Badlands Wilderness Area ¹	3	3	1	0	13 to 17	18 to 28
Bridger Wilderness Area	4	4	3	1	7 to 9	8 to 12
Fitzpatrick Wilderness Area	4	3	3	1	6 to 9	8 to 12
Gates of the Mtns Wilderness Area	0	0	0	0	3 to 4	3 to 4
Grand Teton National Park	1	1	0	0	3 to 5	4 to 8
North Absaroka Wilderness Area	4	3	2	0	9 to 13	11 to 15
Red Rock Lakes Wilderness Area	0	0	0	0	0 to 1	0 to 3
Scapegoat Wilderness Area	0	0	0	0	2 to 2	2 to 3
Teton Wilderness Area	3	3	2	0	6 to 9	7 to 11
Theodore Roosevelt NMP ² (North Unit)	0	0	0	0	1 to 1	1 to 3
Theodore Roosevelt NMP ² (South Unit)	1	0	0	0	1 to 3	2 to 7
U.L. Bend Wilderness Area	1	1	1	0	4 to 5	5 to 8
Washakie Wilderness Area	5	4	4	1	10 to 14	12 to 18
Wind Cave National Park	4	3	2	0	17 to 21	22 to 28
Yellowstone National Park	3	2	1	0	8 to 11	9 to 13
Northern Cheyenne Reservation ³	17	16	14	7	27 to 82	33 to 92

Notes:

¹ The U.S. Congress designated the Wilderness Area portion of Badlands National Park as a mandatory federal PSD Class I area. The remainder of Badlands National Park is a PSD Class II area.

² NMP - National Memorial Park.

³ Although the Northern Cheyenne Reservation is a tribal designated PSD Class I Area, it is not a mandatory federal PSD Class I area subject to EPA's Regional Haze Regulations.

Non-Project Sources - The impact of all air pollutant emission sources not included in Wyoming PRB Oil and Gas Project EIS Alt 1, Alt 2A, Alt 2B or Alt 3, including existing surface coal mines in Wyoming and Montana and the Montana Statewide EIS sources. The range of potential annual average days above a 1.0 dv “just noticeable change” in visibility corresponds to including Montana Alternative A (low) to Montana Alternative B/C/E (high).

Cum Sources - The impact of all cumulative air pollutant emission sources combined, including Wyoming PRB Oil and Gas Project EIS Alt 1, Alt 2A, Alt 2B, Alt 3, and Non-Project Sources (which include the South PRB Coal EIS Proposed Action and Alternatives and Montana Statewide EIS sources). The range of potential annual average days above a 1.0 dv “just noticeable change” in visibility corresponds to: including Non-Project, Wyoming Alternative 3 and Montana Alternative A sources (low); up to including Non-Project, Wyoming Alternative 1 and Montana Alternative B/C/E sources (high).

Source: Argonne 2002

Gaseous orange clouds, some containing concentrations of NO_x, have been produced by overburden blasting at surface coal mines in the PRB. In 1995, 1998, and 1999, OSM received citizen complaints concerning NO_x gases generated from blasting operations drifting off mine permit areas (OSM 2000). No citizen complaints were received by OSM or WDEQ during the 2001 evaluation year, which ended on September 30, 2001 (OSM 2002). These gaseous orange clouds generally do not overlap due to the distances between mines and the variation in blasting schedules. However, areas adjacent to the permits areas for this group of mines could be affected on different occasions by blasting clouds from several different mines, depending on the weather conditions.

The nature of these blasting clouds and human health consequences resulting from short-term exposures to NO_x are discussed in Section 4.1.4. Included are the results of a study of possible public exposure to NO₂ concentrations from blasting. The evaluation is based on short-term measurements (15 minutes) and the results are compared to NO₂ monitoring results from annual and daily monitoring in the PRB as well as to existing workplace standards for NO₂ exposures. There is no short-term ambient air standard for NO₂ in Wyoming.

In response to the public concern about these clouds and the potential consequences to human health, WDEQ and the mines have developed required and voluntary measures to protect the public from exposure to the clouds. These measures are

described in Section 3.5 of this document. The mines in the eastern PRB have also been cooperating in a research and development effort aimed at reducing blasting clouds (Casper Star Tribune, February 3, 2002). This research has led to changes in blasting agents and the size of blasting shots that have reduced NO_x emissions during blasting. As indicated above, no citizen complaints were received by OSM or WDEQ/LQD during the 2001 evaluation year.

Another air quality concern is the venting of methane that occurs when coal is mined. As discussed in Section 3.3 of this document, methane is generated from coal beds. When coal is mined, by surface or underground methods, the methane that is present in the coal is vented to the atmosphere. Methane is a greenhouse gas that contributes to global warming. According to the *Methane Emissions* section of Energy Information Administration/Department of Energy (EIA/DOE) report 0573(99), *Emissions of Greenhouse Gases in the United States 1999*, U.S. anthropogenic methane emissions totaled 28.8 million metric tons in 1999. U.S. 1999 methane emissions from coal mining were estimated at 2.88 million metric tons (10 percent of the U.S. total anthropogenic methane emissions in 1999). According to Table 15 of this report, surface coal mining was estimated to be responsible for about 0.54 million metric tons of methane emissions in 1999. This represents about 1.88 percent of the estimated U.S. anthropogenic methane emissions in 1999, and about 18.75 percent of the

estimated methane emissions attributed to coal mining of all types.

Table 7.2 of the EIA/DOE *Coal Industry Annual Energy Review for 1999* estimated that 688.3 million short tons of coal were produced by surface mines in the United States in 1999. Surface mines in the Wyoming PRB produced approximately 320 million short tons in 1999, or about 46.5 percent of the total production. Using these numbers, it is estimated that the Wyoming PRB coal mines were responsible for approximately 0.9 percent of the estimated United States 1999 anthropogenic methane emission.

In many areas, including the PRB, CBM is being recovered from coal and sold. On a large scale, recovery of CBM from the coal prior to mining by both surface and underground methods could potentially gradually reduce United States emissions of CBM to the atmosphere. In the PRB, CBM is being produced from the coal areas adjacent to and generally downdip of the mines. CBM is currently being produced from the same coal seams that would be mined in all five of the LBA tracts included in this EIS. As discussed in Section 4.1.2, BLM estimates that a large portion of the CBM reserves could be recovered prior to initiation of mining activity on the LBA tracts under the Proposed Action. CBM reserves that are not recovered prior to mining would be vented to the atmosphere.

4.5.5 Water Resources

Surface Water

Streamflows may be reduced during surface coal mining because SMCRA and Wyoming state regulations require capture and treatment of all runoff from disturbed areas in sedimentation ponds before it is allowed to flow off the mine permit areas. Also, the surface coal mine pits in the PRB are large, and these pits, together with ponds and diversions built to keep water out of the pits, can intercept the runoff from significant drainage areas.

Changes in drainage patterns and surface disturbance are decreasing and will continue to decrease flows in most of the ephemeral and intermittent drainages exiting at the mine sites. Development of CBM resources in the area west of the mines could potentially increase surface flow in some drainages. Currently, there is methane production occurring in the general analysis area. The amount of CBM produced water that ultimately reaches the major channels is reduced by evapotranspiration, infiltration into the ground, and surface landowners, who sometimes divert the produced water into reservoirs for livestock use because it is of relatively good quality. For purposes of analysis, the PRB Oil and Gas Project DEIS (BLM 2002a) assumed that the discharged CBM produced water conveyance losses would be 80 percent due to infiltration and evapotranspiration. A more conservative conveyance loss estimate is being evaluated in the FEIS.

The PRB Oil and Gas Project DEIS estimates that the total number of CBM wells in the Upper Cheyenne River and Antelope Creek drainages, in which the North Antelope/Rochelle Complex, Black Thunder, North Rochelle, and Antelope Mines are located, will be approximately 2,900 wells by 2011. The estimated impacts to Antelope Creek and Upper Cheyenne River flow include increasing the annual average flow at the Antelope Creek gaging station near Teckla by 0.3 to 1.0 cfs and increasing the annual average flow of the Cheyenne River at the Riverview gaging station by 0.2 to 0.3 cfs during 2002 through 2017. Flow impacts would be greater in the Antelope Creek and Cheyenne River tributaries within the LBA tracts, since the tracts are closer to the CBM water discharge locations, and conveyance losses are therefore less than at the downstream gaging stations. These CBM water discharges would be constant, as opposed to naturally occurring flows that fluctuate widely on a seasonal and annual basis. Most streams in the area are naturally dry throughout most of each year.

The U.S. Geological Survey has predicted that, after reclamation, major streams in the PRB will exhibit increased runoff ranging from 0.4 percent in the Cheyenne River to 4.3 percent in Coal Creek due to cumulative disturbance as a result of existing surface coal mining (Martin et al. 1988). This is based on the assumption that unit runoff rates will be increased after reclamation due to soil compaction, and the percentage changes in runoff are based on permitted mine acreages in 1981. The additional leases issued since

that time have increased the permitted acreage by about 40 percent and would, under the same assumptions, increase the U.S. Geological Survey's estimated runoff increase by the same incremental amount. This level of increase in runoff is small compared to seasonal and annual variability of runoff in the PRB.

Drainage from all five southern mines combines where Black Thunder Creek enters the Cheyenne River. The drainage area of the Cheyenne River at this point is approximately 2,430 square miles. The entire area of disturbance from these five mines as currently permitted would impact approximately four percent of the drainage basin of the Cheyenne River, and this disturbance would occur over about 50 years. Leasing the five proposed LBA tracts would raise this disturbance acreage to roughly six percent of the Cheyenne River drainage basin at Black Thunder Creek confluence.

Sediment concentrations should not increase significantly in area streams even with the addition of mining the pending and recently issued LBA tracts because, as discussed in Section 4.1.5, state and federal regulations require that all surface runoff from mined lands pass through sedimentation ponds or other sediment control structures. The potential for cumulative adverse impacts to the Cheyenne River drainage is also minimal because it is typically dry for a substantial portion of the year.

The CBM water discharges could result in erosion and degradation of

small drainages, which could affect water quality and channel hydraulic characteristics. From a surface water standpoint, the increased flows due to surface CBM water discharges and the reduced flows due to surface coal mining would tend to offset each other. However, conflicts could also result. The CBM development takes place upstream from the mines. Provisions the mines have taken to prevent water from entering the pits (e.g., storage ponds or diversions) could be adversely affected by flows that were not included in designs or that change conditions for future designs.

Groundwater

As a result of statutory requirements and concerns, several studies and a number of modeling analyses have been conducted to help predict the impacts of surface coal mining on groundwater resources in the Wyoming portion of the PRB. Some of these studies and modeling analyses are discussed below.

In 1987, the U.S. Geological Survey, in cooperation with the WDEQ and OSM, conducted a study of the hydrology of the eastern PRB. The resulting description of the cumulative hydrologic effects of all current and anticipated surface coal mining (as of 1987) was published in 1988 in the U.S. Geological Survey Water-Resources Investigation Report entitled “*Cumulative Potential Hydrologic Impacts of Surface Coal Mining in the Eastern Powder River Structural Basin, Northeastern Wyoming*”, also known as the “CHIA” (Martin, et al. 1988). This report evaluates the potential cumulative

groundwater impacts of surface coal mining in the area and is incorporated by reference into this EIS. The CHIA analysis included the proposed mining of all the 1987 leases at all of the existing mines in the southern mine group (Jacobs Ranch Mine, Black Thunder Mine, North Rochelle Mine, North Antelope/Rochelle Complex, and Antelope Mine). It did not evaluate potential groundwater impacts related to additional coal leasing in this area and it did not consider the potential for overlapping groundwater impacts from coal mining and CBM development.

Each mine must assess the probable hydrologic consequences of mining as part of the mine permitting process. The WDEQ/LQD must evaluate the cumulative hydrologic impacts associated with each proposed mining operation before approving the mining and reclamation plan for each mine, and they must find that the cumulative hydrologic impacts of all anticipated mining would not cause material damage to the hydrologic balance outside of the permit area for each mine. As a result of these requirements, each existing approved mining permit includes an analysis of the hydrologic impacts of the surface coal mining proposed at that mine. If revisions to mining and reclamation permits are proposed, then the potential cumulative impacts of the revisions must also be evaluated. If one or more of the LBA tracts are leased to the applicants, the existing mining and reclamation permit for each respective mine must be revised and approved to include each new lease before it can be mined.

Additional groundwater impact analyses have also been conducted to evaluate the potential cumulative impacts of coal mining and CBM development. One example of these analyses is the report entitled “A Study of Techniques to Assess Surface and Groundwater Impacts Associated with Coal Bed Methane and Surface Coal Mining, Little Thunder Creek Drainage, Wyoming” (Wyoming Water Resources Center 1997). This study was prepared as part of a cooperative agreement involving WDEQ/LQD, the Wyoming SEO, the WSGS, BLM, OSM, and the University of Wyoming. The Wyodak CBM DEIS (BLM 1999a) and FEIS (BLM 1999c) presented the results of a modeling analysis of the potential cumulative impacts of coal mining and CBM development on groundwater in the coal and overlying aquifers as a result of coal mining and CBM development. The technical report for the Wyodak CBM Project EIS modeling analyses is available for public review at the BLM office in Buffalo, Wyoming (Applied Hydrology Associates, Inc. 1999). The results of these previously prepared analyses are incorporated by reference into this EIS document.

The PRB Oil and Gas Project DEIS (BLM 2002a), which was distributed to the public January 2, 2002, includes an updated modeling analysis of the groundwater impacts if an additional 39,000 new CBM wells are drilled in the PRB by the end of 2011. The project area for this EIS covers all of Campbell, Sheridan, and Johnson Counties, as well as the northern portion of Converse County.

Another source of data on the impacts of surface coal mining on groundwater is the monitoring that is required by WDEQ/LQD and administered by the mining operators. Each mine is required to monitor groundwater levels and quality in the coal and in the shallower aquifers in the area surrounding their operations. Monitoring wells are also required to record water levels and water quality in reclaimed areas.

The coal mine groundwater monitoring data is published each year by GAGMO, a voluntary group formed in 1980. Members of GAGMO include most of the companies with operating or proposed mines in the Wyoming PRB, WDEQ, the Wyoming SEO, BLM, U.S. Geological Survey, and OSM. GAGMO contracts with an independent firm each year to publish the annual monitoring results. In 1991, GAGMO published a report summarizing the water monitoring data collected from 1980 to 1990 in the Wyoming PRB (Hydro-Engineering 1991b). In 1996, they published a report summarizing the data collected from 1980 to 1995 (Hydro-Engineering 1996a). In 2001, GAGMO published a report summarizing the water monitoring data collected from 1980 to 2000 (Hydro-Engineering 2001).

The southern group of mines uses about 1,736 ac-ft of water per year for drinking, sanitation, washing equipment, and dust control. Sources of this water include seepage into the mine pits, sediment- and flood-control impoundments as well as production from the aquifers below the coal. The five southern mines

pump an estimated 1,400 ac-ft per year from the pits and dewatering wells.

The major groundwater issues related to surface coal mining that have been identified are:

- the effect of the removal of the coal aquifer and any overburden aquifers within the mine area and replacement of these aquifers with spoil material;
- the extent of the temporary lowering of static water levels in the aquifers around the mine due to dewatering associated with removal of these aquifers within the mine boundaries;
- the effects of the use of water from the subcoal Fort Union Formation by the mines;
- changes in water quality as a result of mining; and
- potential overlapping drawdown in the coal due to proximity of coal mining and CBM development.

The impacts of large scale surface coal mining on a cumulative basis for each of these issues are discussed in the following paragraphs.

The effects of replacing the coal aquifer and overburden with a spoils aquifer is the first major groundwater concern. The following discussion of recharge, movement, and discharge of water in the backfill aquifer is excerpted from the CHIA (Martin et al. 1988:24):

Postmining recharge, movement and discharge of groundwater in the Wasatch aquifer and Wyodak coal aquifer will probably not be substantially different from premining conditions. Recharge rates and mechanisms will not change substantially. Hydraulic conductivity of the spoil aquifer will be approximately the same as in the Wyodak coal aquifer allowing groundwater to move from recharge areas where clinker is present east of mine areas through the spoil aquifer to the undisturbed Wasatch aquifer and Wyodak coal aquifer to the west.

Monitoring data from 1990 to 2000 verify that recharge has occurred and is continuing in the backfill (Hydro-Engineering 1991a, 1992, 1993, 1994, 1995, 1996b, 1997, 1998, 1999, 2000, 2001, and ACC 2001). The water monitoring summary reports prepared each year by GAGMO list current water levels in the monitoring wells completed in the backfill and compare them with the 1980 water levels, as estimated from the 1980 coal water-level contour maps. In the 1991 GAGMO 10-year report, some recharge had occurred in 88 percent of the 51 backfill wells reported at that time. In the GAGMO 20-year report, 79 percent of the 82 backfill wells measured contained water.

Coal companies are required by state and federal law to mitigate any water rights that are interrupted, discontinued, or diminished by mining.

The cumulative size of the backfill area in the PRB and the duration of

mining activity would be increased by mining of the recently issued leases and the currently proposed LBA tracts. Since the mined-out areas are being backfilled and the monitoring data demonstrate that recharge of the backfill is occurring, substantial additional impacts are not anticipated as a result of any of the pending leasing actions. Through September 2000 more than 40 percent of the area disturbed at the entire southern group of mines had been backfilled and regraded. Backfill monitoring wells installed to date at four of the five southern mines indicate that recharge is occurring in the backfill.

Clinker or scoria, the baked and fused rock formed by prehistoric burning of the Wyodak-Anderson coal seam, occurs all along the coal outcrop area (Figure 4-14) and is believed to be the major recharge source for the spoil aquifer, just as it is for the coal. However, not all clinker is saturated. Some clinker is mined for road-surfacing material, but saturated clinker is not generally mined since abundant clinker exists above the water table and does not present the mining problems that would result from mining saturated clinker. Therefore, the major recharge source for the spoil aquifer is not being disturbed by current mining. Clinker does not occur on four of the five LBA tracts being considered in this EIS.

The second major groundwater issue is the extent of water level drawdown in the coal and shallower aquifers in the area surrounding the mines. In this EIS, assessment of cumulative impacts to groundwater related to surface coal mining in the southern

group of mines is based on impact predictions made by JRCC, ALC, TCC, PRCC, and ACC for mine-related drawdown at the Jacobs Ranch Mine, Black Thunder Mine, North Rochelle Mine, North Antelope/Rochelle Complex, and Antelope Mine, respectively, and extrapolating those drawdowns to consider mining of the five LBA tracts included in this EIS. Figure 4-14 depicts the extrapolated worst-case extent of the five-ft cumulative drawdown contour within the Wyodak coal aquifer resulting from the five southern mine operations, including the five LBA tracts included in this EIS. The extent of the five-ft drawdown contour is used by WDEQ/LQD to assess the cumulative extent of impact to the groundwater system caused by mining operations. In Figure 4-14, these drawdown predictions are compared to the actual monitoring information after 20 years of mining and to modeled predictions in the CHIA. Figure 4-14 shows only the predicted drawdowns in the coal aquifer due to mining. The limited extent of the saturated sand aquifers in the Wasatch Formation overburden in the southern group of mines dictates that drawdowns in the Wasatch Formation are much smaller and cover much less area than the coal drawdowns.

The GAGMO 20-year report provides actual groundwater drawdown information after 20 years of mining. Most of the monitoring wells included in the GAGMO 20-year report (488 wells out of 570 total) are completed in the coal beds in the overlying sediments, or in sand channels or interburden between the coal beds at 16 active and proposed mine sites.

Figure 4-14

Since 1996, some BLM monitor wells have been included in the GAGMO reports. The measured changes in water levels in the coal seams after 20 years of monitoring shown on Figure 4-14, were adapted from the 2001 GAGMO 20-year report (Hydro-Engineering 2001). This map shows the area where actual drawdown in the coal seam was five ft or greater after 20 years of mining. CBM production has significantly affected the extent of drawdown in the General Analysis Area.

Figure 4-14 indicates that the drawdowns observed after 20 years of mining were largely beyond the extent of cumulative drawdown due to all anticipated mining sources predicted in the CHIA. The addition of the pending LBA tracts, including the five LBA tracts included in this EIS, would extend the predicted cumulative extent of the five-ft drawdown caused by coal mining even farther beyond the cumulative drawdown prediction in the 1988 CHIA.

The CHIA predicted the approximate area of five ft or more water level decline in the Wyodak coal aquifer which would result from "all anticipated coal mining". "All anticipated coal mining" at that time included 16 surface coal mines operating at the time the report was prepared and six additional mines proposed at that time. All of the currently producing mines, including the Jacobs Ranch Mine, Black Thunder Mine, North Rochelle Mine, North Antelope/Rochelle Complex, and Antelope Mine were considered in the CHIA analysis (Martin et al. 1988). The study predicted that

water supply wells completed in the coal may be affected as far away as eight miles from mine pits, although the effects at that distance were predicted to be minimal.

As drawdowns propagate to the west, available drawdown in the coal aquifer increases. Available drawdown is defined as the elevation difference between the potentiometric surface (elevation to which water will rise in a well bore) and the bottom of the aquifer. Proceeding west, the coal depth increases faster than the potentiometric surface declines, so available drawdown in the coal increases. Since the depth to coal increases, most stock and domestic wells are completed in units above the coal. Consequently, with the exception of methane wells, few wells are completed in the coal in the areas west of the mines. Those wells completed in the coal have considerable available drawdown, so it is unlikely that surface coal mining would cause adverse impacts to wells outside the immediate mine area.

Wells in the Wasatch Formation were predicted to be impacted by drawdown only if they were within 2,000 ft of a mine pit (Martin et al. 1988). Drawdowns occur farther from the mine pits in the coal than in the shallower aquifers because the coal is a confined aquifer that is areally extensive. The area in which the shallower aquifers (Wasatch Formation, alluvium, and clinker) experience a five-ft drawdown would be much smaller than the area of drawdown in the coal because the shallower aquifers are generally discontinuous, of limited areal extent, and often unconfined.

Of the 1,200 water supply wells within the maximum impact area defined in the CHIA study, about 580 are completed in Wasatch aquifers, about 100 in the Wyodak coal aquifer, and about 280 in strata below the coal. There are no completion data available for the remainder of these wells (about 240).

If the five LBA tracts included in this EIS are leased and mined, the groundwater drawdown would be extended into areas surrounding the proposed new leases. The predicted cumulative worst-case drawdown effect from the five southern mines, including the five LBA tracts included in this EIS, is depicted on Figure 4-14. Currently, coal drawdowns from the Jacobs Ranch, Black Thunder and North Rochelle Mines have coalesced, and drawdowns from the North Antelope/Rochelle Complex and Antelope Mine have coalesced. The areas of drawdown from the five southern mines will coalesce in the future with or without the addition of mining activity on the five LBA tracts considered in this EIS.

When a lease is issued to an existing mine for a maintenance tract, the mine must revise its existing mining permit to include the new tract in its mine plan. In order to do that, each lessee would be required to conduct a detailed groundwater analysis to predict the extent of drawdown in the coal and overburden aquifers caused by mining each LBA tract that is leased. WDEQ/LQD would use the revised drawdown predictions to update the CHIA for this portion of the PRB. The applicants have installed monitoring wells which would be used to confirm or refute

drawdowns predicted by analysis. This analysis would be required as part of the WDEQ mine permitting procedure discussed in Section 1.2.

Potential water-level decline in the subcoal Fort Union Formation is the third major groundwater issue. According to the Wyoming SEO records as of July 1999, 14 PRB mines held permits for 42 wells between 400 ft and 10,000 ft deep. The zones of completion of these wells were not specified, and not all of the wells were producing (for example, three of the permits were held by an inactive mine, and one of the wells permitted by Black Thunder Mine has not been used since 1984).

Water level declines in the Tullock Aquifer have been documented in the Gillette area. According to Crist (1991), these declines are most likely attributable to pumpage for municipal use by Gillette and for use at subdivisions and trailer parks in and near the city of Gillette. Most of the water-level declines in the subcoal Fort Union wells occur within one mile of the pumped wells (Crist 1991, Martin et al. 1988). The mine facilities in the PRB are separated by a distance of one mile or more, so little interference between mine supply wells would be expected.

In response to concerns voiced by regulatory personnel, several mines have conducted impact studies of the subcoal Fort Union Formation. The OSM commissioned a cumulative impact study of the subcoal Fort Union Formation to address the effects of mine facility wells on this aquifer unit (OSM 1984). Conclusions from all these studies

are similar and may be summarized as follows:

- Because of the discontinuous nature of the sands in this formation and because most large-yield wells are completed in several different sands, it is difficult to correlate completion intervals between wells.
- In the Gillette area, water levels in this aquifer are probably declining because the city of Gillette and several subdivisions are utilizing water from the formation (Crist 1991). (Note: Gillette is mixing this water with water from wells completed in the Madison Formation at this time. Also, because drawdowns have occurred, some operators are able to dispose of CBM water by injecting it into the subcoal Fort Union Formation near the City of Gillette.)
- Because large saturated thicknesses are available (locally) in this aquifer unit, generally 500 ft or more, a drawdown of 100 to 200 ft in the vicinity of a pumped well would not dewater the aquifer.

The four applicant mines adjacent to the five LBA tracts included in this EIS have permits from the Wyoming SEO for eight subcoal Fort Union Formation water supply wells. Extending the life of one or more of the mines with an LBA tract would result in additional water being withdrawn from the subcoal Fort Union Formation (Tullock Member). The additional water withdrawal would not be expected to extend the

area of water level drawdown over a substantially larger area due to the discontinuous nature of the sands in the Tullock Member and the fact that drawdown and yield reach equilibrium in a well due to recharge effects. Due to the distances separating subcoal Fort Union Formation wells used for mine water supply, these wells have not experienced interference and are not likely to in the future. The North Antelope/Rochelle Complex wells would be in use for roughly three to 5.5 more years if the NARO North and South LBA Tracts are leased, depending on which alternative is selected. Their annual water production may increase, though not directly in proportion to annual coal production, which could increase by 20 percent if the LBA tracts are leased. The Black Thunder Mine wells would be in use for up to 10.7 years if the Little Thunder LBA Tract is leased, depending on which alternative is selected. Their annual water production may increase, though not directly in proportion to annual coal production, which could increase by 11 percent if the LBA tract is leased. The North Rochelle Mine wells would be in use for roughly 4.5 to 7.1 more years if the West Roundup LBA Tract is leased, depending on which alternative is selected. Their annual water production should not increase, as annual coal production would not increase if the LBA tract is leased. The Antelope Mine well would not be in use for an extended period of time if the West Antelope LBA Tract is leased, regardless of which alternative is selected because mine life would not be extended. The annual water production may increase, though not

directly in proportion to annual coal production, which could increase by 66 percent if the LBA tract is leased.

According to the Wyoming SEO, the only permitted, non-mine water supply wells drilled below 1,000 ft in a 100 square-mile area surrounding Wright are four wells permitted by the City of Wright. As discussed above, most of the water-level declines in the subcoal Fort Union wells occur within one mile of pumped wells. The Black Thunder Mine, which is located about six miles east of Wright, is the closest of the four applicant mines to Wright. None of the mines adjacent to the five LBA tracts propose to drill new sub-coal wells if they acquire additional coal. No impacts to the water supply for the town of Wright are anticipated due to the distance between the mines and the town.

Water requirements and sources for the proposed Two Elk and Two Elk Two power plants near the Black Thunder Mine are not currently known. The Wyoming SEO is discouraging further development of the lower Fort Union Formation aquifers, so the most likely groundwater source for Two Elk power plants is the Lance-Fox Hills. This would reduce the chances that the power plants would add to cumulative hydrologic impacts of mining.

The fourth issue of concern with groundwater is the effect of mining on water quality. Specifically, what effect does mining have on the water quality in the surrounding area, and what are the potential water quality problems in the backfill aquifer following mining?

In a regional study of the cumulative impacts of coal mining, the median concentrations of dissolved solids and sulfates were found to be larger in water from backfill aquifers than in water from either the Wasatch overburden or the coal aquifer (Martin et al. 1988). This is expected because blasting and movement of the overburden materials exposes more surface area to water, increasing dissolution of soluble materials, particularly from the overburden materials that were situated above the saturated zone in the premining environment.

One pore volume of water is the volume of water which would be required to saturate the backfill following reclamation. The time required for one pore volume of water to pass through the backfill aquifer is greater than the time required for the postmining groundwater system to reestablish equilibrium. According to the CHIA, estimates of the time required to reestablish equilibrium range from tens to hundreds of years (Martin et al. 1988).

Chemical analyses of 336 samples collected between 1981 and 1986 from 45 wells completed in backfill aquifers at 10 mines indicated that the quality of water in the backfill will, in general, meet state standards for livestock use when recharge occurs (Martin et al. 1988). The major current use of water from the aquifers being replaced by the backfill (the Wasatch and Wyodak Coal aquifers) is for livestock because these aquifers are typically too high in dissolved solids for domestic use and well yields are typically too low for irrigation (Martin et al. 1988).

According to monitoring data published by GAGMO (Hydro Engineering 1991a, 1991b, 1992, 1993, 1994, 1995, 1996b, 1997, 1998, 1999, and 2000), TDS values in backfill wells have ranged from 400 to 25,000 mg/L. Of the 48 backfill wells sampled in 1999 and reported in the 2000 annual GAGMO report (Hydro-Engineering 2000), TDS in 75 percent were less than 5,000 mg/L, TDS in 23 percent were between 5,000 and 10,000 mg/L, and TDS in one well was above 10,000 mg/L. These data support the conclusion that water from the backfill will generally be acceptable for its current use, which is livestock watering, even before equilibrium is established. The incremental effect on groundwater quality due to leasing and mining of one or more of the five LBA tracts included in this EIS would be to increase the total volume of backfill and, thus, the time for equilibrium to reestablish.

The fifth area of concern is the potential for cumulative impacts to groundwater resources in the coal due to the proximity of coal mining and CBM development. The Wyodak coal is being developed by mining and CBM production in the same general area. Dewatering activities associated with reasonably foreseeable CBM development would be expected to overlap with and expand the area of groundwater drawdown in the coal aquifer in the PRB over what would occur due to either coal mining or CBM development alone.

Numerical groundwater flow modeling was used to predict the drawdown impacts in the Wyodak CBM Project FEIS (BLM 1999c). The modeling

considered coal mining and CBM development in order to assess cumulative impacts. Modeling was done to simulate mining with and without CBM development in order to differentiate the impacts of the two types of activities.

Numerical groundwater flow modeling was also used to predict the impacts of the cumulative stresses imposed by mining and CBM development on the Fort Union Formation coal aquifer in the PRB Oil and Gas Project DEIS (BLM 2002a). Modeling was necessary because of the large areal extent, variability, and cumulative stresses imposed by mining and CBM development on the Fort Union coal aquifers. Information from earlier studies was incorporated into the modeling effort for this analysis.

As expected, modeling indicated that the groundwater impacts from CBM development and surface coal mining would be additive in nature and that the addition of CBM development would extend the area experiencing a loss in hydraulic head to the west of the mining area. The 20-year GAGMO report stated that drawdowns in all areas have greatly increased in the last few years due to the water production from the Wyodak coal aquifer by methane producers (Hydro-Engineering 2001).

Figure 4-15 shows the cumulative worst-case coal aquifer drawdown map for the life of the five southern mines (same as Figure 4-14) with the maximum modeled drawdown contours from the PRB Oil and Gas Project DEIS superimposed. These modeled composite maximum coal drawdown contours from mining and

Figure 4-15

CBM development would occur during the period 2006 to 2009 and are for the proposed action of operating 39,367 new CBM wells and 12,077 CBM wells already drilled and permitted for a total of 51,444 CBM wells operating by the end of 2011 (BLM 2002a).

Figure 4-15 indicates that to the north, south and west of the southern mine group, the projected drawdown in the coal aquifer due to CBM production would exceed drawdown due to mining. Drawdowns from CBM development are projected to exceed drawdowns from coal mining as close as one mile from each of the mines.

Drawdowns in the coal caused by CBM development would be expected to reduce the need for dewatering in advance of mining, which would be beneficial for mining. Wells completed in the coal may also experience increased methane emissions in areas of significant aquifer depressurization. There would be a potential for conflicts to occur over who (coal mining or CBM operators) is responsible for replacing or repairing private wells that are adversely affected by the drawdowns; however, the number of potentially affected wells completed in the coal is not large.

As discussed previously, coal companies are required by state and federal law to mitigate any water rights that are interrupted, discontinued, or diminished by coal mining. In response to concerns about the potential impacts of CBM development on water rights, a group of CBM operators and local

landowners developed a standard water well monitoring and mitigation agreement that can be used on a case-by-case basis as development proceeds. All CBM operators on federal oil and gas leases are required to offer this water well agreement to the surface landowners (BLM 2002a).

The Wyodak CBM Project FEIS (BLM 1999c) established requirements for federal CBM lessees to install monitoring wells at specific locations throughout the Wyodak EIS study area. According to the PRB Oil and Gas Project DEIS (BLM 2002a), the CBM companies propose to continue this program. The BLM is currently requiring monitoring wells for exploratory CBM development projects outside of the Wyodak EIS study area.

After CBM development and coal mining projects are completed, it will take longer for groundwater levels to recover due to the overlapping drawdown impacts caused by the dewatering and depressuring of the coal aquifer by both operations.

4.5.6 Alluvial Valley Floors

No cumulative impacts to AVFs are expected to occur as a result of leasing and subsequently mining each of the five LBA tracts. Impacts to designated AVFs are generally not permitted if the AVF is determined to be significant to agriculture. AVFs that are not significant to agriculture can be disturbed during mining but they must be restored as part of the reclamation process. Impacts during mining, prior to AVF restoration, would be expected to be incremental, not additive.

4.5.7 Wetlands

Wetlands are discrete features that are delineated on the basis of specific soil, vegetation, and hydrologic characteristics. Wetlands within areas of coal mining disturbance are impacted; wetlands outside the area of disturbance are not directly affected. Therefore, the impacts to wetlands as a result of surface coal mining are incremental, not additive. Increasing the area to be mined would increase the number of wetlands that would be impacted.

The North Antelope/Rochelle Complex has been authorized to impact 272.60 acres of jurisdictional wetlands, Black Thunder Mine 58.29 acres, North Rochelle Mine 20.24 acres, and Antelope Mine 76.67 acres. These numbers would increase if the LBA tracts are leased to these applicants (see Sections 3.8 and 4.1.7 of this document). COE requires replacement of all impacted jurisdictional wetlands in accordance with Section 404 of the Clean Water Act. As part of the mining and reclamation plans for each mine, COE approves the plan to restore wetlands and the number of acres to be restored. Replacement of functional wetlands may occur in accordance with agreements with the surface managing agency (on public land) or by the private landowners. Federal surface lands administered by the USFS are included in the NARO North, Little Thunder, and West Roundup LBA Tracts. During mining and before replacement of wetlands, all wetland functions would be lost. The replaced wetlands may not function in the same way as the premine wetlands did; however, all

wetlands would be replaced in accordance with COE requirements.

4.5.8 Vegetation

Most of the land that is being or would be disturbed is grassland, sagebrush shrubland, or breaks grassland and is used for grazing and wildlife habitat. Rangeland is by far the predominant land use in the PRB, accounting for 92 percent of the land use in Converse and Campbell Counties. A small amount of previously cultivated lands would be disrupted by mining. At the completion of mining, it is anticipated that all disturbed land would be reclaimed for grazing and wildlife habitat, mostly in the form of mixed native grass prairie, sagebrush shrubland, and, where appropriate, bottomland grassland. Some of the minor community types, such as those occurring on breaks, would not be restored to premining conditions but may be replaced to a higher level due to use of better quality soils.

Based on annual reports prepared by mining companies and submitted to WDEQ, in any given year approximately 10,000 to 15,000 acres of land disturbed by mining activities at the five existing southern surface coal mines would not be reclaimed to the point of planting with permanent seed mixtures. Over the life of the five southern mines, a total of approximately 66,582 acres would be disturbed. This disturbed area includes all existing leases including federal, state, and private coal. The currently proposed NARO North, NARO South, Little Thunder, West Roundup, and West Antelope LBA Tracts would add another 17,375

acres. Almost all of this acreage is native rangeland and would be returned to a native rangeland state through planting of WDEQ/LQD approved revegetation seed mixtures as required.

Several impacts to vegetation would occur as a result of operations at these five mines. Most of the surface disturbance would occur in two vegetation types: Grassland, and Big Sagebrush. Grassland makes up approximately 33.4 percent of the General Analysis Area and the Big Sagebrush vegetation type makes up approximately 32 percent of the General Analysis Area. All five mines plan to restore these two vegetation types as required by law. It is estimated that it would take from 20 to 100 years for Big Sagebrush density to reach premining levels. The Big Sagebrush component provides important wildlife habitat (particularly for mule deer, pronghorn, and sage grouse). The reduction in acreage of Big Sagebrush vegetation type would, therefore, reduce the carrying capacity of the reclaimed lands for pronghorn and sage grouse populations until premining sagebrush density levels are restored. Mule deer should not be affected since they are not as abundant in this area.

Although some of the less extensive native vegetation types (e.g., Graminoid/Forb Ephemeral Drainages) would be restored during reclamation, the treated grazing lands would not. Following reclamation and release of the reclamation bond, however, privately owned surface lands would be returned to agricultural management and the

areas with reestablished native vegetation could again be subject to sagebrush management practices.

Community and species diversities would initially be lower on reclaimed lands. The shrub components would take the longest to be restored to premining conditions. Shrub cover and forage values would gradually increase in the years following reclamation. Over longer periods of time, species re-invasion and shrub establishment on reclaimed lands should largely restore the species and community diversity on these lands to premining levels.

Over the long term, the net effect of the cumulative mine reclamation plans may be the restoration, at least in part, of all vegetation types originally found in the area. However, the shrub component may be substantially reduced in areal extent. Shrubs are relatively unproductive for livestock but very important for wildlife. All of the vegetation types found in the General Analysis Area, as on the LBA tracts, are fairly typical for this region of eastern Wyoming.

4.5.9 Wildlife

The direct impacts of surface coal mining on wildlife occur during mining and are therefore short-term. They include road kills by mine-related traffic, restrictions of wildlife movement created by fences, spoil piles, and pits, and displacement of wildlife from active mining areas. The indirect impacts are longer term and include loss of carrying capacity and microhabitats on reclaimed land due to flatter topography, less diverse

vegetative cover, and reduction in sagebrush density.

After mining and reclamation, alterations in the topography and vegetative cover, particularly the reduction in sagebrush density, would cause a decrease in carrying capacity and diversity on the LBA tracts. Sagebrush would gradually become reestablished on the reclaimed land, but the topographic changes would be permanent.

Cumulative impacts to most wildlife would increase as additional habitat is disturbed but would moderate as more land is reclaimed. Raptor and grouse breeding areas have been diminishing statewide for at least the last 30 years due, in part, to surface disturbing activities. Coal mining and gas exploration and development have been identified as potential contributors to the decline in their breeding habitat. Therefore, surface occupancy and disturbance restrictions, as well as seasonal restriction stipulations, have been applied to operations occurring on or near these crucial areas on public lands. These restrictions have helped protect important raptor and grouse habitat on public lands, but the success of yearlong restrictions on activities near areas critical to grouse has been limited because most of the surface in the PRB is privately owned. Erection of nesting structures and planting of trees on reclaimed land would gradually replace raptor nesting and perching sites. Small- and medium-sized animals would move back into the areas once reclamation is completed.

Numerous grazing management projects (fencing, reservoir developments, spring development, well construction, and vegetative treatments) have also impacted wildlife habitat in the area. The consequences of these developments have proven beneficial to some species and detrimental to others. Fencing has aided in segregation and distribution of livestock grazing, but sheep-tight woven wire fence has restricted pronghorn movement. Water developments are used by wildlife; however, without proper livestock management, many of these areas can become overgrazed. The developed reservoirs provide waterfowl, fish, and amphibian habitat. Vegetation manipulations have included the removal or reduction of native grass-shrublands and replacement with cultivated crops (mainly alfalfa/grass hay), as well as a general reduction of shrubs (mainly sagebrush) in favor of grass. These changes have increased spring and summer habitat for grazing animals, but have also reduced the important shrub component that is critical for winter range, thus reducing overwinter survival for big game and sage grouse. The reduction in sagebrush has been directly blamed for the downward trend in the sage grouse populations.

The regional EIS's (BLM 1974, 1979, 1981, and 1984) predicted significant cumulative impacts to pronghorn from existing concentrated mining and related disturbance as a result of habitat disturbance and creation of barriers to seasonal and daily movements. Significant cumulative indirect impacts were also predicted because of increased human

population and access resulting in more poaching, increased vehicle/pronghorn collisions, and increased disturbance in general. However, the WGFD recently reviewed monitoring data collected on mine sites for big game species and the monitoring requirements for big game species on those mine sites. Their findings concluded that the monitoring had demonstrated the lack of impacts to big game on existing mine sites. No severe mine-caused mortalities have occurred and no long-lasting impacts on big game have been noted on existing mine sites. The WGFD therefore recommended that big game monitoring be discontinued on all existing mine sites. New mines will be required to conduct big game monitoring if located in crucial winter range or in significant migration corridors.

Leasing of the five LBA tracts under the Proposed Actions would increase the area of habitat disturbance in the southern group of mines by 44.3 percent and would enlarge the area where daily wildlife movement is restricted.

The entire NARO North and South, West Roundup, and West Antelope LBA Tracts, and approximately 81 percent of the Little Thunder LBA Tract as proposed are within the Cheyenne River Pronghorn Herd Unit, which includes 4.78 million acres. The mining operations within the Cheyenne River Herd Unit are the North Antelope/Rochelle Complex, Black Thunder, North Rochelle, and Antelope Mines. These mines will cumulatively disturb 48,573 acres within the herd unit based on existing

leases. If the five LBA tracts are leased, the estimated mining disturbance within the Cheyenne River Herd Unit would increase by about 16,344 acres to 64,917 acres. This would represent approximately 1.4 percent of the Cheyenne River Herd Unit area.

Approximately 19 percent of the Little Thunder LBA Tract is within the Hilight Pronghorn Herd Unit, which includes approximately 546,000 acres. The mining operations within the Hilight Herd Unit are the Caballo, Belle Ayr, Cordero-Rajo, Coal Creek, Jacobs Ranch, and Black Thunder Mines. These mines will cumulatively disturb 57,512 acres within the herd unit based on existing leases. If the Black Thunder LBA Tract is leased, the estimated mining disturbance within the Hilight Herd Unit would increase by about 1,031 acres to 58,543 acres. This would represent approximately 10.7 percent of the Hilight Herd Unit area.

The five LBA tracts included in this EIS are located within the Thunder Basin Mule Deer Herd Unit. The herd unit contains approximately 2.33 million acres and includes nine permitted coal mines along Highway 59, from Caballo Mine to the north, to Antelope Mine to the south. Currently, permitted disturbance within this nine-mine group includes approximately 106,085 acres. Addition of the five proposed LBA tracts would increase the disturbance area by about 17,375 acres, an increase of 22.4 percent. The 123,460 acres of existing and proposed mine disturbance represents approximately 5.3 percent

of the 2.33 million acre Thunder Basin Mule Deer Herd Unit.

The WGFD big game herd unit maps show the NARO North and South, Little Thunder, and West Roundup LBA Tracts are out of the normal white-tailed deer range. However, white-tailed deer are infrequently recorded in the vicinity of the West Antelope LBA Tract. Incidental observations are generally confined to the Antelope Creek riparian corridor. The WGFD does not consider the five LBA tracts to include elk use areas, but elk have been recorded within the vicinity of the LBA tracts over the past several years and observed wintering on adjacent grasslands in recent years as well. None of the proposed lease areas or areas within two miles has been classified as crucial or critical elk habitat. The nearest crucial elk habitat is just over four miles east of the Little Thunder LBA Tract on the Jacobs Ranch Mine reclaimed mine land. The WGFD (Oedekoven 1994) designated an area of approximately five square miles on Jacobs Ranch Mine reclaimed or adjacent lands as crucial winter habitat for the Rochelle Hills elk herd. There is potential for expansion of elk habitat on the lease areas through quality reclamation.

The area of active mining in the southern group of five mines contains significant numbers of raptor nests. The largest concentration of nesting activity in the area is associated with the rough breaks country and areas where trees have become established. Raptor mitigation plans have been developed and approved in the approved mining and reclamation plans of each mine. The raptor

mitigation plan for each mine is subject to USFWS review and approval before the mining and reclamation plan is approved. Any nests that are impacted by mining operations must be relocated in accordance with these plans, after special use permits are secured from USFWS and WGFD. The creation of artificial raptor nest sites and raptor perches may ultimately enhance raptor populations in the mined area. On the other hand, where power poles border roads, perched raptors may continue to be illegally shot and continued road kills of scavenging eagles may occur. Any influx of people into previously undisturbed land may also result in increased disturbance of nesting and fledgling raptors.

Cumulative impacts to waterfowl from already approved mining, as well as the five proposed LBA tracts would be minor because most of these birds are transient and most of the ponds in this area are ephemeral. In addition, the more permanent impoundments and reservoirs that are impacted by mining would be restored. Sedimentation ponds and wetland mitigation sites would provide areas for waterfowl during mining.

Few vital sage grouse wintering areas or leks have been, or are planned to be, disturbed as a result of already approved mining and no additional wintering areas or leks would be disturbed if the LBA tracts included in this EIS are leased and mined. However, noise related to the mining activity could indirectly impact sage grouse reproductive success. Sage grouse leks close to active mining could be abandoned if mining-related

noise elevates the existing ambient noise levels. Surface coal mining activity is known to contribute to a drop in male sage grouse attendance at leks close to active mining, and over time this can alter the distribution of breeding grouse (Remington and Braun 1991). Because sage grouse populations throughout Wyoming have been declining over the past several years, the cumulative impact of all energy related development occurring in the area could be significant to the local sage grouse population.

The addition of the five proposed LBA tracts to the area to be disturbed by currently approved mining operations in the southern PRB would cumulatively increase a reduction in habitat for other mammal and bird species. Many of these species are highly mobile, have access to adjacent habitats, and possess a high reproductive potential. Habitat adjacent to existing and proposed mine areas includes sagebrush shrublands, upland grasslands, bottomland grasslands, improved pastures, haylands, wetlands, riparian areas, greasewood shrublands, and ponderosa pine woodlands. As a result, these species should respond quickly and invade suitable reclaimed lands as reclamation proceeds. A research project on habitat reclamation on mined lands within the PRB for small mammals and birds concluded that the diversity of song birds on reclaimed areas was slightly less than on adjacent undisturbed areas, although their overall numbers were greater (Shelley 1992).

Cumulative impacts on fish habitat and populations would be minimal because local drainages generally have limited value due to intermittent or ephemeral flows. Some of the permanent pools along drainages support minnows and other nongame fish, and the larger impoundments and streams in the area that have fish populations would be restored following mining.

Additional discussions of cumulative impacts to wildlife from coal development and industrialization of the eastern PRB are discussed in BLM regional EISs for the area (BLM 1974, 1979, 1981, and 1984), and these documents are incorporated by reference into this EIS.

The cumulative impacts of mining the five LBA tracts included in this EIS would be assessed during the WDEQ/LQD permit approval process, if they are leased. During the permit approval process, the mine permit applications would be reviewed by WGFD and WDEQ/LQD.

4.5.10 Threatened, Endangered, Proposed, and Candidate Species and USFS Region 2 Sensitive Species

Refer to Appendix G.

4.5.11 Land Use and Recreation

Surface coal mining reduces livestock grazing and wildlife habitat, limits access to public lands that are included in the mining areas, and disrupts oil and gas development. In addition, when oil and gas development facilities are present on coal leases, all associated facilities and equipment must be removed

prior to mining. Mining the coal prior to recovery of all of the CBM resources releases CBM into the atmosphere. The potential impacts of conflicts between CBM and coal development are discussed in Section 4.1.2.

Cumulative impacts resulting from energy extraction in the PRB include a reduction of livestock grazing and subsequent revenues, a reduction in habitat for some species of wildlife (particularly pronghorn, sage grouse, and mule deer), and loss of recreational access to public lands (particularly for hunters).

There are no recreational facilities, wilderness areas, etc., in the immediate vicinity of the existing southern group of mines, and the majority of the land is seldom used by the public except for dispersed recreation (e.g., hunting), off-road vehicles, and sightseeing. Hunting and other public access is generally limited inside of the mine permit areas for safety reasons. However, approximately 77 percent of this land surface is private and access is controlled by the landowner. Leasing the NARO North, Little Thunder, and West Roundup LBA Tracts would affect access to public lands because public lands administered by USFS are included on these tracts. Leasing the NARO South and West Antelope LBA Tracts would not affect access to public lands because no public lands are included on these tracts.

The increased human presence associated with the cumulative energy development in the eastern PRB has likely increased levels of legal and illegal hunting. Conversely, the

mines in the area have become refuges for big game animals during hunting seasons since they are often closed to hunting. Reclaimed areas are attractive forage areas for big game. As an example, reclaimed lands at the Jacobs Ranch Mine have been declared crucial elk winter habitat by WGFD (Oedekoven 1994). Energy development-related indirect impacts to wildlife have resulted from and will continue to result from human population growth. Energy development has been the primary cause of human influx into the eastern PRB. Mining the LBA tracts under the Proposed Actions and/or Alternatives 2 and 3 would allow a continuation of employment and production at the North Antelope/Rochelle Complex, Black Thunder, North Rochelle, and Antelope Mines by up to 11 years.

The demand for outdoor recreational activities, including hunting and fishing, has increased proportionately as population has increased. However, at the same time these demands are increasing, wildlife habitat and populations are being reduced. This conflict between decreased habitat availability and increased recreational demand has had (or may have) several impacts: demand for hunting licenses may increase to the point that a lower success in drawing particular licenses will occur; hunting and fishing, in general, may become less enjoyable due to more limited success and overcrowding; poaching may increase; the increase in people and traffic may continue to result in shooting of nongame species and road kills; and increased off-road activities may continue to result in disturbance of

wildlife during sensitive wintering or reproductive periods.

Campbell County's public recreation facilities are some of the most extensively developed in the Rocky Mountain Region, and use by young, recreation-oriented residents is high. The relatively strong financial position of the county recreation program appears to assure future recreation opportunities for residents regardless of the development of the LBA tracts or any other specific mine. Converse County's recreational facilities are not as advanced and development of the LBA tracts and the ensuing employment increase may increase demand for recreational opportunities in Converse County.

4.5.12 Cultural Resources

In most cases, treatment of eligible sites is confined to those that would be directly impacted, while those that may be indirectly impacted receive little or no consideration unless a direct mine-associated effect can be established. The higher population levels associated with coal development coupled with increased access to remote areas can result in increased vandalism both on and off mine property. Surface coal mining operations may contribute to the permanent unintentional destruction of segments of the archeological record. Surface coal mining is generally limited to lands where the overburden thickness is relatively thin (200 ft or less).

A majority of the known cultural resource sites in the eastern PRB are known because of studies at existing and proposed coal mines. Based on

the cultural inventories conducted for the five southern mines, there is an estimated average density of 5.7 sites per square mile (640 acres) in this area and approximately 10 percent of these sites are eligible for the NRHP. The cultural inventories conducted on the five LBA tracts found that the density of sites and occurrence of eligible sites is slightly lower than the average density on the NARO North and South, Little Thunder, and West Roundup LBA Tracts, and slightly higher than the average density on the West Antelope LBA Tract. Approximately 580 cultural resource sites will be impacted by already approved mines, with an estimated 86 of these sites being eligible for nomination to the NRHP. These numbers would increase if the LBA tracts are leased.

Adverse impacts to cultural sites include ground disturbance and changes in setting or context. Ground disturbance, the major impact, can affect the integrity of or destroy a site. Changes in setting or context greatly impact historical properties. Mitigation measures such as stabilization, restoration, or moving of buildings may cause adverse impacts to context, in-place values, and overall integrity. Additionally, the loss of a site through mitigation can constitute an adverse impact by eliminating the site from the regional database and/or affecting its future research potential.

Beneficial results or impacts have also occurred from coal development. Valuable data have been collected during cultural resource surveys. Data that would otherwise not be collected until some time in the

future, or lost in the interim, have been made available for study. Mitigation has also resulted in the collection and preservation of data that would otherwise be lost. The data that has been and will be collected provides opportunities for regional and local archeological research projects.

4.5.13 Native American Concerns

No cumulative impacts to Native American traditional values or religious sites have been identified as a result of leasing and subsequent mining of the NARO North and South, Little Thunder, West Roundup, and West Antelope LBA Tracts.

4.5.14 Paleontological Resources

Impacts to paleontological resources as a result of the already approved cumulative energy development occurring in the eastern PRB consist of losses of plant, invertebrate, and vertebrate fossil material for scientific research, public education (interpretive programs), and other values. Losses have and will result from the destruction, disturbance, or removal of fossil materials as a result of surface-disturbing activities, as well as unauthorized collection and vandalism. A beneficial impact of surface mining can be the exposure of fossil materials for scientific examination and collection, which might never occur except as a result of overburden removal, exposure of rock strata, and mineral excavation.

4.5.15 Visual Resources

A principal visual impact within the area of the five southern mines is the

visibility of mine pits and facility areas. People most likely to see these facilities would either be passing through the area or visiting it on mine-related business. Except for the loading facilities and the draglines, the pits and facilities are not visible from more than a few miles away. While sufficient capacity exists, future changes in facilities may be constructed to mine the LBA tracts and to improve operating efficiency and air quality protection at the mines.

After mining, the reclaimed slopes might appear somewhat smoother than premining slopes and there would be fewer gullies than at present. Even so, the landscape of the reclaimed mines would look very much like the undisturbed landscape within the General Analysis Area.

4.5.16 Noise

Existing land uses within the eastern PRB (e.g., mining, livestock grazing, oil and gas production, wildlife habitat, and recreation) contribute to noise levels, but wind is generally the primary noise source. Mining on the LBA tracts would not increase the number of noise-producing facilities within the eastern PRB, but it would lengthen the time this particular noise source would exist, expand the area this noise source would affect, and may augment the level of impacts to other resources (e.g., increased exposure of wildlife to noise impact and increased noise impact to recreational users). Mining-related noise is generally masked by the wind at short distances, so cumulative overlap of noise impacts between mines is not likely.

Recreational users and grazing lessees utilizing lands surrounding active mining areas do hear mining-related noise, but this has not been reported to cause a significant impact. As stated above, wildlife in the immediate vicinity of mining may be adversely affected by noise; however, observations at surface coal mines in the area indicate that wildlife generally adapt to noise conditions associated with active coal mining.

Cumulative increases in noise from trains serving the eastern PRB mines have caused substantial increases (more than five dBA) in noise levels along segments of the rail lines over which the coal is transported to markets. However, no significant adverse impacts have been reported as a result.

4.5.17 Transportation Facilities

New or enhanced transportation facilities (road, railroads, and pipelines) are expected to occur as a result of energy development in the PRB. However, no new cumulative impacts to transportation facilities are expected to occur as a direct result of leasing and subsequent mining of the LBA tracts. The transportation facilities for the North Antelope/Rochelle Complex, Black Thunder, North Rochelle, and Antelope Mines are already in place. Construction of new rail facilities for transporting the coal out of the region, such as the proposed DM&E railroad, would add another route of coal transportation out of the basin, but would not be expected to increase the number of coal trains without an increase in market demand for the

coal. Traffic levels from the mines would be maintained for a longer time period under the action alternatives. Oil and gas pipelines on the tracts would have to be relocated or removed prior to mining.

4.5.18 Socioeconomics

Because of all of the energy-related development that has been occurring in and around Campbell and Converse Counties in the past 30 years, socioeconomic impacts are a major concern. Wyoming's economy has been structured around the basic industries of extractive minerals, agriculture, tourism, timber, and manufacturing. Each of these basic industries is important. Many Wyoming communities depend on the minerals industry for much of their economic well being. The minerals industry is by far the largest single contributor to the economy of Wyoming. The 2001 valuation on minerals industry production and property in 2000 was \$6,407,060,245, or 61 percent of the State's total valuation. Since most minerals are taxed as a percentage of their assessed valuation, this makes the minerals industry a significant revenue base for both local and state government in Wyoming. Wyoming mineral production in 2000 placed the state first in coal production, fifth in natural gas production, sixth in oil production (Wyoming Department of Administration and Information 2002), and sixteenth in nonfuel mineral production in the United States (USGS 2000).

Since 1990, coal production in Campbell and Converse Counties has increased by an average of 7.6

percent per year (Wyoming Department of Commerce 1996 and WSGS 2001c). WSGS is currently projecting that coal production in Campbell and Converse Counties will decrease by 2.1 percent in 2002, increase by 3 percent in 2003, and increase by about one percent per year during 2004 through 2007 (WSGS 2002b). In the first three quarters of 2001, Wyoming coal supplied 39 percent of the nation's steam coal needs, and PRB coal was used to generate electricity for public consumption in 28 states, Canada, Mexico, and Spain (U.S. Department of Energy 2002). Electricity consumers in those states benefit from low prices for PRB coal, from cleaner air due to the low sulfur content of the coal, and from the royalties, taxes, and bonus payments that the federal government receives from the coal.

Locally, continued sale of PRB coal helps stabilize municipal, county, and state economies. By 2005, annual coal production is projected to generate about \$2.6 billion of total economic activity, including \$351 million of personal income, and support the equivalent of 15,885 full-time positions (BLM 1996a).

In addition to the five proposed LBA tracts studied in this EIS, a number of mineral and related developments have occurred, are in progress, or are anticipated in Campbell County and the surrounding area. The 90-Mw Wygen I coal-fired power plant is currently under construction near the Wyodak Mine east of Gillette. The operator of the facility, Black Hills Energy Capital, Inc., expects the plant to be completed by 2003 (Black

Hills Corporation 2001). A second coal-fired plant, the 500-Mw Wygen II, is currently being permitted nearby. NAPG has proposed the construction of three coal-fired power plants in Campbell County: the 300-Mw Two Elk and the 500-Mw Two Elk Two plants near the Black Thunder Mine, and the 500-Mw Middle Bear plant near the Cordero-Rojo Mining Complex (Billings Gazette 2001). In addition, NAPG has proposed the construction of a power line that would link its two 500-Mw power plants with interstate transmission lines in the Front Range of Colorado (Billings Gazette 2002). According to Pedersen Planning Consultants (2001), power plant development between 2001 and 2010 could bring over 6,000 temporary and 450 permanent jobs to Campbell County alone.

The DM&E Railroad Corporation has proposed the construction of a rail line connecting its existing facilities in South Dakota and Minnesota with PRB coal mines. The lead regulatory agency for the expansion project, the Surface Transportation Board, granted final approval in January 2002. DM&E must still obtain permits or approvals from other agencies including the BLM, USFS, and COE, and several lawsuits have been filed against the proposal following the approval of the project by the Surface Transportation Board (WSGS 2002b). For Wyoming, the estimated direct-construction workforce is 700 persons for the estimated \$1.5 billion project.

Recently, Gillette has experienced a population increase as a result of CBM development in the area. In the

past several years, Gillette's population has increased, unemployment has decreased, housing has become increasingly tight, and traffic and criminal activity have increased. Under the Proposed Action for the Wyoming Oil and Gas Project DEIS (BLM 2002a), it is assumed that CBM development would require 2,047 employees (1,974 CBM and 67 non-CBM) for a 20-year project life.

If all of the new projects are undertaken, it is likely that the population in northeastern Wyoming would continue to grow, and there would be increasing demands on housing, schools, roads, law enforcement, and other aspects of the communities in this area. The population increase would be expected to be somewhat dispersed among all of the communities in the area, which include Douglas, Wright, and Newcastle as well as Gillette. The extent of the impacts to the local communities would depend on the amount of overlap between the construction periods on the proposed projects. According to a 2001 study of future housing needs in Campbell County (Pederson Planning Consultants 2001), it was estimated that increases in CBM development and surface coal mine employment, coupled with the construction of currently proposed power plants, could increase Campbell County housing demand by over 5,000 housing units, with the peak occurring in about 2005. Delays in power plant and railroad permitting and construction could alter the timing and magnitude of the peak in population and housing demand. At this time, based on the status of their

planning and permitting efforts, the Black Hills Corporation, Inc. Wygen I and Wygen II coal-fired power plants, the NAPG Two Elk coal-fired power plant, and the proposed DM&E rail line are considered reasonably foreseeable developments based on the status of their planning and permitting efforts. The NAPG Two Elk Unit Two coal-fired power plant, and the NAPG Middle Bear coal-fired power plant are proposals which are not reasonably foreseeable at this time, and the ENCOAL coal enhancement facility is indefinitely postponed. Of the currently proposed power plants, only the Wygen I plant is currently under construction. Construction of the other proposed plants would be dependent on completion of permitting requirements and availability of financing. Construction of the proposed DM&E railroad is also dependent on completion of permitting requirements and availability of financing as well as resolution of legal issues. Increases in mining employment would potentially occur gradually as new coal leases are permitted for mining. Up to 186 additional jobs are anticipated if all five LBA tracts studied in this EIS are leased.

The construction of coal-fired power plants and the DM&E Railroad expansion and continued CBM development would result in direct fiscal benefits to city, county, and state governments. Equipment and facilities would be subject to excise (sales and use) and ad valorem (property) taxes. Counties that have a major construction project of \$50 million or larger also receive extra revenues in the form of impact

assistance. According to an article in the Gillette News-Record, if the three NAPG power plants are constructed, Campbell, Converse, Weston, and Crook Counties could receive as much as \$11 million in impact assistance (Gillette News-Record 2001c).

4.6 The Relationship Between Local Short-term Uses of Man's Environment and the Maintenance and Enhancement of Long-term Productivity

From 2002 on, the North Antelope/Rochelle Complex would be able to produce coal at an average production level of 75 mmtpy for 12 years under Alternative 1 (No Action Alternative), compared with an average of 90 mmtpy for 16 years under the Proposed Action, an average of 90 mmtpy for 17.5 years under Alternative 2, or an average of 90 mmtpy for 15 years under Alternative 3 (Table 2-1). From 2002 on, the Black Thunder Mine would be able to produce coal at an average production level of 38.3 mmtpy for 24 years under Alternative 1 (the No Action Alternative), compared with an average of 42.5 mmtpy for 32 years under the Proposed Action, or an average of 42.5 mmtpy for 34.7 years under Alternatives 2 and 3 (Table 2-2). From 2002 on, the North Rochelle Mine would be able to produce coal at an average production level of 35 mmtpy for 7.3 years under Alternative 1 (No Action Alternative), compared with an average of 35 mmtpy for another 11.8 years under the Proposed Action, or an average of 35 mmtpy for 13.1 years under Alternative 2 (13.4 years under

Alternative 2 plus Lease WYW-127221 modification), or an average of 35 mmtpy for another 14 years under Alternative 3 (14.4 years under Alternative 3 plus Lease WYW-127221 modification) (Table 2-3). From 2002 on, the Antelope Mine would be able to produce coal at an average production level of 13.9 mmtpy for another 25 years under Alternative 1 (No Action Alternative), compared with an average of 23 mmtpy for 25 years under the Proposed Action, an average of 24.1 mmtpy for 25 years under Alternative 2, or an average of 20.7 mmtpy for another 25 years under Alternative 3 (Table 2-4).

As the coal is mined, almost all components of the present ecological system, which have developed over a long period of time, would be modified. In partial consequence, the reclaimed land would be topographically lower, and although it would resemble original contours, it would lack some of the original diversity of geometric form.

The forage and associated grazing and wildlife habitat that the LBA tracts provide would be temporarily lost during mining and reclamation. During mining of the LBA tracts there would be a combined loss of native vegetation on 17,375 acres (Proposed Action for all five LBA tracts) up to a maximum of 19,943 acres (Alternative 2 for all tracts except Alternative 3 plus lease WYW-127221 modification for the West Roundup LBA Tract) with an accompanying disturbance of wildlife habitat and grazing land. This disturbance would occur incrementally over a period of years. The mine sites would be returned to

equivalent or better forage production capacity for domestic livestock before the performance bonds are released. Long-term productivity would depend largely on postmining range-management practices, which to a large extent would be controlled by private landowners.

Mining would disturb pronghorn habitat, but the LBA tracts would be suitable for pronghorn following successful reclamation. Despite loss and displacement of wildlife during mining, it is anticipated that reclaimed habitat would support a diversity of wildlife species similar to premining conditions. The diversity of species found in undisturbed rangeland would not be completely restored on the leased lands for an estimated 50 years after the initiation of disturbance. Re-establishment of mature sagebrush habitat--which is crucial for pronghorn and sage grouse--could take even longer.

CBM is currently being recovered from within and/or near each of the LBA tracts and BLM's analysis suggests that a large portion of the CBM resources on each of the tracts can be recovered prior to mining. CBM that is not recovered prior to mining would be vented to the atmosphere during the mining process. Methane is a greenhouse gas which contributes to global warming. According to the *Methane Emissions* section of Energy Information Administration/Department of Energy (EIA/DOE) report 0573(99), *Emissions of Greenhouse Gases in the United States 1999*, U.S. anthropogenic methane emissions totaled 28.8 million metric tons in 1999. U.S.

1999 methane emissions from coal mining were estimated at 2.88 million metric tons (10 percent of the U.S. total anthropogenic methane emissions in 1999). According to Table 15 of this report, surface coal mining was estimated to be responsible for about 0.54 million metric tons of methane emissions in 1999. This represents about 1.88 percent of the estimated U.S. anthropogenic methane emissions in 1999, and about 18.75 percent of the estimated methane emissions attributed to coal mining of all types. Based on the 1999 coal production figure, the Wyoming PRB coal mines were responsible for approximately 0.9 percent of the estimated U.S. 1999 anthropogenic methane emission, and the North Antelope/Rochelle Complex, Black Thunder, North Rochelle, and Antelope Mines were responsible for approximately 0.4 percent of estimated U.S. 1999 anthropogenic methane emissions. Currently, the North Antelope/Rochelle Complex, Black Thunder Mine, and Antelope Mine anticipate increasing coal production rates if they acquire leases for the NARO North and South LBA Tracts, the Little Thunder LBA Tract, and the West Antelope LBA Tract, respectively. The North Rochelle Mine does not propose to increase coal production rates if they acquire a lease for the West Roundup LBA Tract.

Total U.S. methane emissions attributable to coal mining would not be likely to decrease if one or more of these five LBA tracts are not leased at this time because a decision to lease or not to lease these tracts would not directly affect total U.S. coal

production. However, the methane on an LBA tract could be more completely recovered if leasing is delayed.

If these LBA tracts are leased and mined, there would be a deterioration of the groundwater quality in the lease areas; however, the water quality would still be adequate for livestock and wildlife. This deterioration would probably occur over a long period of time. As a result of mining alone, depth to groundwater would increase within roughly 25 miles away from the five southern mine pits in the coal aquifer. The water levels in the coal aquifer should return to premining levels at some time after mining has ceased because recharge areas would not be disturbed in order to recover the coal in the LBA tracts.

Mining operations and associated activities would degrade the air quality and visual resources of the area on a short-term basis. Following coal removal, removal of surface facilities, and completion of reclamation, there would be no long-term impact on air quality. The long-term impact on visual resources would be negligible.

Short-term impacts to recreation values may occur from reduction in big game populations due to habitat disturbance and reduction in access to some public lands. These changes would primarily impact hunting in the lease areas. However, because reclamation would result in a wildlife habitat similar to that which presently exists and access to public lands would be restored, there should

be no long-term adverse impacts on recreation.

The long-term economy of the region would be enhanced as a result of the Proposed Actions and action alternatives. The Proposed Action, Alternative 2, and Alternative 3 would extend the life of the North Antelope/Rochelle Complex by from three to 5.5 years (Table 2-1). The Proposed Action, Alternative 2, and Alternative 3 would extend the life of the Black Thunder Mine by from eight to 10.7 years (Table 2-2). The Proposed Action, Alternative 2, Alternative 2 plus lease WYW-127221 modification, Alternative 3, and Alternative 3 plus lease WYW-127221 modification would extend the life of the North Rochelle Mine by from 4.5 to 7.1 years (Table 2-3). The Proposed Action and Alternatives 2 and 3 are not predicted to extend the life of the Antelope Mine.

4.7 Irreversible and Irretrievable Commitments of Resources

The major commitment of resources would be the mining and consumption of 1,331.2 million tons (Proposed Action for all five LBA tracts) up to a maximum of 1,731.4 million tons (Alternative 2 for all tracts except Alternative 3 plus lease WYW-127221 modification for the West Roundup LBA Tract) of coal to be used for electrical power generation. CBM that is not recovered prior to mining would also be irreversibly and irretrievably lost (see additional discussion of the impacts of venting CBM to the atmosphere in Section 4.6). It is estimated that one to two percent of the energy produced would be

required to mine the coal, and this energy would also be irretrievably lost.

The quality of topsoil on approximately 17,375 acres (Proposed Action for all five LBA tracts) up to a maximum of approximately 19,943 acres (Alternative 2 for all tracts except Alternative 3 plus lease WYW-127221 modification for the West Roundup LBA Tract) would be irreversibly changed. Soil formation processes, although continuing, would be irreversibly altered during mining-related activities. Newly formed soil material would be unlike that in the natural landscape.

Loss of life may conceivably occur due to the mining operations and vehicular and train traffic. On the basis of surface coal mine accident rates in Wyoming as determined by the Mine Safety and Health Administration (1997) for the 10-year period 1987-1996, fatal accidents (excluding contractors) occur at the rate of 0.003 per 200,000 man-hours worked. Disabling (lost-time) injuries occur at the rate of 1.46 per 200,000 man-hours worked. Any injury or loss of life would be an irretrievable commitment of human resources.

Disturbance of all known historic and prehistoric sites on the mine areas would be mitigated to the maximum extent possible. However, accidental destruction of presently unknown archeological or paleontological values would be irreversible and irretrievable.

5.0 CONSULTATION AND COORDINATION

In addition to this EIS¹, other factors and consultations are considered and play a major role in determining the decision on these proposed lease applications. These include the following.

Regional Coal Team Consultation.

The four coal lease applications included in this draft EIS were all reviewed and discussed at the October 25, 2000 PRRCT public meeting in Cheyenne, Wyoming. Each of the applicants presented information about their existing mine and pending lease application to the PRRCT at that meeting. Voting and nonvoting members of the PRRCT include the governors of Wyoming and Montana, the Northern Cheyenne Tribe, the Crow Tribal Council, the USFS, OSM, USFWS, National Park Service, and USGS. The PRRCT determined that the lands in the four applications met the qualifications for processing as production maintenance tracts. The PRRCT recommended that the BLM continue to process all four lease applications.

Governor's Consultation. The BLM Wyoming State Director notified the Governor of Wyoming on April 5, 2000 that PRCC had filed a lease application with BLM for the NARO North and NARO South LBA Tracts. The BLM Wyoming State Director notified the Governor of Wyoming on April 15, 2000 that ALC filed a lease application with BLM for the Little

Thunder LBA Tract. The BLM Wyoming State Director notified the Governor of Wyoming on August 24, 2000 that TCC filed a lease application with BLM for the West Roundup LBA Tract. The BLM Wyoming State Director notified the Governor of Wyoming on October 3, 2000 that ACC filed a lease application with BLM for the West Antelope LBA Tract.

Public Notice. A notice announcing the receipt of the PRCC, ALC, and TCC coal lease applications was published in the *Federal Register* on September 12, 2000. This notice also announced the date, time, and place of the PRRCT meeting to be held on October 25, 2000 to discuss these applications. BLM published a Notice of Intent to Prepare an Environmental Impact Statement and Notice of Scoping in the *Federal Register* on October 3, 2001 and in the Gillette News-Record on September 25, 2001 and October 2, 2001. The publications served as public notice that the ACC coal lease application had been received, announced the time and location of a public scoping meeting, and requested public comment on all four lease applications.

Parties on the distribution list were sent letters announcing the time and location of a public scoping meeting in September 2001. The public scoping meeting was held on October 10, 2001 in Gillette, Wyoming. At the public meeting, PRCC, TBCC, TCC, and ACC personnel orally presented information about their mines and their needs for the coal. The presentations were followed by a

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

question and answer period, during which one oral comment was made. The scoping period extended from October 1 through October 31, 2001, during which time BLM received 12 written comments.

The EPA will publish a Notice of Availability in the *Federal Register* for the DEIS. The BLM will publish a Notice of Availability and Notice of Public Hearing in the *Federal Register* for the DEIS. There will be a 60-day comment period on the DEIS. A formal public hearing will be held during the 60-day comment period to solicit public comments on the DEIS and on the fair market value, the maximum economic recovery, and the proposed competitive sale of coal from the five LBA tracts. Following the comment period on the DEIS, the FEIS will be prepared. Comments received from the public, state and federal review agencies on the DEIS will be included in the FEIS. Parties on the distribution list will be sent copies of the FEIS when it is completed, and the EPA and BLM will publish a Notice of Availability for the FEIS. After a 30-day availability period, BLM will make a separate decision to hold or not to hold a competitive lease sale for each of the federal coal in these five tracts. A separate ROD will be signed for each of the tracts. Copies of each ROD will be mailed to parties on the mailing list and others who commented on this LBA during the NEPA process. After each ROD is signed, there will be a 30-day appeal period before the ROD is implemented.

Department of Justice Consultation

After each competitive coal lease sale,

but prior to issuance of a lease, BLM will solicit the opinion of the Department of Justice on whether the planned lease issuance creates a situation inconsistent with federal anti-trust laws. The Department of Justice is allowed 30 days to make this determination. If the Department of Justice has not responded in writing within the 30 days, BLM can proceed with issuance of the lease.

Other Consultations. Other federal, state, and local governmental agencies that were directly consulted in preparation of this EIS are listed in Table 5-1.

List of Preparers. This EIS was prepared by WWC Engineering, a third party contractor, under the direction of the BLM. Representatives from cooperating agencies contributed to and participated in the NEPA process. Tables 5-2 and 5-3 provide listings of the BLM, USFS, and OSM interdisciplinary team and the third-party consultant personnel who prepared and reviewed this EIS.

Distribution List. This EIS was distributed to numerous Congressional offices, federal agencies, state governments, local governments, industry representatives, interest groups, and individuals for their review and comment (Tables 5-4a and 5-4b).

Table 5-1. Other Federal, State, and Local Governmental Agencies Consulted in EIS Preparation.

Agency or Organization	Individual	Position
Powder River Regional Coal Team	5 Voting Members and 21 Nonvoting Members	
Wyoming Game and Fish Department	Lynn Jahnke	Wildlife & Fish Supervisor
Wyoming Department of Environmental Quality		
Air Quality Division	Bernard Daily	Program Manager for New Source Review Program
	Judy Shamley	Sr. Analyst
Land Quality Division	Donald McKenzie	District III Supervisor
	Doug Emme	Engineer
Wyoming Department of Administration and Information	Wayne Liu	Division of Economic Analysis, Senior Economist
Wyoming Department of Revenue	Allen Black	Ad Valorem Tax Division, Administrator
	Randy Bolles	Mineral Tax Division, Administrator
Wyoming Employment Center	Betsy Hockert	Analyst
USDA/Natural Resources Conservation Service	Randy White	Soil Scientist
USDI/OSM, Casper, Wyoming	Mark Humphrey	Mine Engineer

5.0 Consultation and Coordination

Table 5-2. List of Contributors and Reviewers.

Name	Project Responsibility
BLM Casper Field Office	
Mike Karbs	Project Supervisor
Mike Brogan	Water Resources
Joe Meyer	Soils
Chris Arthur	Cultural
Willie Fitzgerald	Wildlife
BLM Wyoming State Office	
Bob Janssen	Coal Program Coordination
Janet Kurman	NEPA Coordination
Mavis Love	Land Adjudication
Julie Weaver	Land Adjudication
Susan Caplan	Air Quality and Climate
BLM Buffalo Field Office	
B.J. Earle	Cultural Resources
Tom Bills	Wildlife Resources
Larry Gerard	Wildlife Resources
BLM National Science and Technology Center	
Scott Archer	Air Quality and Climate
Office of Surface Mining Reclamation and Enforcement Western Regional Coordinating Center	
Floyd McMullen	EIS Project Coordinator
U.S. Forest Service Douglas Ranger District	
JoAnne Homuth	EIS Project Coordinator and Paleontological Resources
Joe Reddick	Project Coordination
Tim Byer	Wildlife Resources
Ian Ritchie	Cultural Resources
U.S. Forest Service Nebraska National Forest	
Barbara A. Beasley	Paleontological Resources

Table 5-3. List of Preparers.

Name	Education/Experience	Responsibility
BLM Casper Field Office		
Nancy Doelger	M.S., B.S. Geology, 25 years professional experience	EIS Project Leader/Editor
BLM Wyoming State Office Reservoir Management Group		
Dwain McGarry	B.S. Graduate Study, Geology, 24 Years professional experience	CBM Geology
Lee Almasy	B.S. Petroleum Engineering, 6 years professional experience	CBM Reservoir Engineering
WWC Engineering-Third Party Contractor		
Ken Collier	B.S. Geology, 24 years professional experience (Licensed Wyoming Geologist)	Project Management Report Preparation
Doyl Fritz	M.S., B.S. Civil Engineering, 31 years professional experience (Licensed Professional Engineer)	Report Preparation
Steve Holzerland	M.S., B.S. Rangeland Ecology and Watershed Management, 12 years professional experience	Report Preparation
Jack Fritz	B.S. Chemical Engineering, 4 years professional experience	Report Preparation
Mal McGill	2 years professional experience	CADD
Rodney Ventling	11 years professional experience	CADD
Heidi Robinson	10 years professional experience	Document Production
Intermountain Resources-Subcontractor		
Jim Orpet	M.S., B.S. Wildlife Management, 23 years professional experience	Physical Resources
Russell Tait	B.S. Wildlife Management, 10 years professional experience	Physical Resources
GCM Services, Inc.-Subcontractor		
David Ferguson	M.A. Anthropology, 14 years professional experience	Cultural Resources
Garren Meyer	B.A. Anthropology, 10 years professional experience	Cultural Resources
McVehil-Monnett Associates, Inc.-Subcontractor		
Phil Dinsmoor	M.S. Landscape Architecture, B.S. Landscape Architecture/Natural Resource Management, 25 years professional experience	Air Quality
Robin Carlson	B.S. Geology, 18 years professional experience (Licensed Wyoming Geologist)	Air Quality

Table 5-3. List of Preparers (Continued).

Name	Education/Experience	Responsibility
BKS Environmental Associates, Inc.- Subcontractor		
Brenda Schladweiler	B.S. Range Management, M.S. Soil Science, 23 years professional experience	Vegetation Baseline
Paige Wolken	B.A. Biology, M.S. Plant and Soil Science, 8 years professional experience	Vegetation Baseline
Heidi Smith	B.S. Horticulture, M.S. Agronomy, 3 years professional experience	Vegetation Baseline
Thunderbird Wildlife Consulting, Inc.-Subcontractor		
Kort Clayton	M.S. Biology, 8 years professional experience	Wildlife Baseline
Kimberly Brown	M.S. Biology, 10 years professional experience	Wildlife Baseline
Gwyn McKee	M.S. Wildlife Ecology, 15 years professional experience	Wildlife Baseline
Bonnie Postovit	M.S. Zoology, 25 years professional experience	Wildlife Baseline
Howard Postovit	M.S. Wildlife Ecology, 25 years professional experience	Wildlife Baseline
William Winland	B.S. Biology, 15 years professional experience	Wildlife Baseline
Argonne National Laboratories		
Kyong C. Chun	PhD. Environmental Health Engineering, 30 years professional experience	Air Quality Impact Assessment
Young-soo Chang	Ph.D. Chemical Engineering, 20 years professional experience	Air Quality Impact Modeling

Table 5-4a. BLM Distribution List for Coal Leasing.

Federal & State Officials

Governor of Wyoming Jim Geringer
 Governor of Montana Judy Martz
 U.S. Representative Barbara Cubin
 U.S. Senator Craig Thomas
 U.S. Senator Mike Enzi
 Wyoming Senator Bill Barton
 Wyoming Representative Bruce Burns
 Wyoming Representative Nick Deegan
 Wyoming Senator Dick Erb
 Wyoming Representative John Hines
 Wyoming Senator Tom Kinnison
 Wyoming Representative Jack Landon
 Wyoming Representative George McMurtry
 Wyoming Representative Douglas Osborn
 Wyoming Senator John Schiffer
 Wyoming Representative Jeff Wasserburger
 Wyoming Senator Steve Youngbauer

Federal Agencies

BLM Washington Office
 BLM Buffalo Field Office
 BLM Casper Field Office
 BLM Montana State Office
 BLM Powder River Field Office
 BLM Rawlins Field Office
 BLM Wyoming State Office
 Bureau of Indian Affairs (multiple offices)
 Bureau of Reclamation
 Department of Energy
 EPA Region VIII
 Federal Highway Administration
 HQ-USAF/CEVP
 Mineral Management Service
 National Park Service, Washington Office
 National Park Service, Air Resources Div.
 Devils Tower National Monument
 Office of Surface Mining, Washington Office
 OSM, Western Regional Coordinating Ctr.
 OSM, Casper Office
 USDI Rocky Mountain Regional Solicitor

U.S. Army Corps of Engineers
 U.S. Fish & Wildlife Service, Washington, D.C.
 U.S. Fish & Wildlife Service, Cheyenne, WY
 U.S. Geological Survey, Reston, Virginia
 U.S. Geological Survey, Denver Federal Ctr.
 U.S. Geological Survey, Water Resource Div.
 USDA Forest Service, Washington Office
 USDA Forest Service Rocky Mtn. Region
 USDA Forest Service, Med. Bow Nat'l Forest
 USDA Forest Service, Douglas Ranger Dist.

State Agencies

Montana Office of the Governor
 Wyoming Clearinghouse Coordinator
 WY Employment Research & Planning Dept.
 Wyoming Dept. of Environmental Quality--
 Land Quality & Air Quality Divisions
 Wyoming Div. of Economic Analysis
 Wyoming Office of Federal Land Policy
 Wyoming Oil and Gas Conservation Comm.
 Wyoming Parks & Cultural Resources Dept.
 Wyoming State Engineer's Office
 Wyoming Department of Transportation
 Wyoming State Historic Preservation Office
 Wyoming Game & Fish Department
 Wyoming Business Council
 Wyoming Department of Agriculture
 Wyoming Industrial Siting Division
 Wyoming Public Service Commission
 Wyoming State Geological Survey
 Wyoming State Inspector of Mines
 Wyoming Water Development Commission

Local Agencies and Government

Big Horn County, Montana Planning Board
 Campbell County, Wyoming Commission
 Campbell Cty, WY School Superintendent
 City of Douglas, Wyoming
 City of Gillette, Wyoming
 City of Newcastle, Wyoming
 Converse County, Wyoming Commissioners

Table 5-4a. BLM Distribution List for Coal Leasing (Continued).

Converse County, Wyoming School District	National Mining Association
Converse Cty., Wyoming Joint Powers Board	National Wildlife Federation
Converse County, Wyoming Planning Office	Natural Resources Defense Council
Powder River County, Montana	Petroleum Association of Wyoming
Rosebud County, Montana Commission	Powder River Basin Resource Council
Town of Wright, Wyoming	Sierra Club (Sheridan, Wyoming)
Weston County, Montana Commission	The Fund for Animals
	The Nature Conservancy
	Wildlife Management Institute
Tribal Organizations and Individuals	Wyoming Assoc of Professional Archeologists
Arapahoe Business Council	Wyoming Bankers Association
C'Hair, William	Wyoming Business Alliance
Cheyenne River Sioux Tribe	Wyoming Geological Association
E. Shoshone Spiritual Leader	Wyoming Mining Association
E. Shoshone Tribal Attorney	Wyoming Outdoor Council
Flandreau Santee Sioux Tribe	Wyoming Stock Growers Association
Long Sioux, Clifford	Wyoming Wildlife Federation
Lower Brule Sioux Tribe	Wyoming Wool Growers Association
N. Arapaho Historian	
N. Cheyenne Cultural Committee	Companies/Businesses
N. Cheyenne Tribal Council	American Colloid Company
N. Cheyenne Tribe	Antelope Coal Company
Oglala Sioux Tribal Administration	Ark Land Company
Oglala Sioux Tribal Council	Arnjac
Rosebud Sioux Tribe	Belle Ayr Mine
S. Cheyenne/S. Arapaho Tribes	Bjork, Lindley, Danielson & Baker, P.C.
Santee Sioux Tribal Council	Bridgeview Coal Company
Shoshone Business Council	Buckskin Mine
Sicangu Lakota Treaty Council	Burlington Northern Railroad Company
Standing Rock Sioux Agency	Burns & McDonnell
Standing Rock Sioux Tribe	C.H. Snyder Company
	CE&MT, Incorporated
Organizations	CH2M Hill
Advisory Council on Historic Preservation	Consol, Inc., Exploration & Land Dept.
Big Horn Audubon Society	Cordero-Rojo Mine Complex
Campbell County Economic Dev. Corp.	Decker Coal Company
Cheyenne Audubon Society	Dry Fork Coal Company
Foundation for N. American Wild Sheep	Ducker, Montgomery, Lewis, & Aronstein
Friends of the Bow/Biodiversity Assoc.	Duke Energy
Izaak Walton League of America	Eagle Butte Mine
Medicine Wheel Coalition	ECC
Murie Audubon Society	

Table 5-4a. BLM Distribution List for Coal Leasing (Continued).

ENCOAL	Thunder Basin Coal Company
Environmental Solutions, Incorporated	Thunder Basin Coalition
Evergreen Enterprises	Torch Energy
Foster-Wheeler Environmental	TRC Environmental
Glenrock Coal Company	TRC Mariah Associates Incorporated
Greystone	Triton Coal Company
Hardin & Associates	URS Greiner Woodward Clyde
Independent Consultants Network	U.S. West Communications
Independent Production Company	Western Energy Company
Intermountain Resources	Western Fuels Association
Jacobs Ranch Coal Corporation	Western Gas Resources
Kennecott Energy Company	Williams Production RMT Company
Kenneth R. Paulsen Consultants	WWC Engineering
Kfx Wyoming Incorporated	Wyodak Resources Dev. Corporation
Kiewit Mining Company	Yates Petroleum Company
KN Energy	
L.E. Peabody & Associates	Press
M&K Oil Company, Incorporated	Associated Press
Marston & Marston	Casper Journal
McGraw-Hill	Casper Star Tribune
McVehil-Monnett Associates, Inc.	Cheyenne-Wyoming Eagle
Meineadair Consultants	Douglas Budget
Mine Engineers, Incorporated	Gillette News-Record
Mining Associates of Wyoming	Rocky Mountain Oil Journal
Nerco Coal Company	Western Coal Newsletter
North Rochelle Mine	
Norwest Mine Services	Educational Institutions
P&M Coal Company	Northwestern Univ. Policy Research Inst.
Pacificorp/Interwest Mining	UW Libraries, Coe Reference Department
PIC Technologies	CSU, The Libraries
Poudre Environmental Consulting	
Powder River Coal Company	Individuals
Powder River Eagle Studies	Antelope, Sr., Howard
Powder River Energy Corporation	Barbero, Ralph
RAG Coal West, Incorporated	Benson, Scott
Redstone Resources	Bierman, Sheldon
Riverside Technology, Incorporated	Cundy, Cecil
Royal Gold Incorporated	Daub, Jerry
San Juan Coal Company	Higgins, Nancy
Shea & Gardner	Jacob, Gerald
The Rim Companies	Natta, F.L.

5.0 Consultation and Coordination

Table 5-4a. BLM Distribution List for Coal Leasing (Continued).

Olson, Ted
Robertson, C.J.
Saulcy, Bill
Williams, John
Winland, Mark

Table 5-4b. Distribution List for SPRB Coal Draft EIS.

Individuals

Addison, Rodney	Deemar, Irving R.
Amber , Richard	DeFevere, Brandy Jo
Anderson, Jacque Putnam	Delzell, Larry
Baalman, Lynne & Mark	Deputy, Robert W.
Balog, Peter	Devlin, James A.
Bartlett, Randy	Diefenderfer, Michael R.
Beal, Carl & Mitzi	Dilts, John C. & Betty
Bishop, Hugh & Valeri	Dilts, Jerry and Barbara
Boland, Edward	Dilts, Fred W.
Bovey, Glenn S.	Dix, David R.
Bradshaw, Donald B.	Dorman, Jenise E.
Breecher, V.M.	Dorough , Thomas A.
Brenk, William C.	Dymond, Michael S.
Brenk, Charles A.	Ellbogen, John P.
Broadhead, Dean	Engle, Fred L.
Brown, Maurice	Faith, J. Gregory
Budd, May	Farley, Thomas H.
Cagle, Bill	Gallegos, Beth H.
Cavaiuolo, John P.	Gamberg, Russell J.
Champion, W.H.	Gates, John W.
Cheesema, Rilla	Gibbons, J.P.
Cogil, Jolene A.	Gray, Martha
Collins, GF Trust	Haefele, James & Estelle
Columbus, Joseph A.	Hammond, William C.
Cook, D.L.	Hando, Ronald E.
Cook, Rita C.	Hanson, Joyce A.
Crandall, Terry R.	Harden, James L.
Crary, Calvert D.	Harrell, J.S.
Culver Trust, A.M.	Harvey, M.J.
Dale, Robert L.	Head, Debra Johnson
Dean, Hudson	Hobson, DeMar Johnson
	Holt, David T.

Table 5-4b. Distribution List for SPRB Coal Draft EIS (Continued).

Horn, Clarence W.	Noonan, Thomas J.
Isenberger, Matthew & Peggy	O'Connell, R.K.
Jacobs, Donald F.	Ogle, Morris E.
Jacobs, Donald & Rosemae	Ostling, Michael E.
Johnstone, Wilma	Ostling, Susan M.
Kane, Ollie M.	Pasternak, Alan B.
Kane, Frank & Patsy	Peel, Daniel
Kaufman, Marcella	Provine, Charles & Evelyn
Keisling, James D.	Putnam, Forest & Jan
Kelly, Gale O. & Patsy R.	Putnam, Harry
Kennedy, M. John	Putnam, Forest
Kentta, Harold	Randolph, Rex L.
Killion, B.K.	Rasmussen, Donald B.
Klabzuba, Robert	Redle, William D.
Klaenhammer, H.M.	Reid, Stewart
Klungness, Milton L.	Reno, Floyd C. & Eda
Klurfeld, Gregor	Reynolds, Kathleen Ann
Krokosz, Emily	Rickard, O.L.
Kuta, Delores	Robinson, Thomas M.
Kutter, Julie E.	Roderick, Jonathan & Carol
Ladd, Jerry D.	Roemer, Lamar B.
Larmon, Jim S. & Connie L.	Rogers, Keating M.
Lauchnor, Emily H.	Rogers, Geri
Lawson, Don & Marjorie	Rogers, Richard J.
Leutwyler, Scott	Rousch, Linda
Litton, Patricia L.	Sauble, Dennis Mackey
Lunning, Leonard	Saye, Frank M.
Mackey, Robert & Dorothy	Schlenker, Kenneth
Mackey, William	Schulte, Frank L.
Macy, Rose T.	Shainholtz, James & Barbara
Madrid, Louis A.	Sharp, Jim L.
Mares, Ben E.	Sheets, R.P.
McBride, Dorothy L.	Shockley, Melba J.
McCurley, Karan Lea Kane	Shogrin, F.L.
Medema, James & Millie	Smolik, Leroy M.
Miller, Mary Lou	Smolik, Robert G.
Mills, Clark & Doris	SnowBillie, Ruth
Mills, Dale & Edith	Spencer, Russell A.
Mitchell, Victor, Cynthia	Sprinkle, Joseph A.
Nelson, Richard R.	Stadelman, Diana & Joseph
Nimmo, Jolynn & Terry	Stalls, I.L.

Table 5-4b. Distribution List for SPRB Coal Draft EIS (Continued).

Stone, Elizabeth	B.S. & B. Oil Company
Storms, Michael C.	Bank One, Texas
Storms, Robert F.	Bankers Trust Company
Strang, John P.	Bankfirst
Stuart, Paul R.	Basin Exploration, Incorporated
TeSelle, Roger	BBI Company
Thomas, Vern Guy	Beacon Exploration Company
Treichel, William	Beard Oil Company
Tsukishima, Mary S.	Belle Fourche Pipeline Company
Tucker, Julian C.	Berenergy Corporation
Tucker, Toni A.	Big West Oil & Gas, Incorporated
Tucker, R. Lee	Black Hills Exploration & Production Co.
Vaught, George G.	Black Magic #1, LLC
Voiles, Joy Lynn Kane	Blake Construction Company
VonDrehle, William F.	Bowers Oil & Gas, Incorporated
Wagner, Richard L.	Box Creek Mineral Ltd Partnership
Wanger, Sharlene	Bridle Bit Ranch Company
Wanger, Deena L.	Buck Stanley Trust
Weese, Jennie	Burlington Northern Railroad
M.Weinmann, John G.	BWAB LLC
Weinstein, Ethel B.	Caroline Hunt Trust Estate
Wilkinson, Jerry	Cenex Harvest States Coop
Wilkinson, John Allen	Chemical Bank
Wold, John S.	Chisholm Trail Ventures, L.P.
Worthington, Tina Marie	Citation 1998 Investment, L.P.
Wunderlich, Leann A.	CNG Producing Company
Young, Dennis	Coastal Oil & Gas Corporation
	Columbus Energy Corporation
Businesses/Organizations	Cometra-Bank-Texas
A.G. Andrikopoulos Res., Incorporated	Conoco, Incorporated
AE Investments, Incorporated	Coral Petroleum, Ltd.
Altex Oil Corporation	Cramer Oil Company
American Exploration Company	Credit Lyonnais New York Branch
American Oil & Gas Corporation	Crest Resources, Incorporated
American Prod. Partnership Ltd III	D&D Resources
Ameriplor Corporation	Daven Corporation
Andover Oil Company	Davis Oil Company
APC Operating Partnership	Dee Bentley, Incorporated
Axcon Corporation	Dever Minerals
B&J Resources LLC	Devon Energy Corporation

DNR Oil & Gas Incorporated
Double Eagle

Table 5-4b. Distribution List for SPRB Coal Draft EIS (Continued).

Dymond Resources Ltd. Partnership	Jenne, Lucile Trusts I & II
Eland Energy	Jetta Production Company Inc./JPC LLC
Eloise McKee Trust	Jim's Water Service
Energen Resources MAQ, Incorporated	JN Exploration & Production L.P.
Enterprise 1987 Ltd.	JRJ Ranches
Eureka Oil Company	KAB Acquisition L.P.-III
Fairway Resources, Incorporated	Kaffka & Company
Fayette Oil & Gas Corporation	Kaiser-Francis Oil Company
FDIC	Karen McDonald Trust
FDM Property Trust	Kenneth F. Cummings & Company
Fidelity Oil Holdings, Incorporated	Kenneth Revland Trust
Fina Oil & Chemical	Kerr McGee Corporation
First Interstate Bank of Commerce	Key Production Company
First Interstate Bank of Denver	Kirby Minerals
Forcenergy Gas Exploration	KN Gas Gathering, Incorporated
Four G Oil Company	KN Production Company
Four-Ten Exploration	L.B. Industries
FSU Foundation	Lance Oil & Gas Company
Future Realty, Incorporated	LFL Joint Venture Investments
G.H. Corporation	Lloyd Company
Gene F. Lang & Company	Lucille F. Emery Trust
Geotech Production Company	LY Ltd. Liability Company
Gordon L. Heele Trust	Lyeth-Burk Partnership
GPM Incorporated	Mach Petroleum, Incorporated
Gunsmoke Production Company	Machris, Maurice A. Trust
Hanson & Strahn, Incorporated	Malibu Presbyterian Church
Headington Oil Company, L.P.	Manufacturers Hanover Trust
Hewitt Family Partnership	Marathon Oil Company
High Plains Associates, Incorporated	Martin Exploration Management Company
Howell Petroleum Corporation	Maxim Drilling & Exploration
Hunt Oil Company	Maxus Exploration Company
Hurley Oil Properties	McCullis Resources Company, Incorporated
Independent Production Company	McMurry Oil Company
Internationale Nederlanden (U.S.)	McNeil Street Drilling Venture
Interstate Investment Company	Meany Land & Exploration, Incorporated
Intoil, Incorporated	Merit Petroleum Company
J.A. Humphrey Trust	MIGC, Incorporated
J.K. Brown Holdings, Incorporated	Morse Acquisition LLC

5.0 Consultation and Coordination

Mullinex Associates 69/Mullinex
Murjo Oil & Royalty Company
N. American Explorer, Incorporated
Naomi Hopkins Trust
Nationsbanc Leasing Corp. of N. America
New England Mutual Life Insurance Co.

Table 5-4b. Distribution List for SPRB Coal Draft EIS (Continued).

Nortex Corporation	RBC Exploration Company
North Baptist Church	Redle, Yonkee, & Toner
Northern Production Company, Incorporated	Redstone Resources
Norwest Bank of Colorado	Resources Investment Corporation
Norwest Bank of Denver, Trustee	Reunion Energy Company
Ocean Energy, Incorporated	Richard Altman & Company
Oilfield Salvage & Service	Rockrimmon Royalty Company, LLC
Olive Oil, L.C.	ROEC, Incorporated
Oxy USA, Incorporated	Ryder Stilwell Oil
PAMCO Investments Corporation	Samson Hydrocarbon Company
Panhandle Eastern Pipeline Company	Scorpio Resources
Pathfinder Energy, Incorporated	Seco Energy Corporation
Paul Revere Life Insurance Company	Shell Western E&P Company
Peak Resource Management, Incorporated	Sioux Ranch, Incorporated
Pennzoil Corporation	Skelly Oil Company
Perry & Butler	Smithco Properties
Perry R. Bass, Incorporated	Sonat Exploration Company
Petro Atlas Corporation	South Coast Oil Corporation
Petroleum, Incorporated	Spear Lazy S Land Company
Phillips Petroleum Company	Sports Resources, Incorporated
Phoenix Mutual Life Insurance Company	Spring Creek Ranch, LLC
Platte Valley Management Company	Stanwich Energy Company
Powder River Coal Company	State Leases, LLC
Powder River Oil & Gas Vent., LLC	States, Incorporated
Preston, Reynolds, & Company, Incorporated	Stockman's Bank & Trust
Prima Oil & Gas Company	Stroock & Rogers
Princess Properties, LLC	Sunshine Valley Petroleum Corporation
Providence Energy Corporation	Swift Energy Company
Providence Mutual Life Ins. Company	Talala Corporation
Questar Exploration & Production	Tarus Exploration USA, Incorporated
R.E. McDonald & Company	TBI Exploration, Incorporated
R.W. Scott Investments, LLC	TCPL Resources USA, Ltd.
Ralph W. Zimmer Trust	Texaco Exploration & Production, Inc.
	Textron Collective Investment Trust

The Chase Manhattan Bank
The Daube Company
The Esperanza Corporation
The Oswald Family Trust
The Thermo Company
Thorofare Resources
Tindall Operating Company
Tom Brown, Incorporated
Two Rivers Ranch
TXP Operating Company
U.S. National Bank Association
United Pipe & Supply, Incorporated
United States National Bank of Ogden
University of Montana
Unocal

Table 5-4b. Distribution List for SPRB Coal Draft EIS (Continued).

U.S. West Communications, Incorporated
Vale Company
Vastar Resource, Incorporated
Victoria Exploration, Incorporated
Walker Trust
Wells Resources, Incorporated
Wellstar Corporation
Western Production Company
Western Ranches International
Westport Oil & Gas Company, Incorporated
Westtex 66 Pipeline Company
Whiting Petroleum Corporation
WP Properties Corporation
Young Trust
ZAB, Inc./Zalman Resources

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7.0 GLOSSARY

aboriginal - Related to early or primitive cultures in a region.

ad valorem tax - A tax paid as a percentage of the assessed value of property.

adverse impact - An apparent direct or indirect detrimental effect.

aliquot - An exact portion.

alkalinity - The degree to which the pH of a substance is greater than 7.

alluvial deposit - Deposits of clay, silt, sand, gravel, and/or other materials carried by moving surface water, such as streams, and deposited at points of weak water flow; alluvium.

alluvial valley floor (AVF) - An area of unconsolidated stream-laid deposits holding streams with water availability sufficient for subirrigation or flood irrigation agricultural activities (see 30 CFR 701.5).

alluvium - Sorted or semi-sorted sediment consisting of clay, silt, sand, gravel, or other unconsolidated rock material deposited in comparatively recent geologic time by a stream or other body of running water in the bed of that stream or on its flood plain or delta.

alternative - In terms of the National Environmental Policy Act, one of several substitute or alternate proposals that a federal agency is considering in an environmental analysis.

ambient - Surrounding conditions (or environment) in a given place and time.

annual precipitation - The quantity of water that falls yearly in the form of rain, hail, sleet, and snow.

approximate original contour - Post-mining surface configuration achieved by backfilling and grading of mined-out areas so that the reclaimed land surface resembles the general surface configuration of the land prior to mining (see 30 CFR 701.5).

aquatic - Living or growing in or on the water.

aquifer - A layer of permeable rock, sand, or gravel that stores and transmits water in sufficient quantities for a specific use.

aquitard - A confining bed that retards but does not totally prevent the flow of water to or from an adjacent aquifer; a leaky confining bed.

arithmetic mean - The sum of the values of n numbers divided by n. It is usually referred to as simply the “mean” or “average”.

ash - The residual non-combustible matter in coal that comes from included silt, clay, silica, or other substances. The lower the ash content, the better the quality of the coal.

avian - Of, relating to, or derived from birds.

backfill - The operation of refilling an excavation. Also, the material placed in an excavation when it is refilled.

baseline - Conditions, including trends, existing in the human environment before a proposed action is begun; a benchmark state from which the environmental consequences of an action are forecast; the no-action alternative.

beneficial impact - An apparent direct or indirect advantageous effect.

bentonite - A clay formed by the decomposition of volcanic ash which has the ability to absorb large amounts of water and to expand to several times its normal volume; used in adhesives, cements and ceramic fillers.

bonus - That value in excess of the rentals and royalties that is paid to the United States as part of the consideration for receiving a lease for publicly owned minerals [see 43 CFR 3400.0-5(c)].

braided stream - A stream flowing in several dividing and reuniting channels resembling the strands of a braid.

buffer zone - An area between two different land uses that is intended to resist, absorb, or otherwise preclude development or intrusion between the two use areas.

bypass coal - An isolated part of a coal deposit that is not leased and that can only be economically mined in an environmentally sound manner as a part of continued mining by an existing adjacent operation [see 43 CFR 3400.0.5(d)].

clinker (scoria) - Baked and fused rock resulting from in-place burning of coal deposits.

coal bed methane (CBM) - Methane gas that is generated during the coal-forming process.

colluvium - Rock fragments, sand, or soil material that accumulates at the base of slopes; slope wash.

confluence - The point at which two or more streams meet.

conglomerate - A rock that contains rounded rock fragments or pebbles cemented together by another mineral substance.

contiguous - Lands or legal subdivisions having a common boundary, lands having only a common corner are not contiguous.

cooperating agency - An agency which has jurisdiction by law in an action being analyzed in an environmental document and who is requested to participate in the NEPA process by the agency that is responsible for preparing the environmental document [see 40 CFR 1501.6 and 1508.5].

crucial wildlife habitat - Parts of the habitat necessary to sustain a wildlife population during periods of their life cycle. It may be a limiting factor on the population, such as nesting habitat or winter habitat.

cultural resources - The remains of human activity, occupation, or endeavor reflected in districts, sites, structures, buildings, objects, artifacts, ruins, works of art, architecture, and natural features that reveal the nature of historic and prehistoric human events. These resources consist of (1) physical remains, (2) areas where significant human events occurred, and (3) the environment immediately surrounding the resource.

cumulative impact - The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7).

decibel - A unit of sound measurement. In general, a sound doubles in loudness for every increase of 10 decibels.

deciview (dv) - A general measure of view impairment (13 deciview equals a view of approximately 60 miles) caused by pollution.

dip - The angle at which a rock layer is inclined from the horizontal.

direct (or primary) impact - An impact caused by an action that occurs at the same time and place as the action (see 40 CFR 1508.8).

discharge - Any of the ways that ground water comes out of the surface, including through springs, creeks, or being pumped from a well.

dissected upland - An upland or high area in which a large part of the original surface has been deeply cut into by streams.

dragline - A type of excavating crane that casts a rope- or cable-hung bucket a considerable distance, collects the dug material by pulling the bucket toward itself on the ground with a second rope or cable, elevates the bucket, and dumps the material on a backfill bank or pile.

eolian deposit - Sediment carried, formed, or deposited by the wind, as sand dunes.

ephemeral stream - A stream that flows occasionally because of surface runoff, and is not influenced by permanent ground water.

erosion - The wearing away of the land surface by running water, wind, ice or other geologic agents.

evapotranspiration - The sum total of water lost from the land by evaporation and plant transpiration.

excavation (archeological) - The scientifically controlled recovery of subsurface materials and information from a cultural site. Recovery techniques are relevant to research problems and are designed to produce maximum knowledge about the site's use, its relation to other sites and the natural environment, and its significance in the maintenance of the cultural system.

fair market value - The amount in cash, or in terms reasonably equivalent to cash, for which in all probability a coal deposit would be sold or leased by a knowledgeable owner willing but not obligated to sell or lease to a knowledgeable purchaser who desires but is not obligated to buy or lease.

fixed carbon - In coal, the solid combustible material remaining after removal of moisture, ash, and volatile matter. It is expressed as a percentage.

floodplain - The relatively flat area or lowland adjoining a body of flowing water, such as a river or stream, that is covered with water when the river or stream overflows its banks.

forage - Vegetation used for food by wildlife, particularly big game wildlife, and domestic livestock.

formation (geologic) - A rock body distinguishable from other rock bodies and useful for mapping or description. Formations may be combined into groups or subdivided into members.

fossil - The remains or traces of an organism or assemblage of organisms that have been preserved by natural processes in the earth's crust. Many minerals that may be of biologic origin are not considered to be fossils (e.g. oil, gas, asphalt, limestone).

geometric mean - The nth root of the product of the values of n positive numbers.

ground water - Subsurface water that fills available openings in rock or soil materials to the extent that they are considered water saturated.

habitat - A place where a plant or animal naturally or normally lives and grows.

habituation - The process of becoming accustomed to, or used to, something; acclimation.

hazardous materials - Substance which, because of its potential for corrosivity, toxicity, ignitability, chemical reactivity, or explosiveness, may cause injury to persons or damage to property.

hazardous waste - Those materials defined in Section 101 (14) of the Comprehensive Environmental Response, Compensation and Liability Act of 1980, and listed in 40 CFR § 261.

heterogenous - Made up of dissimilar constituents.

human environment - The natural and physical environment and the relationship of people with that environment (see 30 CFR 1508.14).

hydraulic conductivity - The capacity of a medium to transmit water; permeability coefficient. Expressed as the volume of water at the prevailing temperature that will move in unit time under a unit hydraulic gradient through a unit area. Units include gallons per day per square foot, centimeters per second.

hydraulic - Pertaining to fluid in motion, or to movement or action caused by water.

hydric soil - A soil that is saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions that favor the growth and regeneration of hydrophytic (water-loving) vegetation. Hydric soils that occur in areas having positive indicators of hydrophytic vegetation and wetland hydrology are wetland soils.

hydrocarbon - Any organic compound, gaseous, liquid, or solid, consisting solely of carbon and hydrogen.

hydrogeology - The science that deals with subsurface waters and with related geologic aspects of surface waters.

hydrology - The science dealing with the behavior of water as it occurs in the atmosphere, on the surface of the ground, and underground.

hydrophytic vegetation - The plant life growing in water or on a substrate that is at least periodically deficient in oxygen as a result of excessive water content. When hydrophytic vegetation comprises a community where indicators of hydric soils and wetland hydrology also occur, the area has wetland vegetation.

impermeable - Not capable of transmitting fluids or gasses in appreciable quantities.

incised - Having a margin that is deeply and sharply notched.

indirect (or secondary) impact - A reasonably foreseeable impact resulting from an action but occurring later in time than or removed in distance from that action (see 40 CFR 1508.8).

in-place coal reserves - The estimated volume of all of the coal reserves in a lease without considering economic or technological factors which might restrict mining.

in-situ leach mining - Removal of the valuable components of a mineral deposit through chemical leaching without physical extraction of the rock.

interbedded - Layers of one type of rock, typically thin, that are laid between or that alternate with layers of another type of rock.

interburden - A layer of sedimentary rock that separates two mineable coal beds.

interdisciplinary - Characterized by participation or cooperation among two or more disciplines or fields of study.

intermittent stream - A stream that does not flow year-round but has some association with ground water for surface or subsurface flow.

laminated - Consolidated or unconsolidated sediment that is characterized by thin (less than 1 cm thick) layers.

land and resource management plan (LRMP) - A land use plan that directs the use and allocation of U.S. Forest Service lands and resources.

lead agency - The agency or agencies preparing or having taken primary responsibility for preparing an environmental document (see 40 CFR 1508.16).

lease (mineral) - A legal document executed between a mineral owner or lessor and another party or lessee which grants the lessee the right to extract minerals from the tract of land for which the lease has been obtained [see 43 CFR 3400.0-5(r)].

lek - A traditional breeding area for grouse species where territorial males display and establish dominance.

lenticular - Term describing a body of rock or earth that thins out in all directions from the center like a double convex optical lens.

limb (geologic) - One side of a fold (syncline or anticline).

limestone - A sedimentary rock consisting chiefly of calcium carbonate.

lineament - A linear topographic feature of regional extent that is believed to reflect crustal structure.

loadout facilities - The mine facilities used to load the mined coal for transport out of the mine.

loam - A rich, permeable soil composed of a mixture of clay, silt, sand, and organic matter.

maintenance tract - A federal coal tract that would continue or extend the life of an existing coal mine.

major federal action - An action with effects that may be major and which is potentially subject to federal control and responsibility (see 40 CFR 1508.18).

maximum economic recovery (MER) - The requirement that, based on standard industry operating practices, all profitable portions of a leased federal coal deposit must be mined. MER determinations will consider existing proven technology; commercially available and economically feasible equipment; coal quality, quantity, and marketability; safety, exploration, operating, processing, and transportation costs; and compliance with applicable laws and regulations [see 43 CFR 3480.0-5(a)(24)].

meteorological - Related to the science dealing with the atmosphere and its phenomena, especially as relating to weather.

methane - A colorless, odorless, and inflammable gas; the simplest hydrocarbon; chemical formula = CH₄. It is the principal constituent of natural gas and is also found associated with crude oil and coal.

mineable coal - Coal that can be economically mined using present day mining technology.

mineral rights - The rights of one who owns the mineral estate (subsurface).

mining permit - A permit to conduct surface coal mining and reclamation operations issued by the state regulatory authority pursuant to a state program or by the Secretary pursuant to a federal program (see 30 CFR 701.5).

mitigation - An action to avoid, minimize, reduce, eliminate, replace, or rectify the impact of a management practice.

mudstone - A hardened sedimentary rock consisting of clay. It is similar to shale but lacks distinct layers.

National Register of Historic Places (NRHP) - A list of districts, sites, buildings, structures and objects significant in American history, architecture, archeology and culture maintained by the Secretary of the Interior. Expanded as authorized by Section 2(b) of the Historic Sites Act of 1935 (16 U.S.C. 462) and Section 101(a)(1) (A) of the National Historic Preservation Act.

natural gas - Combustible gases (such as hydrocarbons) or mixtures of combustible gases and non-combustible gases (such as helium) which are in a gaseous phase at atmospheric conditions of temperature and pressure.

NEPA process - All measures necessary for compliance with the National Environmental Policy Act of 1969 (see 40 CFR 1508.21).

no action alternative - An alternative where no activity would occur. The development of a no action alternative is required by regulations implementing the National Environmental Policy Act (40 CFR 1502.14). The no action alternative provides a baseline for estimating the effects of other alternatives.

outcrop - A rock formation that appears at or near the surface; the intersection of a rock formation with the surface.

overburden - Material of any nature, consolidated or unconsolidated, that overlies a coal or other useful mineral deposit, excluding topsoil.

paleontological resource - A site containing evidence of plant or non-human animal life of past geological periods, usually in the form of fossil remains.

peak discharge or flow - The highest discharge of water recorded over a specified period of time at a given stream location; also called maximum flow. Often thought of in terms of spring snowmelt, summer, fall or winter rainy season flows.

perennial species (vegetation) - Vegetation that lives over from season to season.

perennial stream - A stream or part of a stream that flows continuously during the calendar year as a result of groundwater discharge or surface runoff.

permeability - The ability of rock or soil to transmit a fluid.

permit application package - A proposal to conduct surface coal mining and reclamation operations on federal lands, including an application for a permit, permit revision, or permit renewal and all the information required by SMCRA, the applicable state program, any applicable cooperative agreement, and all other applicable laws and regulations including, with respect to federal leased coal, the Mineral Leasing Act and its implementing regulations.

permit area - The area of land, indicated on the approved map submitted by the operator with his or her application, required to be covered by the operator's performance bond under the regulations at 30 CFR Part 800 and which shall include the area of land upon which the operator proposes to conduct surface coal mining and reclamation operations under the permit, including all disturbed areas (see 30 CFR 701.5).

physiography - Physical geography.

piezometer - A well, generally of small diameter, that is used to measure the elevation of the water table.

playa - The sandy, salty, or mud-caked flat floor of a basin with interior drainage, usually occupied by a shallow ephemeral lake during or after rain or snow storms.

point source (pollution) - A point at which pollution is added to a system, either instantaneously or continuously. An example is a smokestack.

pore volume - the amount of fluid necessary to fill the void space in an unsaturated porous medium (i.e., mine backfill).

porosity - The percentage of the bulk volume of rock, sediment or soil that is not occupied by sediment or soil particles; the void space in rock or sediment. It may be isolated or connected.

postmining topography - The relief and contour of the land that remains after mining has been completed.

potentiometric surface - The surface that coincides with the static level of water in an aquifer. The surface is represented by the levels to which water from a given aquifer will rise under its full hydrologic head.

predator - An animal that obtains food by killing and consuming other animals.

prime or unique farmland - Those lands which are defined by the Secretary of Agriculture in 7 CFR part 657 (*Federal Register* Vol. 4 No. 21) and which have historically been used for cropland (see 30 CFR 701.5).

proposed action - In terms of National Environmental Policy Act, the project, activity, or action that a federal agency proposes to implement or undertake and which is the subject of an environmental analysis.

qualified surface owner - The natural person or persons (or corporation, the majority stock of which is held by a person or persons otherwise meeting the requirements of this section) who:

- (1) Hold legal or equitable title to the surface of split estate lands;
- (2) Have their principal place of residence on the land, or personally conduct farming or ranching operations upon a farm or ranch unit to be affected by surface mining operations; or received directly a significant portion of their income, if any, from such farming and ranching operations; and
- (3) have met the conditions of (1) and (2) above for a period of at least three years, except for persons who gave written consent less than three years after they met the requirements of both (1) and (2) above [see 43 CFR 3400.0-5(gg)].

raptor - Bird of prey, such as an eagle, falcon, hawk, owl, or vulture.

recharge - The processes by which groundwater is absorbed into a zone of saturation.

reclamation - Rehabilitation of a disturbed area to make it acceptable for designated uses. This normally involves regrading, replacement of topsoil, revegetation and other work necessary to restore the disturbed area for post-mining use.

record of decision (ROD) - A document separate from, but associated with, an environmental impact statement that publicly and officially discloses the responsible official's decision on the proposed action (see 40 CFR 1505.2).

recoverable coal - The amount of coal that can actually be recovered for sale from the demonstrated coal reserve base.

rental payment - Annual payment from a lessee to a lessor to maintain the lessee's mineral lease rights.

resource management plan (RMP) - A land use plan, as prescribed by FLPMA, that directs the use and allocation of public lands and resources managed by BLM. Prior to selection of the RMP, different alternative management plans are compared and evaluated in an environmental impact statement (EIS) to determine which plan will best direct the management of the public lands and resources.

revegetation - The reestablishment and development of self-sustaining plant cover following land disturbance. This may occur through natural processes, or the natural processes may be enhanced by human assistance through seedbed preparation, reseeding, and mulching.

right of way (ROW) - The right to pass over property owned by another. The strip of land over which facilities such as roadways, railroads, or power lines are built.

riparian - The area adjacent to rivers and streams that lies between the stream channel and upland terrain and that supports specific vegetation influenced by perennial and/or intermittent water.

royalty (mineral) - A share of production that is free of the expense of production. It is generally paid by a lessee to a lessor of a mineral lease as part of the terms of the lease.

runoff - That portion of rainfall that is not absorbed; it may be used by vegetation, lost by evaporation, or it may find its way into streams as surface flow.

salinity - Refers to the solids, such as sodium chloride (table salt) and alkali metals, that are dissolved in water. Often in non saltwater areas, total dissolved solids is used as an equivalent term.

sandstone - A common sedimentary rock primarily composed of sand grains, mainly quartz, that are cemented together by other mineral material.

scoping - A public informational process required by the National Environmental Policy Act to determine private and public concerns, scope of issues, and/or questions regarding a proposed action to be evaluated in an environmental impact analysis.

scoria (clinker) - Baked and fused rock resulting from in-place burning of coal deposits.

sedimentation pond - An impoundment used to remove solids from water in order to meet water quality standards or effluent limitations before the water leaves the permit area (see 30 CFR 701.5).

semi-arid - A climate or region characterized by little yearly rainfall and by the growth of a number of short grasses and shrubs.

severance tax - A tax on the removal of minerals from the ground.

shale - A very fine-grained clastic rock or sediment consisting predominately of clay-sized particles that is laminated; lithified, layered mud.

significant impact - A qualitative term used to describe the anticipated importance of impacts to the human environment as a result of an action.

siltstone - A fine-grained clastic rock consisting predominately of silt-sized particles.

socioeconomics - The social and economic situation that might be affected by a proposed action.

soil survey - The systematic examination, description, classification, and mapping of soils in an area, usually a county. Soil surveys are classified according to the level of detail of field examination. Order I is the most detailed and Order V is the least detailed.

spontaneous combustion - The heating and slow combustion of coal and coaly material initiated by the absorption of oxygen.

stipulations - Requirements that are part of the terms of a mineral lease. Some stipulations are standard on all Federal leases. Other stipulations may be applied to specific leases at the discretion of the surface management agency to protect valuable surface resources or uses existing on those leases.

storage coefficient - The volume of water that can be released from storage per unit surface area of a saturated confined aquifer, per unit decline in the component of hydraulic head normal to the surface. It is calculated by taking the product of the specific storage and the aquifer thickness.

stratigraphic - Of, relating to, or determined by stratigraphy, which is the branch of geology dealing with the study of the nature, distribution, and relations of layered rocks in the earth's crust.

stripping ratio - The unit amount of overburden that must be removed to gain access to a similar unit amount of coal.

subirrigation - In alluvial valley floors, the supplying of water to plants from underneath, or from a semi-saturated or saturated subsurface zone where water is available for use by vegetation (see 30 CFR 701.5).

subbituminous - A lower rank of coal (35-45% carbon) with a heating value between that of bituminous and lignite, usually 8,300-11,500 Btu per pound.

Subbituminous coal contains a high percentage of volatile matter and moisture.

surface disturbance - Any disturbance by mechanical actions which alters the soil surface.

surface rights - Rights to the surface of the land, does not include rights to oil, gas, or other subsurface minerals or subsurface rights.

suspended solids - The very fine soil particles which remain in suspension in water for a considerable period of time without contact with the stream or river channel bottom.

tectonic fracture - Fractures caused by deformation of the earth's crust.

threatened and endangered (T&E) species - These species of plants or animals classified as threatened or endangered pursuant to section 4 of the Endangered Species Act. Any species which is in danger of extinction, or is likely to become so within the foreseeable future.

Category 1 - Substantial biological information on file to support the appropriateness of proposing to list as endangered or threatened.

Category 2 - Current information indicates that proposing to list as endangered or threatened is possibly appropriate, but substantial biological information is not on file to support an immediate ruling (U.S. Fish and Wildlife Service).

topography - Physical shape of the ground surface; the configuration of land surface including its relief, elevation, and the position of its natural and manmade features.

topsoil - The surface layer of a soil.

total dissolved solids (TDS) - The total quantity in milligrams per liter of dissolved materials in water.

transmissivity - The rate at which water is transmitted through a unit width of an aquifer under a unit hydraulic gradient. Equals the hydraulic conductivity multiplied by the aquifer thickness. Values are given in units of gallons per day per foot.

transpiration - The discharge of water vapor by plants.

truck & shovel - A mining method used to remove overburden and coal in a strip mining operation. Truck and shovel operations use large bucket-equipped digging and loading machines (shovels) and large dump trucks to remove overburden instead of using a dragline for overburden removal.

typic - Typical.

unconfined aquifer - An aquifer where the water table is exposed to the atmosphere through openings in the overlying materials.

unsuitability criteria - The 20 criteria described in 43 CFR 3461, the application of which results in an assessment of federal coal lands as suitable or unsuitable for surface coal mining.

uranium - A very hard, heavy, metallic element that is crucial to development of atomic energy.

vegetation type - A kind of existing plant community with distinguishable characteristics described in terms of the present vegetation that dominates an area.

vertebrate fossils - The remains of animals that possessed a backbone; examples are fish, amphibians, reptiles, dinosaurs, birds, and mammals.

vesicular - Rock containing many small cavities which were formed by the expansion of a bubble of gas or steam during the solidification of the rock.

visual resources - The physical features of a landscape which can be seen (e.g., land, water, vegetation, structures, and other features).

Visual Resource Management (VRM) - The systematic means to identify visual values, establish objectives which provide the standards for managing those values, and evaluate the visual impacts of proposed projects to ensure that objectives are met.

volatile matter - In coal, those substances, other than moisture, that are given off as gas or vapor during combustion.

waterfowl - A bird that frequents water, especially a swimming bird.

wetlands - Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient, under normal circumstances, to support a prevalence of vegetative or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands include marshes, bogs, sloughs, potholes, river overflows, mud flats, wet meadows, seeps, and springs [see 33 CFR 328.3(a)(7)(b)].

wild and scenic river - Rivers or sections of rivers designated by Congressional actions under the 1968 Wild and Scenic Rivers Act as wild, scenic, or recreational by an act of the Legislature of the state or states through which they flow. Wild

and scenic rivers may be classified and administered under one or more of the following categories:

wild river areas - Rivers or sections of rivers that are free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and waters unpolluted. These represent vestiges of primitive America.

scenic river areas - Rivers or sections of rivers that are free of impoundments, with watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads.

recreational river areas - Rivers or sections of rivers that are readily accessible by road or railroad, that may have some development along their shorelines, and that may have undergone some impoundment or diversion in the past.

wilderness - An area of undeveloped Federal land designated wilderness by Congress, retaining its primeval character and influence, without permanent improvements or human habitation, protected and managed to preserve its natural conditions and that (1) generally appears to have been affected primarily by the forces of nature with the imprint of man's work substantially unnoticeable, (2) has outstanding opportunities for solitude or primitive and unconfined recreation, (3) has at least 5,000 acres or is of sufficient size to make practical its preservation and use in an unimpaired condition, and (4) also may contain features that are of ecological, geological, scientific, educational, scenic, or historical value. These characteristics were identified by Congress in the Wilderness Act of 1964.

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U.S. Forest Service or USFS	1-7, 1-9, 1-11, 1-18, 1-19, 1-20, 1-21, 1-22, 1-23, 1-24, 1-25, 2-30, 2-32, 3-40, 3-41, 3-42, 3-51, 3-68, 3-73, 3-74, 4-2, 4-46, 4-54, 4-63, 4-69, 4-70, 4-85, 4-92, 4-93, 4-97, 4-110, 4-112, 4-130, 4-135, 4-136, 4-140, 5-1, 5-2, 5-4, 5-7, B-1, B-2, B-4, B-5, B-7, B-8, B-10, B-11, B-13, B-14, D-5, D-6, E-3, E-8, E-11, E-12, E-19, E-22, E-25, E-28, G-1, G-2, G-23, G-24, G-30, G-31, G-32, G-33, G-34, G-35, G-36, G-37, G-38, G-39, G-40, G-41, G-42, G-43, G-45, G-46, G-54
U.S. Environmental Protection Agency or EPA	ES-9, ES-10, 1-26, 2-3, 3-21, 3-26, 3-29, 3-30, 3-31, 3-32, 3-33, 3-34, 3-46, 3-69, 3-77, 3-82, 3-83, 3-38, 3-85, 3-86, 3-88, 4-18, 4-19, 4-20, 4-21, 4-28, 4-31, 4-36, 4-80, 4-96, 4-98, 4-100, 4-101, 4-102, 4-104, 4-107, 4-110, 4-113, 4-114, 5-2, 5-7, E-3, E-4, E-5, E-6, E-7, E-8, E-9, E-10, E-11, E-13, E-14, E-16

U.S. Fish and Wildlife Service or USFWS	1-21, 1-25, 3-40, 3-43, 3-49, 4-67, 4-110, 4-112, 4-134, 5-1, B-2, B-5, B-8, B-11, B-14, E-3, E-11, E-12, G-2, G-3, G-5, G-7, G-8, G-9, G-10, G-11, G-12, G-13, G-14, G-15, G-16, G-17, G-18, G-19, G-20, G-21, G-22, G-23, G-24, G-25, G-26, G-27, G-28, G-41, G-42, G-43, G-50, G-51, G-52, G-53
wetland(s)	ES-5, ES-11, ES-13, 1-26, 2-49, 2-55, 3-1, 3-40, 3-41, 4-60, 4-61, 4-63, 4-68, 4-77, 4-79, 4-81, 4-82, 4-85, 4-130, 4-134, 4-135, A-1, G-9, G-21, G-35
Wyoming Department of Environmental Quality or WDEQ	ES-9, ES-10, ES-11, ES-181, 1-14, 1-15, 1-16, 1-17, 1-18, 1-19, 2-3, 2-4, 2-7, 2-8, 2-11, 2-13, 2-19, 2-27, 2-36, 2-41, 2-49, 3-11, 3-17, 3-20, 3-21, 3-22, 3-24, 3-31, 3-36, 3-37, 3-38, 3-39, 3-40, 3-43, 4-1, 4-6, 4-18, 4-19, 4-20, 4-21, 4-25, 4-28, 4-29, 4-30, 4-31, 4-34, 4-35, 4-36, 4-39, 4-40, 4-41, 4-44, 4-48, 4-51, 4-53, 4-55, 4-58, 4-59, 4-62, 4-64, 4-66, 4-67, 4-68, 4-69, 4-81, 4-84, 4-88, 4-89, 4-93, 4-94, 4-98, 4-100, 4-102, 4-112, 4-113, 4-115, 4-118, 4-119, 4-121, 4-124, 4-130, 4-131, 4-135, 5-3, 5-7, A-1, E-3, E-9, E-11, E-12, E-14, E-30, E-32, G-2, G-3, G-22, G-25, G-26, G-29, G-30, G-50
Wyoming Game and Fish Department or WGFD	3-43, 3-45, 3-46, 3-67, 3-68, 3-69, 4-64, 4-68, 4-133, 4-134, 4-135, 4-136, 5-3, G-50, G-52, G-53

APPENDIX A

FEDERAL AND STATE PERMITTING REQUIREMENTS AND AGENCIES

APPENDIX A: FEDERAL AND STATE AGENCIES & PERMITTING REQUIREMENTS	
Agency	Lease/Permit/Action
FEDERAL	
Bureau of Land Management	Coal Lease Resource Recovery & Protection Plan Scoria Sales Contract Exploration Drilling Permit
Office of Surface Mining Reclamation and Enforcement	Preparation of Mining Plan Approval Document SMCRA Oversight
Office of the Secretary of the Interior	Approval of Mining Plan
Mine Safety and Health Administration	Safety Permit and Legal ID Ground Control Plan Major Impoundments Explosives Use and Storage Permit
Bureau of Alcohol, Tobacco, and Firearms	Explosive's Manufacturer's License Explosives Use and Storage Permit
Federal Communication Commission	Radio Permit: Ambulance Mobile Relay System Radio License
Nuclear Regulatory Commission	Radioactive By-Products Material License
Army Corps of Engineers	Authorization of Impacts to Wetlands and Other Waters of the U.S.
Department of Transportation	Hazardous Waste Shipment Notification
Federal Aviation Administration	Radio Tower Permits
STATE	
State Land Commission	Coal Lease Scoria Lease
Department of Environmental Quality-Land Quality Division	Permit and License to Mine
Department of Environmental Quality-Air Quality Division	Air Quality Permit to Operate Air Quality Permit to Construct
Department of Environmental Quality-Water Quality Division	National Pollutant Discharge Elimination System Water Discharge Permit Permit to Construct Sedimentation Pond Authorization to Construct Septic Tank & Leach Field Authorization to Construct and Install a Public Water Supply and Sewage Treatment System
Department of Environmental Quality-Solid Waste Management Program	Solid Waste Disposal Permit-Permanent and Construction
State Engineer's Office	Appropriation of Surface Water Permits Appropriation of Ground Water Permits
Industrial Siting Council	Industrial Siting Certificate of Non-Jurisdiction
Department of Health	Radioactive Material Certificate of Registration

APPENDIX B

UNSUITABILITY CRITERIA FOR THE
NARO NORTH, NARO SOUTH, LITTLE THUNDER,
WEST ROUNDUP, AND WEST ANTELOPE LBA TRACTS

Appendix B. Unsuitability Criteria for the NARO North LBA Tract

UNSUITABILITY CRITERIA	GENERAL RECOMMENDATIONS FOR BUFFALO RESOURCE AREA (BLM 1985a, 2001a), PLATTE RIVER RESOURCE AREA (BLM 1985b), and TBNG (USFS 1985, 2001, 2002a)	FINDINGS FOR NARO NORTH LBA TRACT
1. Federal Land Systems. With certain exceptions that do not apply to this tract, all federal lands included in the following systems are unsuitable for mining: National Parks, National Wildlife Refuges, National System of Trails, National Wilderness Preservation System, National Wild and Scenic Rivers, National Recreation Areas, Lands acquired through the Land and Water Conservation Fund, National Forests and Federal lands in incorporated cities, towns and villages.	There are Federal lands located around Gillette, Sheridan, and Wright which were determined to be unsuitable under this criterion. The TBNG is not a proclaimed National Forest. TBNG lands are included in the NARO North LBA Tract.	The TBNG lands included in the NARO North LBA Tract are not unsuitable under this criterion. None of the federal lands determined to be unsuitable under Criterion 1 are present on the NARO North LBA Tract, and therefore there are no unsuitable findings.
2. Rights-Of-Way and Easements. Federal lands that are within ROWs or easements or within surface leases for residential, commercial, industrial or other public purposes, on federally owned surface, are unsuitable for mining.	Portions of the BNSF&UP railroad, the Tri-County 230-Kv transmission line, and Wyoming State Highway 450 ROWs were found to be unsuitable under this criterion within the general review area.	The portions of the Tri-County 230-Kv transmission line, the BNSF&UP, and Highway 450 ROWs that were found to be unsuitable are not located on the NARO North LBA Tract. There are no unsuitable findings under Criterion 2 for the NARO North LBA Tract.
3. Dwellings, Roads, Cemeteries, and Public Buildings. Federal lands within 100 ft of a ROW of a public road or a cemetery; or within 300 ft of any public building, school, church, community or institutional building or public park; or within 300 ft of an occupied dwelling are unsuitable for mining.	Portions of Wyoming State Highway 450, Interstate Highway I-90, and one cemetery were found to be unsuitable under this criterion. Decisions were deferred on other highways/roads, occupied dwellings, and one school.	Highway 450, I-90, and the cemetery are not located on the NARO North LBA Tract. No occupied dwellings, other highways/roads, or schools are located on the tract. Therefore, there are no unsuitable findings under Criterion 3 for the NARO North LBA Tract.
4. Wilderness Study Areas. Federal lands designated as wilderness study areas are unsuitable for mining while under review for possible wilderness designation.	No lands in the general review area are within a wilderness study area.	There are no unsuitable findings under Criterion 4 for the NARO North LBA Tract.
5. Lands with Outstanding Scenic Quality. Scenic federal lands designated by visual resource management analysis as Class I (outstanding visual quality or high visual sensitivity) but not currently on National Register of Natural Landmarks are unsuitable.	No lands in the general review area meet the scenic criteria as outlined.	There are no unsuitable findings under Criterion 5 for the NARO North LBA Tract.
6. Land Used for Scientific Study. Federal lands under permit by the surface management agency and being used for scientific studies involving food or fiber production, natural resources, or technology demonstrations and experiments are unsuitable for the duration of the study except where mining would not jeopardize the purpose of the study.	A vegetation monitoring study site (NE ¼ of Sec. 1, T.41N., R.71W.), and the Hoe Creek Site (Sec. 7, T.47N., R.72W.) were found to be unsuitable under this criterion.	Neither the vegetation monitoring site or the Hoe Creek site are located on the NARO North LBA Tract. There are no unsuitable findings under Criterion 6 for the NARO North LBA Tract.
7. Cultural Resources. All publicly or privately owned places which are included in or are eligible for inclusion in the NRHP and an appropriate buffer zone are unsuitable.	On the basis of the consultation with SHPO, there were no unsuitable findings under this criterion in the general review area. Continue using the "Standard Archeological Stipulation for Cultural Resources" to new leases.	There are no unsuitable findings under Criterion 7 for the NARO North LBA Tract. The "Standard Archeological Stipulation for Cultural Resources" should be applied if this tract is leased.
8. Natural Areas. Federal lands designated as natural areas or National Natural Landmarks are unsuitable.	No lands in the general review area are designated as natural areas or as National Natural Landmarks.	There are no unsuitable findings under Criterion 8 for the NARO North LBA Tract.

UNSUITABILITY CRITERIA	GENERAL RECOMMENDATIONS FOR BUFFALO RESOURCE AREA (BLM 1985a, 2001a), PLATTE RIVER RESOURCE AREA (BLM 1985b), and TBNG (USFS 1985, 2001, 2002a)	FINDINGS FOR NARO NORTH LBA TRACT
9. Critical Habitat for Threatened or Endangered Plant and Animal Species. Federally designated critical habitat for threatened or endangered plant and animal species, and scientifically documented essential habitat for threatened or endangered species are unsuitable.	There is no federally designated critical habitat for threatened or endangered plant or animal species within the general review area.	There are no unsuitable findings under Criterion 9 for the NARO North LBA Tract.
10. State Listed Species. Federal lands containing habitat determined to be critical or essential for plant or animal species listed by a state pursuant to state law as threatened or endangered shall be considered unsuitable.	Wyoming does not maintain a state list of threatened or endangered species of plants or animals. Therefore, this criterion does not apply.	There are no unsuitable findings under Criterion 10 for the NARO North LBA Tract.
11. Bald or Golden Eagle Nests. An active bald or golden eagle nest and appropriate buffer zone are unsuitable unless the lease can be conditioned so that eagles will not be disturbed during breeding season or unless golden eagle nests will be moved.	Defer suitability decisions and evaluate bald and golden eagle nests on a case by case basis prior to lease issuance. Establish buffer zones around nests after consultation with USFWS.	There are currently no active bald or golden eagle nests or established buffer zones located on the NARO North LBA Tract. There are no unsuitable findings under Criterion 11 for the NARO North LBA Tract.
12. Bald and Golden Eagle Roost and Concentration Areas. Bald and golden eagle roost and concentration areas on federal lands used during migration and wintering are unsuitable unless mining can be conducted in such a way as to ensure that eagles shall not be adversely disturbed.	Defer suitability decisions and evaluate bald and golden eagle roost areas on a case by case basis prior to lease issuance. Establish buffer zones after consultation with USFWS.	There are currently no bald or golden eagle roosts or established buffer zones located on the NARO North LBA Tract. There are no unsuitable findings under Criterion 12 for the NARO North LBA Tract.
13. Falcon Nesting Sites and Buffer Zones. Federal lands containing active falcon (excluding kestrel) cliff nesting sites and a suitable buffer zone shall be considered unsuitable unless mining can be conducted in such a way as to ensure the falcons will not be adversely affected.	Defer suitability decisions on falcon nesting sites and evaluate on a case by case basis prior to lease issuance. Establish buffer zones around nesting sites after consultation with USFWS.	There are currently no falcon nesting sites or established buffer zones located on the NARO North LBA Tract. There are no unsuitable findings under Criterion 13 for the NARO North LBA Tract.
14. Habitat for Migratory Bird Species. Federal lands which are high priority habitat for migratory bird species of high federal interest shall be considered unsuitable unless mining can be conducted in such a way as to ensure that migratory bird habitat will not be adversely affected during the period it is in use.	Defer suitability decisions on migratory bird habitat and evaluate on a case by case basis prior to lease issuance. Establish buffer zones around nesting sites after consultation with USFWS.	No high priority habitat for migratory bird species of high federal interest has been identified on the NARO North LBA Tract and adjacent areas. There are no unsuitable findings under Criterion 14 for the NARO North LBA Tract.
15. Fish and Wildlife Habitat for Resident Species. Federal lands which the surface management agency and state jointly agree are fish, wildlife and plant habitat of resident species of high interest to the state, and which are essential for maintaining these priority wildlife species, shall be considered unsuitable unless mining can be conducted in such a way as to ensure no long-term impact on the species being provided will occur.	Defer suitability decisions on grouse leks and evaluate on a case by case basis prior to lease issuance. Establish buffer zones after consultation with USFWS.	There are no active or inactive sage grouse leks on or within two miles of the NARO North LBA Tract. There are no unsuitable findings under Criterion 15 for the NARO North LBA Tract.
16. Floodplains. Federal lands in riverine, coastal, and special floodplains shall be considered unsuitable where it is determined that mining could not be undertaken without substantial threat of loss of life or property.	The BLM and USFS have determined that the identified floodplains could potentially be mined. Therefore, all lands within the general review area are considered suitable.	Site-specific stipulations and resource protection safeguards will be applied if necessary during mining and reclamation planning. There are no unsuitable findings under Criterion 16 for the NARO North LBA Tract.
17. Municipal Watersheds. Federal lands which have been committed by the surface management agency to use as municipal watersheds shall be considered unsuitable.	There are no designated municipal watersheds in the general review area.	There are no unsuitable findings under Criterion 17 for the NARO North LBA Tract.

UNSUITABILITY CRITERIA	GENERAL RECOMMENDATIONS FOR BUFFALO RESOURCE AREA (BLM 1985a, 2001a), PLATTE RIVER RESOURCE AREA (BLM 1985b), and TBNG (USFS 1985, 2001, 2002a)	FINDINGS FOR NARO NORTH LBA TRACT
18. National Resource Waters. Federal lands with national resource waters, as identified by states in their water quality management plans, and 1/4-mile buffer zones shall be unsuitable.	There are no designated national resource waters within the TBNG review area.	There are no unsuitable findings under Criterion 18 for the NARO North LBA Tract.
19. Alluvial Valley Floors. Federal lands identified by the surface management agency, in consultation with the state, as AVFs where mining would interrupt, discontinue or preclude farming, are unsuitable. Additionally, when mining federal lands outside an AVF would materially damage the quality or quantity of water in surface or underground water systems that would supply AVFs, the land shall be considered unsuitable.	Consider areas determined to contain AVFs significant to farming as unsuitable. Defer decisions on other AVFs and analyze on a case by case basis at the time a lease action is evaluated.	No AVFs identified as significant to farming and therefore unsuitable for mining have been identified on the NARO North LBA Tract. There are no unsuitable findings under Criterion 19 for the NARO North LBA Tract.
20. State or Indian Tribe Criteria. Federal lands to which is applicable a criterion proposed by the state or Indian tribe located in the planning area and adopted by rulemaking by the Secretary are unsuitable.	There are no criterion proposed by state or Indian tribes that have been approved by the Secretary of the Interior. No tribal lands are located in or near the review area.	There are no unsuitability findings for this criterion on the NARO North LBA Tract.

Appendix B. Unsuitability Criteria for the NARO South LBA Tract

UNSUITABILITY CRITERIA	GENERAL RECOMMENDATIONS FOR BUFFALO RESOURCE AREA (BLM 1985a, 2001a), PLATTE RIVER RESOURCE AREA (BLM 1985b), and TBNG (USFS 1985, 2001, 2002a)	FINDINGS FOR NARO SOUTH LBA TRACT
1. Federal Land Systems. With certain exceptions that do not apply to this tract, all federal lands included in the following systems are unsuitable for mining: National Parks, National Wildlife Refuges, National System of Trails, National Wilderness Preservation System, National Wild and Scenic Rivers, National Recreation Areas, Lands acquired through the Land and Water Conservation Fund, National Forests and Federal lands in incorporated cities, towns and villages.	There are Federal lands located around Gillette, Sheridan, and Wright which were determined to be unsuitable under this criterion. The TBNG is not a proclaimed National Forest. No TBNG lands are included in the NARO South LBA Tract.	None of the federal lands determined to be unsuitable under Criterion 1 are present on the NARO South LBA Tract, and therefore there are no unsuitable findings.
2. Rights-Of-Way and Easements. Federal lands that are within ROWs or easements or within surface leases for residential, commercial, industrial or other public purposes, on federally owned surface, are unsuitable for mining.	Portions of the BNSF&UP railroad, the Tri-County 230-Kv transmission line, and Wyoming State Highway 450 ROWs were found to be unsuitable under this criterion within the general review area.	The portions of the Tri-County transmission line and Highway 450 ROWs that were found to be unsuitable are not located on the NARO South LBA Tract. The LBA tract includes a portion of the BNSF&UP railroad ROW. This ROW was designated unsuitable for mining and the lease will be stipulated to exclude mining within the ROW.
3. Dwellings, Roads, Cemeteries, and Public Buildings. Federal lands within 100 ft of a ROW of a public road or a cemetery; or within 300 ft of any public building, school, church, community or institutional building or public park; or within 300 ft of an occupied dwelling are unsuitable for mining.	Portions of Wyoming State Highway 450, Interstate Highway I-90, and one cemetery were found to be unsuitable under this criterion. Decisions were deferred on other highway/roads, occupied dwellings, and one school.	Highway 450, I-90, and the cemetery are not located on the NARO South LBA Tract. No occupied dwellings, unsuitable highways/roads, or schools are located on the tract. Therefore, there are no unsuitable findings under Criterion 3 for the NARO South LBA Tract.
4. Wilderness Study Areas. Federal lands designated as wilderness study areas are unsuitable for mining while under review for possible wilderness designation.	No lands in the general review area are within a wilderness study area.	There are no unsuitable findings under Criterion 4 for the NARO South LBA Tract.
5. Lands with Outstanding Scenic Quality. Scenic federal lands designated by visual resource management analysis as Class I (outstanding visual quality or high visual sensitivity) but not currently on National Register of Natural Landmarks are unsuitable.	No lands in the general review area meet the scenic criteria as outlined.	There are no unsuitable findings under Criterion 5 for the NARO South LBA Tract.
6. Land Used for Scientific Study. Federal lands under permit by the surface management agency and being used for scientific studies involving food or fiber production, natural resources, or technology demonstrations and experiments are unsuitable for the duration of the study except where mining would not jeopardize the purpose of the study.	A vegetation monitoring study site (NE ¼ of Sec. 1, T.41N., R.71W.) and the Hoe Creek Site (Sec. 7, T.47N., T.72W.) were found to be unsuitable under this criterion.	Neither the vegetation monitoring site or the Hoe Creek site are located on the NARO South LBA Tract. There are no unsuitable findings under Criterion 6 for the NARO South LBA Tract.
7. Cultural Resources. All publicly or privately owned places which are included in or are eligible for inclusion in the NRHP and an appropriate buffer zone are unsuitable.	On the basis of the consultation with SHPO, there were no unsuitable findings under this criterion in the general review area. Continue to apply the "Standard Archeological Stipulations for Culture Resources" to new leases.	There are no unsuitable findings under Criterion 7 for the NARO South LBA Tract. The "Standard Archeological Stipulation for Cultural Resources" should be applied if this tract is leased.
8. Natural Areas. Federal lands designated as natural areas or National Natural Landmarks are unsuitable.	No lands in the general review area are designated as natural areas or as National Natural Landmarks.	There are no unsuitable findings under Criterion 8 for the NARO South LBA Tract.
9. Critical Habitat for Threatened or Endangered Plant and Animal Species. Federally designated critical habitat for threatened or endangered plant and animal species, and scientifically documented essential habitat for threatened or endangered species are unsuitable.	There is no federally designated critical habitat for threatened or endangered plant or animal species within the general review area.	There are no unsuitable findings under Criterion 9 for the NARO South LBA Tract.

UNSUITABILITY CRITERIA	GENERAL RECOMMENDATIONS FOR BUFFALO RESOURCE AREA (BLM 1985a, 2001a), PLATTE RIVER RESOURCE AREA (BLM 1985b), and TBNG (USFS 1985, 2001, 2002a)	FINDINGS FOR NARO SOUTH LBA TRACT
10. State Listed Species. Federal lands containing habitat determined to be critical or essential for plant or animal species listed by a state pursuant to state law as threatened or endangered shall be considered unsuitable.	Wyoming does not maintain a state list of threatened or endangered species of plants or animals. Therefore, this criterion does not apply.	There are no unsuitable findings under Criterion 10 for the NARO South LBA Tract.
11. Bald or Golden Eagle Nests. An active bald or golden eagle nest and appropriate buffer zone are unsuitable unless the lease can be conditioned so that eagles will not be disturbed during breeding season or unless golden eagle nests will be moved.	Defer suitability decisions and evaluate bald and golden eagle nests on a case by case basis prior to lease issuance. Establish buffer zones around nests after consultation with USFWS.	There are currently no active bald or golden eagle nests or established buffer zones located on the NARO South LBA Tract. There are no unsuitable findings under Criterion 11 for the NARO South LBA Tract.
12. Bald and Golden Eagle Roost and Concentration Areas. Bald and golden eagle roost and concentration areas on federal lands used during migration and wintering are unsuitable unless mining can be conducted in such a way as to ensure that eagles shall not be adversely disturbed.	Defer suitability decisions and evaluate bald and golden eagle roost areas on a case by case basis prior to lease issuance. Establish buffer zones after consultation with USFWS.	There are currently no bald or golden eagle roost areas or established buffer zones located on the NARO South LBA Tract. There are no unsuitable findings under Criterion 12 for the NARO South LBA Tract.
13. Falcon Nesting Sites and Buffer Zones. Federal lands containing active falcon (excluding kestrel) cliff nesting sites and a suitable buffer zone shall be considered unsuitable unless mining can be conducted in such a way as to ensure the falcons will not be adversely affected.	Defer suitability decisions on falcon nesting sites and evaluate on a case by case basis prior to lease issuance. Establish buffer zones around nesting sites after consultation with USFWS.	There are currently no falcon nesting sites or established buffer zones located on the NARO South LBA Tract. There are no unsuitable findings under Criterion 13 for the NARO South LBA Tract.
14. Habitat for Migratory Bird Species. Federal lands which are high priority habitat for migratory bird species of high federal interest shall be considered unsuitable unless mining can be conducted in such a way as to ensure that migratory bird habitat will not be adversely affected during the period it is in use.	Defer suitability decisions on migratory bird habitat and evaluate on a case by case basis prior to lease issuance. Establish buffer zones around nesting sites after consultation with USFWS.	No high priority habitat for migratory bird species of high federal interest has been identified on the NARO South LBA Tract or adjacent areas. There are no unsuitable findings under Criterion 14 for the NARO South LBA Tract .
15. Fish and Wildlife Habitat for Resident Species. Federal lands which the surface management agency and state jointly agree are fish, wildlife and plant habitat of resident species of high interest to the state, and which are essential for maintaining these priority wildlife species, shall be considered unsuitable unless mining can be conducted in such a way as to ensure no long-term impact on the species being provided will occur.	Defer suitability decisions on grouse leks and evaluate on a case by case basis prior to lease issuance. Establish buffer zones after consultation with USFWS.	There are no active or inactive sage grouse leks on or within two miles of the NARO South LBA Tract. There are no unsuitable findings under Criterion 15 for the NARO South LBA Tract.
16. Floodplains. Federal lands in riverine, coastal, and special floodplains shall be considered unsuitable where it is determined that mining could not be undertaken without substantial threat of loss of life or property.	The BLM and USFS have determined that the identified floodplains could potentially be mined. Therefore, all lands within the general review area are considered suitable.	Site-specific stipulations and resource protection safeguards will be applied if necessary during mining and reclamation planning. There are no unsuitable findings under Criterion 16 for the NARO South LBA Tract.
17. Municipal Watersheds. Federal lands which have been committed by the surface management agency to use as municipal watersheds shall be considered unsuitable.	There are no designated municipal watersheds in the general review area.	There are no unsuitable findings under Criterion 17 for the NARO South LBA Tract.
18. National Resource Waters. Federal lands with national resource waters, as identified by states in their water quality management plans, and 1/4-mile buffer zones shall be unsuitable.	There are no designated national resource waters within the TBNG review area.	There are no unsuitable findings under Criterion 18 for the NARO South LBA Tract.
19. Alluvial Valley Floors. Federal lands identified by the surface management agency, in consultation with the state, as AVFs where mining would interrupt, discontinue or preclude farming, are unsuitable. Additionally, when mining federal lands outside an AVF would materially damage the quality or quantity of water in surface or underground water systems that would supply AVFs, the land shall be considered unsuitable.	Consider areas determined to contain AVFs significant to farming as unsuitable. Defer decisions on other AVFs and analyze on a case by case basis at the time a lease action is evaluated.	No AVFs identified as significant to farming and therefore unsuitable for mining have been identified on the NARO South LBA Tract. There are no unsuitable findings under Criterion 19 for the NARO South LBA Tract.

Appendix B

UNSUITABILITY CRITERIA	GENERAL RECOMMENDATIONS FOR BUFFALO RESOURCE AREA (BLM 1985a, 2001a), PLATTE RIVER RESOURCE AREA (BLM 1985b), and TBNG (USFS 1985, 2001, 2002a)	FINDINGS FOR NARO SOUTH LBA TRACT
20. State or Indian Tribe Criteria. Federal lands to which is applicable a criterion proposed by the state or Indian tribe located in the planning area and adopted by rulemaking by the Secretary are unsuitable.	There are no criterion proposed by state or Indian tribes that have been approved by the Secretary of the Interior. No tribal lands are located in or near the review area.	There are no unsuitability findings for this criterion on the NARO South LBA Tract.

Appendix B. Unsuitability Criteria for the Little Thunder LBA Tract

UNSUITABILITY CRITERIA	GENERAL RECOMMENDATIONS FOR BUFFALO RESOURCE AREA (BLM 1985a, 2001a), PLATTE RIVER RESOURCE AREA (BLM 1985b), and TBNG (USFS 1985, 2001, 2002a)	FINDINGS FOR LITTLE THUNDER LBA TRACT
1. Federal Land Systems. With certain exceptions that do not apply to this tract, all federal lands included in the following systems are unsuitable for mining: National Parks, National Wildlife Refuges, National System of Trails, National Wilderness Preservation System, National Wild and Scenic Rivers, National Recreation Areas, Lands acquired through the Land and Water Conservation Fund, National Forests and Federal lands in incorporated cities, towns and villages.	There are Federal lands located around Gillette, Sheridan, and Wright which were determined to be unsuitable under this criterion. The TBNG is not a proclaimed National Forest. TBNG lands are included in the Little Thunder LBA Tract.	The TBNG lands included in the Little Thunder LBA Tract are not unsuitable under this criterion. None of the federal lands determined to be unsuitable under Criterion 1 are present on the Little Thunder LBA Tract, and therefore there are no unsuitable findings.
2. Rights-Of-Way and Easements. Federal lands that are within ROWs or easements or within surface leases for residential, commercial, industrial or other public purposes, on federally owned surface, are unsuitable for mining.	Portions of the BNSF&UP railroad, the Tri-County 230-Kv transmission line, and the Wyoming State Highway 450 ROWs were found to be unsuitable under this criterion within the general review area.	The portion of the Tri-County transmission line that was found to be unsuitable is not located on the Little Thunder LBA Tract. The LBA tract may be configured to include a portion of the north-south BNSF&UP ROW. This portion of the ROW was designated unsuitable for mining and the lease will be stipulated to exclude mining within the ROW. The LBA includes a portion of the Highway 450 ROW east of the intersection with the main north-south railroad ROW. This portion of the ROW was designated unsuitable for mining and the lease will be stipulated to exclude mining within the ROW.
3. Dwellings, Roads, Cemeteries, and Public Buildings. Federal lands within 100 ft of a ROW of a public road or a cemetery; or within 300 ft of any public building, school, church, community or institutional building or public park; or within 300 ft of an occupied dwelling are unsuitable for mining.	Portions of Wyoming State Highway 450, Interstate Highway I-90, and one cemetery were found to be unsuitable under this criterion. Decisions were deferred on other highways/roads, occupied dwellings, and one school.	The Little Thunder LBA Tract includes a portion of Highway 450 east of the intersection with the north-south main BNSF&UP railroad trunk line which was designated unsuitable for mining and the lease will be stipulated to exclude mining within 100 ft of this highway ROW. There are no other unsuitable findings under Criterion 3 for the Little Thunder LBA Tract.
4. Wilderness Study Areas. Federal lands designated as wilderness study areas are unsuitable for mining while under review for possible wilderness designation.	No lands in the general review area are within a wilderness study area.	There are no unsuitable findings under Criterion 4 for the Little Thunder LBA Tract.
5. Lands with Outstanding Scenic Quality. Scenic federal lands designated by visual resource management analysis as Class I (outstanding visual quality or high visual sensitivity) but not currently on National Register of Natural Landmarks are unsuitable.	No lands in the general review area meet the scenic criteria as outlined.	There are no unsuitable findings for Criterion 5 for the Little Thunder LBA Tract.
6. Land Used for Scientific Study. Federal lands under permit by the surface management agency and being used for scientific studies involving food or fiber production, natural resources, or technology demonstrations and experiments are unsuitable for the duration of the study except where mining would not jeopardize the purpose of the study.	A vegetation monitoring study site (NE ¼, Sec. 1, T.41N., R.71W.) and the Hoe Creek Site (Sec. 7, T.47N., R.72W.) were found to be unsuitable under this criterion.	Neither the vegetation monitoring site or the Hoe Creek site are located on the Little Thunder LBA Tract. There are no unsuitable findings under Criterion 6 for the Little Thunder LBA Tract.
7. Cultural Resources. All publicly or privately owned places which are included in or are eligible for inclusion in the NRHP and an appropriate buffer zone are unsuitable.	On the basis of the consultation with SHPO, there were no unsuitable findings under this criterion in the general review area. Continue using the "Standard Archeological Stipulation for Cultural Resources" to new leases.	There are no unsuitable findings under Criterion 7 for the Little Thunder LBA Tract. The "Standard Archeological Stipulation for Cultural Resources" should be applied if this tract is leased.
8. Natural Areas. Federal lands designated as natural areas or National Natural Landmarks are unsuitable.	No lands in the general review area are designated as natural areas or as National Natural Landmarks.	There are no unsuitable findings under Criterion 8 for the Little Thunder LBA Tract.

UNSUITABILITY CRITERIA	GENERAL RECOMMENDATIONS FOR BUFFALO RESOURCE AREA (BLM 1985a, 2001a), PLATTE RIVER RESOURCE AREA (BLM 1985b), and TBNG (USFS 1985, 2001, 2002a)	FINDINGS FOR LITTLE THUNDER LBA TRACT
9. Critical Habitat for Threatened or Endangered Plant and Animal Species. Federally designated critical habitat for threatened or endangered plant and animal species, and scientifically documented essential habitat for threatened or endangered species are unsuitable.	There is no federally designated critical habitat for threatened or endangered plant or animal species within the general review area.	There are no unsuitable findings under Criterion 9 for the Little Thunder LBA Tract.
10. State Listed Species. Federal lands containing habitat determined to be critical or essential for plant or animal species listed by a state pursuant to state law as threatened or endangered shall be considered unsuitable.	Wyoming does not maintain a state list of threatened or endangered species of plants or animals. Therefore, this criterion does not apply.	There are no unsuitable findings under Criterion 10 for the Little Thunder LBA Tract.
11. Bald or Golden Eagle Nests. An active bald or golden eagle nest and appropriate buffer zone are unsuitable unless the lease can be conditioned so that eagles will not be disturbed during breeding season or unless golden eagle nests will be moved.	Defer suitability decisions and evaluate bald and golden eagle nests on a case by case basis prior to lease issuance. Establish buffer zones around nests after consultation with USFWS.	There are currently golden eagle nests on the Little Thunder LBA Tract. Evaluate suitability prior to lease issuance during consultation with USFWS.
12. Bald and Golden Eagle Roost and Concentration Areas. Bald and golden eagle roost and concentration areas on federal lands used during migration and wintering are unsuitable unless mining can be conducted in such a way as to ensure that eagles shall not be adversely disturbed.	Defer suitability decisions and evaluate bald and golden eagle roost areas on a case by case basis prior to lease issuance. Establish buffer zones after consultation with USFWS.	Evaluate suitability prior to lease issuance during consultation with USFWS.
13. Falcon Nesting Sites and Buffer Zones. Federal lands containing active falcon (excluding kestrel) cliff nesting sites and a suitable buffer zone shall be considered unsuitable unless mining can be conducted in such a way as to ensure the falcons will not be adversely affected.	Defer suitability decisions on falcon nesting sites and evaluate on a case by case basis prior to lease issuance. Establish buffer zones around nesting sites after consultation with USFWS.	No falcon nesting sites have been identified on the Little Thunder LBA Tract. There are no unsuitable findings under Criterion 13 for the Little Thunder LBA Tract.
14. Habitat for Migratory Bird Species. Federal lands which are high priority habitat for migratory bird species of high federal interest shall be considered unsuitable unless mining can be conducted in such a way as to ensure that migratory bird habitat will not be adversely affected during the period it is in use.	Defer suitability decisions on high priority habitat for migratory bird species of high federal interest and evaluate on a case by case basis prior to lease issuance. Establish buffer zones for nesting areas after consultation with USFWS.	Evaluate suitability prior to lease issuance during consultation with USFWS.
15. Fish and Wildlife Habitat for Resident Species. Federal lands which the surface management agency and state jointly agree are fish, wildlife and plant habitat of resident species of high interest to the state, and which are essential for maintaining these priority wildlife species, shall be considered unsuitable unless mining can be conducted in such a way as to ensure no long-term impact on the species being provided will occur.	Defer suitability decisions on grouse leks and evaluate on a case by case basis prior to lease issuance. Establish buffer zones after consultation with USFWS.	There are no active sage grouse leks on or within two miles of the Little Thunder LBA Tract. There is one inactive sage grouse lek located on an existing Black Thunder Mine lease within two miles of a portion of the Little Thunder LBA Tract. Evaluate suitability prior to lease issuance during consultation with USFWS.
16. Floodplains. Federal lands in riverine, coastal, and special floodplains shall be considered unsuitable where it is determined that mining could not be undertaken without substantial threat of loss of life or property.	The BLM and USFS have determined that the identified floodplains could potentially be mined. Therefore, all lands within the general review area are considered suitable.	Site-specific stipulations and resource protection safeguards will be applied if necessary during mining and reclamation planning. There are no unsuitable findings under Criterion 16 for the Little Thunder LBA Tract.
17. Municipal Watersheds. Federal lands which have been committed by the surface management agency to use as municipal watersheds shall be considered unsuitable.	There are no designated municipal watersheds in the general review area.	There are no unsuitable findings under Criterion 17 for the Little Thunder LBA Tract.

UNSUITABILITY CRITERIA	GENERAL RECOMMENDATIONS FOR BUFFALO RESOURCE AREA (BLM 1985a, 2001a), PLATTE RIVER RESOURCE AREA (BLM 1985b), and TBNG (USFS 1985, 2001, 2002a)	FINDINGS FOR LITTLE THUNDER LBA TRACT
18. National Resource Waters. Federal lands with national resource waters, as identified by states in their water quality management plans, and 1/4-mile buffer zones shall be unsuitable.	There are no designated national resource waters within the TBNG review area.	There are no unsuitable findings under Criterion 18 for the Little Thunder LBA Tract.
19. Alluvial Valley Floors. Federal lands identified by the surface management agency, in consultation with the state, as AVFs where mining would interrupt, discontinue or preclude farming, are unsuitable. Additionally, when mining federal lands outside an AVF would materially damage the quality or quantity of water in surface or underground water systems that would supply AVFs, the land shall be considered unsuitable.	Consider areas determined to contain AVFs significant to farming as unsuitable. Defer decisions on other AVFs and analyze on a case by case basis prior to lease issuance.	No AVFs identified as significant to farming and therefore unsuitable for mining have been identified on the Little Thunder LBA Tract. There are no unsuitable findings under Criterion 19 for the Little Thunder LBA Tract.
20. State or Indian Tribe Criteria. Federal lands to which is applicable a criterion proposed by the state or Indian tribe located in the planning area and adopted by rulemaking by the Secretary are unsuitable.	There are no criterion proposed by state or Indian tribes that have been approved by the Secretary of the Interior. No tribal lands are located in or near the review area.	There are no unsuitability findings for this criterion on the Little Thunder LBA Tract.

Appendix B. Unsuitability Criteria for the West Roundup LBA Tract

UNSUITABILITY CRITERIA	GENERAL RECOMMENDATIONS FOR BUFFALO RESOURCE AREA (BLM 1985a, 2001a), PLATTE RIVER RESOURCE AREA (BLM 1985b), and TBNG (USFS 1985, 2001, 2002a)	FINDINGS FOR WEST ROUNDUP LBA TRACT
1. Federal Land Systems. With certain exceptions that do not apply to this tract, all federal lands included in the following systems are unsuitable for mining: National Parks, National Wildlife Refuges, National System of Trails, National Wilderness Preservation System, National Wild and Scenic Rivers, National Recreation Areas, Lands acquired through the Land and Water Conservation Fund, National Forests and Federal lands in incorporated cities, towns and villages.	There are Federal lands located around Gillette, Sheridan, and Wright which were determined to be unsuitable under this criterion. The TBNG is not a proclaimed National Forest. TBNG lands are included in the West Roundup LBA Tract.	The TBNG lands included in the West Roundup LBA Tract are not unsuitable under this criterion. None of the federal lands determined to be unsuitable under Criterion 1 are present on the West Roundup LBA Tract, and therefore there are no unsuitable findings.
2. Rights-Of-Way and Easements. Federal lands that are within ROWs or easements or within surface leases for residential, commercial, industrial or other public purposes, on federally owned surface, are unsuitable for mining.	Portions of the BNSF&UP railroad, the Tri-County 230-Kv transmission line, and the Wyoming State Highway 450 ROWs were found to be unsuitable under this criterion within the general review area. USFS has determined that portions of the North Rochelle Special Use Permit area are unsuitable under this criterion (USFS 2002b).	The portions of the Tri-County 230-Kv transmission line, the BNSF&UP, and the Wyoming Highway 450 ROWs that were found to be unsuitable are not on the West Roundup LBA Tract. The LBA tract may be configured to include the North Rochelle USFS Special Use Permit for ancillary facilities. The special use permit area has been determined to be unsuitable for mining and the lease will be stipulated to exclude mining in the unsuitable portions of the special use permit area (USFS 2002b).
3. Dwellings, Roads, Cemeteries, and Public Buildings. Federal lands within 100 ft of a ROW of a public road or a cemetery; or within 300 ft of any public building, school, church, community or institutional building or public park; or within 300 ft of an occupied dwelling are unsuitable for mining.	Portions of Wyoming State Highway 450, Interstate Highway I-90, and one cemetery were found to be unsuitable for mining under this criterion. Decisions were deferred on other highways/roads, occupied dwellings, and one school.	Highway 450, I-90, and the designated cemetery are not located on the West Roundup LBA Tract. No occupied dwellings, highways/roads, or schools are located on the tract. Therefore, there are no unsuitable findings under Criterion 3 for the West Roundup LBA Tract.
4. Wilderness Study Areas. Federal lands designated as wilderness study areas are unsuitable for mining while under review for possible wilderness designation.	No lands in the general review area are within a wilderness study area.	There are no unsuitable findings under Criterion 4 for the West Roundup LBA Tract.
5. Lands with Outstanding Scenic Quality. Scenic federal lands designated by visual resource management analysis as Class I (outstanding visual quality or high visual sensitivity) but not currently on National Register of Natural Landmarks are unsuitable.	No lands in the general review area meet the scenic criteria as outlined.	There are no unsuitable findings Under Criterion 5 for the West Roundup LBA Tract.
6. Land Used for Scientific Study. Federal lands under permit by the surface management agency and being used for scientific studies involving food or fiber production, natural resources, or technology demonstrations and experiments are unsuitable for the duration of the study except where mining would not jeopardize the purpose of the study.	A vegetation monitoring study site (NE ¼, Sec. 1, T.41N., R.71W.) and the Hoe Creek Site (Sec. 7, T.47N., R.72W.) were found to be unsuitable under this criterion.	Neither the vegetation monitoring site or the Hoe Creek site are located on the West Roundup LBA Tract. There are no unsuitable findings under Criterion 6 for the West Roundup LBA Tract.
7. Cultural Resources. All publicly or privately owned places which are included in or are eligible for inclusion in the NRHP and an appropriate buffer zone are unsuitable.	On the basis of the consultation with SHPO, there were no unsuitable findings under this criterion in the general review area. Continue using the "Standard Archeological Stipulation for Cultural Resources" to new leases.	There are no unsuitable findings under Criterion 7 for the West Roundup LBA Tract. The "Standard Archeological Stipulation for Cultural Resources" should be applied if this tract is leased.
8. Natural Areas. Federal lands designated as natural areas or National Natural Landmarks are unsuitable.	No lands in the general review area are designated as natural areas or as National Natural Landmarks.	There are no unsuitable findings under Criterion 8 for the West Roundup LBA Tract.

UNSUITABILITY CRITERIA	GENERAL RECOMMENDATIONS FOR BUFFALO RESOURCE AREA (BLM 1985a, 2001a), PLATTE RIVER RESOURCE AREA (BLM 1985b), and TBNG (USFS 1985, 2001, 2002a)	FINDINGS FOR WEST ROUNDUP LBA TRACT
9. Critical Habitat for Threatened or Endangered Plant and Animal Species. Federally designated critical habitat for threatened or endangered plant and animal species, and scientifically documented essential habitat for threatened or endangered species are unsuitable.	There is no federally designated critical habitat for threatened or endangered plant or animal species within the general review area.	There are no unsuitable findings under Criterion 9 for the West Roundup LBA Tract.
10. State Listed Species. Federal lands containing habitat determined to be critical or essential for plant or animal species listed by a state pursuant to state law as threatened or endangered shall be considered unsuitable.	Wyoming does not maintain a state list of threatened or endangered species of plants or animals. Therefore, this criterion does not apply.	There are no unsuitable findings under criterion 10 for the West Roundup LBA Tract.
11. Bald or Golden Eagle Nests. An active bald or golden eagle nest and appropriate buffer zone are unsuitable unless the lease can be conditioned so that eagles will not be disturbed during breeding season or unless golden eagle nests will be moved.	Defer suitability decisions and evaluate bald and golden eagle nests on a case by case basis prior to lease issuance. Establish buffer zones around nests after consultation with USFWS.	There are currently no bald or golden eagle nests or established buffer zones located on the West Roundup LBA Tract. There are no unsuitable findings under Criterion 11 for the West Roundup LBA Tract.
12. Bald and Golden Eagle Roost and Concentration Areas. Bald and golden eagle roost and concentration areas on federal lands used during migration and wintering are unsuitable unless mining can be conducted in such a way as to ensure that eagles shall not be adversely disturbed.	Defer suitability decisions and evaluate bald and golden eagle roost areas on a case by case basis prior to lease issuance. Establish buffer zones after consultation with USFWS.	There are currently no bald or golden eagle roost areas or established buffer zones located on the West Roundup LBA Tract. There are no unsuitable findings under Criterion 12 for the West Roundup LBA Tract.
13. Falcon Nesting Sites and Buffer Zones. Federal lands containing active falcon (excluding kestrel) cliff nesting sites and a suitable buffer zone shall be considered unsuitable unless mining can be conducted in such a way as to ensure the falcons will not be adversely affected.	Defer unsuitability decisions on falcon nesting sites and evaluate on a case by case basis prior to lease issuance. Establish buffer zones around nesting sites after consultation with USFWS.	No falcon nesting sites have been identified on the West Roundup LBA Tract. There are no unsuitable findings under Criterion 13 for the West Roundup LBA Tract.
14. Habitat for Migratory Bird Species. Federal lands which are high priority habitat for migratory bird species of high federal interest shall be considered unsuitable unless mining can be conducted in such a way as to ensure that migratory bird habitat will not be adversely affected during the period it is in use.	Defer suitability decisions on high priority habitat for migratory bird species of high federal interest and evaluate on a case by case basis prior to lease issuance. Establish buffer zones for nesting areas after consultation with USFWS.	Evaluate suitability prior to lease issuance during consultation with USFWS.
15. Fish and Wildlife Habitat for Resident Species. Federal lands which the surface management agency and state jointly agree are fish, wildlife and plant habitat of resident species of high interest to the state, and which are essential for maintaining these priority wildlife species, shall be considered unsuitable unless mining can be conducted in such a way as to ensure no long-term impact on the species being provided will occur.	Defer suitability decisions on grouse leks and evaluate on a case by case basis prior to lease issuance. Establish buffer zones after consultation with USFWS.	There are no active sage grouse leks on or within two miles of the West Roundup LBA Tract. There is one inactive sage grouse lek located on an existing Black Thunder Mine lease within two miles of a portion of the West Roundup LBA Tract. Evaluate suitability prior to lease issuance during consultation with USFWS.
16. Floodplains. Federal lands in riverine, coastal, and special floodplains shall be considered unsuitable where it is determined that mining could not be undertaken without substantial threat of loss of life or property.	The BLM and USFS have determined that the identified floodplains could potentially be mined. Therefore, all lands within the general review area are considered suitable.	Site-specific stipulations and resource protection safeguards will be applied if necessary during mining and reclamation planning. There are no unsuitable findings under Criterion 16 for the Little Thunder LBA Tract.
17. Municipal Watersheds. Federal lands which have been committed by the surface management agency to use as municipal watersheds shall be considered unsuitable.	There are no designated municipal watersheds in the general review area.	There are no unsuitable findings under Criterion 17 for the West Roundup LBA Tract.

UNSUITABILITY CRITERIA	GENERAL RECOMMENDATIONS FOR BUFFALO RESOURCE AREA (BLM 1985a, 2001a), PLATTE RIVER RESOURCE AREA (BLM 1985b), and TBNG (USFS 1985, 2001, 2002a)	FINDINGS FOR WEST ROUNDUP LBA TRACT
18. National Resource Waters. Federal lands with national resource waters, as identified by states in their water quality management plans, and 1/4-mile buffer zones shall be unsuitable.	There are no designated national resource waters within the TBNG review area.	There are no unsuitable findings under Criterion 18 for the West Roundup LBA Tract.
19. Alluvial Valley Floors. Federal lands identified by the surface management agency, in consultation with the state, as AVFs where mining would interrupt, discontinue or preclude farming, are unsuitable. Additionally, when mining federal lands outside an AVF would materially damage the quality or quantity of water in surface or underground water systems that would supply AVFs, the land shall be considered unsuitable.	Consider areas determined to contain AVFs significant to farming as unsuitable. Defer decisions on other AVFs and analyze on a case by case basis prior to lease issuance.	No AVFs identified as significant to farming and therefore unsuitable for mining have been identified on the West Roundup LBA Tract. There are no unsuitable findings under Criterion 19 for the West Roundup LBA Tract.
20. State or Indian Tribe Criteria. Federal lands to which is applicable a criterion proposed by the state or Indian tribe located in the planning area and adopted by rulemaking by the Secretary are unsuitable.	There are no criterion proposed by state or Indian tribes that have been approved by the Secretary of the Interior. No tribal lands are located in or near the review area.	There are no unsuitability findings for this criterion on the West Roundup LBA Tract.

Appendix B. Unsuitability Criteria for the West Antelope LBA Tract

UNSUITABILITY CRITERIA	GENERAL RECOMMENDATIONS FOR BUFFALO RESOURCE AREA (BLM 1985a, 2001a), PLATTE RIVER RESOURCE AREA (BLM 1985b), and TBNG (USFS 1985, 2001, 2002a)	FINDINGS FOR WEST ANTELOPE LBA TRACT
1. Federal Land Systems. With certain exceptions that do not apply to this tract, all federal lands included in the following systems are unsuitable for mining: National Parks, National Wildlife Refuges, National System of Trails, National Wilderness Preservation System, National Wild and Scenic Rivers, National Recreation Areas, Lands acquired through the Land and Water Conservation Fund, National Forests and Federal lands in incorporated cities, towns and villages.	There are Federal lands located around Gillette, Sheridan, and Wright which were determined to be unsuitable under this criterion. The TBNG is not a proclaimed National Forest. No TBNG lands are included in the West Antelope LBA Tract.	None of the federal lands determined to be unsuitable under Criterion 1 are present on the West Antelope LBA Tract, and therefore there are no unsuitable findings.
2. Rights-Of-Way and Easements. Federal lands that are within ROWs or easements or within surface leases for residential, commercial, industrial or other public purposes, on federally owned surface, are unsuitable for mining.	Portions of the BNSF&UP railroad, the Tri-County 230-Kv transmission line, and Wyoming State Highway 450 ROWs were found to be unsuitable under this criterion within the general review area.	The portions of the Tri-County 230-Kv transmission line, the BNSF&UP, and the Wyoming Highway ROWs that were determined to be unsuitable are not located on the West Antelope LBA Tract. There are no unsuitable findings under Criterion 2 for the West Antelope LBA Tract.
3. Dwellings, Roads, Cemeteries, and Public Buildings. Federal lands within 100 ft of a ROWs of a public road or a cemetery; or within 300 ft of any public building, school, church, community or institutional building or public park; or within 300 ft of an occupied dwelling are unsuitable for mining.	Portions of Wyoming State Highway 450, Interstate Highway I-90, and one cemetery were found to be unsuitable under this criterion. Decisions were deferred on other highways/roads, occupied dwellings, and one school.	Highway 450, I-90, and the cemetery are not located on the West Antelope LBA Tract. No occupied dwellings, other highways/roads, or schools are located on the tract. Therefore, there are no unsuitable findings under Criterion 3 for the West Antelope LBA Tract.
4. Wilderness Study Areas. Federal lands designated as wilderness study areas are unsuitable for mining while under review for possible wilderness designation.	No lands in the general review area are within a wilderness study area.	There are no unsuitable findings under Criterion 4 for the West Antelope LBA Tract.
5. Lands with Outstanding Scenic Quality. Scenic federal lands designated by visual resource management analysis as Class I (outstanding visual quality or high visual sensitivity) but not currently on National Register of Natural Landmarks are unsuitable.	No lands in the general review area meet the scenic criteria as outlined.	There are no unsuitable findings under Criterion 5 for the West Antelope LBA Tract.
6. Land Used for Scientific Study. Federal lands under permit by the surface management agency and being used for scientific studies involving food or fiber production, natural resources, or technology demonstrations and experiments are unsuitable for the duration of the study except where mining would not jeopardize the purpose of the study.	A vegetation monitoring study site (NE ¼ of Sec. 1, T.41N., R.71W.), and the Hoe Creek Site (Sec. 7, T.47N., R.72W.) were found to be unsuitable under this criterion.	Neither the vegetation monitoring site or the Hoe Creek site are located on the West Antelope LBA Tract. There are no unsuitable findings under Criterion 6 for the West Antelope LBA Tract.
7. Cultural Resources. All publicly or privately owned places which are included in or are eligible for inclusion in the NRHP and an appropriate buffer zone are unsuitable.	On the basis of the consultation with SHPO, there were no unsuitable findings under this criterion in the general review area. Continue using the "Standard Archeological Stipulation for Cultural Resources" to new leases.	There are no unsuitable findings under Criterion 7 for the West Antelope LBA Tract. The "Standard Archeological Stipulation for Cultural Resources" should be applied if this tract is leased.
8. Natural Areas. Federal lands designated as natural areas or National Natural Landmarks are unsuitable.	No lands in the general review area are designated as natural areas or as National Natural Landmarks.	There are no unsuitable findings under Criterion 8 for the West Antelope LBA Tract.
9. Critical Habitat for Threatened or Endangered Plant and Animal Species. Federally designated critical habitat for threatened or endangered plant and animal species, and scientifically documented essential habitat for threatened or endangered species are unsuitable.	There is no federally designated critical habitat for threatened or endangered plant or animal species within the general review area.	There are no unsuitable findings under Criterion 9 for the West Antelope LBA Tract.

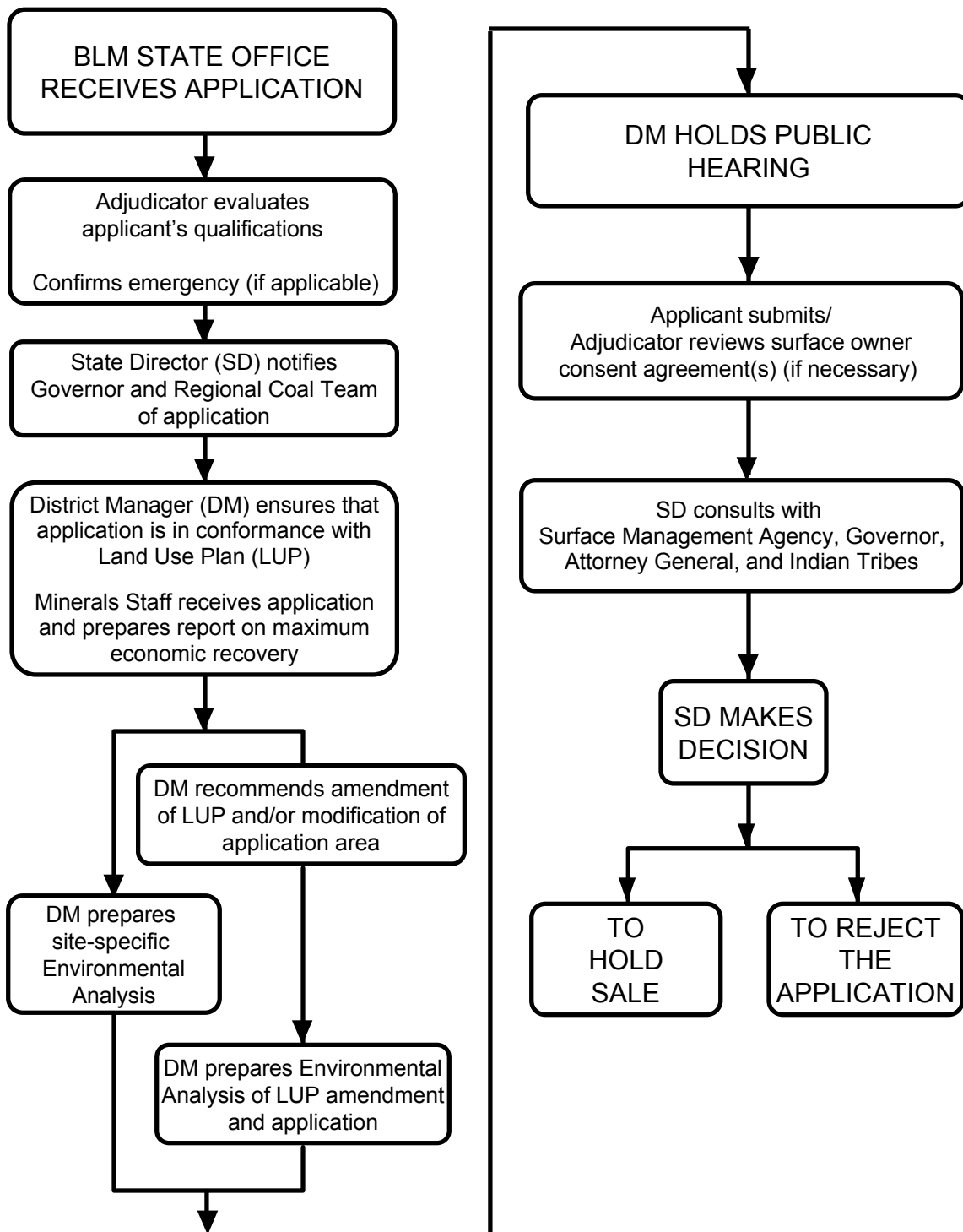
UNSUITABILITY CRITERIA	GENERAL RECOMMENDATIONS FOR BUFFALO RESOURCE AREA (BLM 1985a, 2001a), PLATTE RIVER RESOURCE AREA (BLM 1985b), and TBNG (USFS 1985, 2001, 2002a)	FINDINGS FOR WEST ANTELOPE LBA TRACT
10. State Listed Species. Federal lands containing habitat determined to be critical or essential for plant or animal species listed by a state pursuant to state law as threatened or endangered shall be considered unsuitable.	Wyoming does not maintain a state list of threatened or endangered species of plants or animals. Therefore, this criterion does not apply.	There are no unsuitable findings under Criterion 10 for the West Antelope LBA Tract.
11. Bald or Golden Eagle Nests. An active bald or golden eagle nest and appropriate buffer zone are unsuitable unless the lease can be conditioned so that eagles will not be disturbed during breeding season or unless golden eagle nests will be moved.	Defer suitability decisions and evaluate bald and golden eagle nests on a case by case basis at the time of leasing. Establish buffer zones around nests after consultation with USFWS.	There are golden eagle nests on the West Antelope LBA Tract. Evaluate suitability prior to lease issuance during consultation with USFWS.
12. Bald and Golden Eagle Roost and Concentration Areas. Bald and golden eagle roost and concentration areas on federal lands used during migration and wintering are unsuitable unless mining can be conducted in such a way as to ensure that eagles shall not be adversely disturbed.	Defer suitability decisions and evaluate bald and golden eagle roost areas on a case by case basis prior to lease issuance. Establish buffer zones after consultation with USFWS.	Evaluate suitability prior to lease issuance during consultation with USFWS.
13. Falcon Nesting Sites and Buffer Zones. Federal lands containing active falcon (excluding kestrel) cliff nesting sites and a suitable buffer zone shall be considered unsuitable unless mining can be conducted in such a way as to ensure the falcons will not be adversely affected.	Defer suitability decisions on falcon nesting sites and evaluate on a case by case basis prior to lease issuance. Establish buffer zones around nesting sites after consultation with USFWS.	No falcon nesting sites have been identified on the West Antelope LBA Tract. There are no unsuitable findings under Criterion 13 for the West Antelope LBA Tract.
14. Habitat for Migratory Bird Species. Federal lands which are high priority habitat for migratory bird species of high federal interest shall be considered unsuitable unless mining can be conducted in such a way as to ensure that migratory bird habitat will not be adversely affected during the period it is in use.	Defer suitability decisions on high priority habitat for migratory bird species of high federal interest and evaluate on a case by case basis prior to lease issuance. Establish buffer zones for nesting areas after consultation with USFWS.	Evaluate suitability prior to lease issuance during consultation with USFWS.
15. Fish and Wildlife Habitat for Resident Species. Federal lands which the surface management agency and state jointly agree are fish, wildlife and plant habitat of resident species of high interest to the state, and which are essential for maintaining these priority wildlife species, shall be considered unsuitable unless mining can be conducted in such a way as to ensure no long-term impact on the species being provided will occur.	Defer suitability decisions on grouse leks and evaluate on a case by case basis prior to lease issuance. Establish buffer zones after consultation with USFWS.	There are no active or inactive sage grouse leks on or within two miles of the West Antelope LBA Tract. There are no unsuitable findings under Criterion 15 for the West Antelope LBA Tract.
16. Floodplains. Federal lands in riverine, coastal, and special floodplains shall be considered unsuitable where it is determined that mining could not be undertaken without substantial threat of loss of life or property.	The BLM and USFS have determined that the identified floodplains could potentially be mined. Therefore, all lands within the general review area are considered suitable.	Site-specific stipulations and resource protection safeguards will be applied if necessary during mining and reclamation planning. There are no unsuitable findings under Criterion 16 for the West Antelope LBA Tract.
17. Municipal Watersheds. Federal lands which have been committed by the surface management agency to use as municipal watersheds shall be considered unsuitable.	There are no designated municipal watersheds in the general review area.	There are no unsuitable findings under Criterion 17 for the West Antelope LBA Tract.
18. National Resource Waters. Federal lands with national resource waters, as identified by states in their water quality management plans, and 1/4-mile buffer zones shall be unsuitable.	There are no designated national resource waters within the TBNG review area.	There are no unsuitable findings under Criterion 18 for the West Antelope LBA Tract.

UNSUITABILITY CRITERIA	GENERAL RECOMMENDATIONS FOR BUFFALO RESOURCE AREA (BLM 1985a, 2001a), PLATTE RIVER RESOURCE AREA (BLM 1985b), and TBNG (USFS 1985, 2001, 2002a)	FINDINGS FOR WEST ANTELOPE LBA TRACT
19. Alluvial Valley Floors. Federal lands identified by the surface management agency, in consultation with the state, as AVFs where mining would interrupt, discontinue or preclude farming, are unsuitable. Additionally, when mining federal lands outside an AVF would materially damage the quality or quantity of water in surface or underground water systems that would supply AVFs, the land shall be considered unsuitable.	Consider areas determined to contain AVFs significant to farming as unsuitable. Defer decisions on other AVFs and analyze on a case by case basis prior to lease issuance.	A portion of Spring Creek located on the West Antelope LBA Tract is a potential AVF, however, there is no present or historical record of agricultural uses of this potential AVF. There are no unsuitable findings under Criterion 19 for the West Antelope LBA Tract.
20. State or Indian Tribe Criteria. Federal lands to which is applicable a criterion proposed by the state or Indian tribe located in the planning area and adopted by rulemaking by the Secretary are unsuitable.	There are no criterion proposed by state or Indian tribes that have been approved by the Secretary of the Interior. No tribal lands are located in or near the review area.	There are no unsuitability findings for this criterion on the West Antelope LBA Tract.

APPENDIX C

COAL LEASE-BY-APPLICATION FLOW CHART

COAL LEASE-BY-APPLICATION



APPENDIX D

BUREAU OF LAND MANAGEMENT
SPECIAL COAL LEASE STIPULATIONS,
U.S. FOREST SERVICE SPECIAL STIPULATIONS,
AND FORM 3400-12 COAL LEASE

BLM will attach the following special stipulations to each LBA tract that is leased:

SPECIAL STIPULATIONS

In addition to observing the general obligations and standards of performance set out in the current regulations, the lessee shall comply with and be bound by the following special stipulations.

These stipulations are also imposed upon the lessee's agents and employees. The failure or refusal of any of these persons to comply with these stipulations shall be deemed a failure of the lessee to comply with the terms of the lease. The lessee shall require his agents, contractors and subcontractors involved in activities concerning this lease to include these stipulations in the contracts between and among them. These stipulations may be revised or amended, in writing, by the mutual consent of the lessor and the lessee at any time to adjust to changed conditions or to correct an oversight.

(a) CULTURAL RESOURCES

(1) Before undertaking any activities that may disturb the surface of the leased lands, the lessee shall conduct a cultural resource intensive field inventory in a manner specified by the Authorized Officer of the BLM or of the surface managing agency, if different, on portions of the mine plan area and adjacent areas, or exploration plan area, that may be adversely affected by lease-related activities and which were not previously inventoried at such a level of intensity. The inventory

shall be conducted by a qualified professional cultural resource specialist (i.e., archeologist, historian, historical architect, as appropriate), approved by the Authorized Officer of the surface managing agency (BLM, if the surface is privately owned), and a report of the inventory and recommendations for protecting any cultural resources identified shall be submitted to the Assistant Director of the Western Support Center of the Office of Surface Mining, the Authorized Officer of the BLM, if activities are associated with coal exploration outside an approved mining permit area (hereinafter called Authorized Officer), and the Authorized Officer of the surface managing agency, if different. The lessee shall undertake measures, in accordance with instructions from the Assistant Director, or Authorized Officer, to protect cultural resources on the leased lands. The lessee shall not commence the surface disturbing activities until permission to proceed is given by the Assistant Director or Authorized Officer.

(2) The lessee shall protect all cultural resource properties within the lease area from lease-related activities until the cultural resource mitigation measures can be implemented as part of an approved mining and reclamation or exploration plan.

(3) The cost of conducting the inventory, preparing reports, and carrying out mitigation measures shall be borne by the lessee.

(4) If cultural resources are discovered during operations under this lease, the lessee shall immediately bring them to the attention of the Assistant Director or Authorized Officer, or the Authorized Officer of the surface managing agency, if the Assistant Director is not available. The lessee shall not disturb such resources except as may be subsequently authorized by the Assistant Director or Authorized Officer.

Within two (2) working days of notification, the Assistant Director or Authorized Officer will evaluate or have evaluated any cultural resources discovered and will determine if any action may be required to protect or preserve such discoveries. The cost of data recovery for cultural resources discovered during lease operations shall be borne by the surface managing agency unless otherwise specified by the Authorized Officer of the BLM or of the surface managing agency, if different.

(5) All cultural resources shall remain under the jurisdiction of the United States until ownership is determined under applicable law.

(b) ***PALEONTOLOGICAL
RESOURCES***

If paleontological resources, either large and conspicuous, and/or of significant scientific value are discovered during construction, the find will be reported to the Authorized Officer immediately. Construction will be suspended within 250 feet of said find. An evaluation of the paleontological discovery will be made by a BLM approved professional paleontologist within five (5) working days, weather permitting, to determine the appropriate action(s) to prevent the potential loss of any significant paleontological value. Operations within 250 feet of such discovery will not be resumed until written authorization to proceed is issued by the Authorized Officer. The lessee will bear the cost of any required paleontological appraisals, surface collection of fossils, or salvage of any large conspicuous fossils of significant scientific interest discovered during the operations.

(c) ***MULTIPLE MINERAL
DEVELOPMENT***

Operations will not be approved which, in the opinion of the Authorized Officer, would unreasonably interfere with the orderly development and/or production from a valid existing mineral lease issued prior to this one for the same lands.

(d) ***OIL AND GAS/COAL
RESOURCES***

The BLM realizes that coal mining operations conducted on Federal coal

leases issued within producing oil and gas fields may interfere with the economic recovery of oil and gas; just as Federal oil and gas leases issued in a Federal coal lease area may inhibit coal recovery. BLM retains the authority to alter and/or modify the resource recovery and protection plans for coal operations and/or oil and gas operations on those lands covered by Federal mineral leases so as to obtain maximum resource recovery.

(e) **RESOURCE RECOVERY AND PROTECTION**

Notwithstanding the approval of a resource recovery and protection plan (R2P2) by the BLM, lessor reserves the right to seek damages against the operator/lessee in the event (i) the operator/lessee fails to achieve maximum economic recovery (MER) (as defined at 43 CFR 3480.0-5(21)) of the recoverable coal reserves or (ii) the operator/lessee is determined to have caused a wasting of recoverable coal reserves. Damages shall be measured on the basis of the royalty that would have been payable on the wasted or unrecovered coal.

The parties recognize that under an approved R2P2, conditions may require a modification by the operator/lessee of that plan. In the event a coal bed or portion thereof is not to be mined or is rendered unmineable by the operation, the operator/lessee shall submit appropriate justification to obtain approval by the Authorized Officer to leave such reserves unmined. Upon approval by the Authorized Officer, such coal beds or portions thereof

shall not be subject to damages as described above. Further, nothing in this section shall prevent the operator/lessee from exercising its right to relinquish all or portion of the lease as authorized by statute and regulation.

In the event the Authorized Officer determines that the R2P2, as approved, will not attain MER as the result of changed conditions, the Authorized Officer will give proper notice to the operator/lessee as required under applicable regulations. The Authorized Officer will order a modification if necessary, identifying additional reserves to be mined in order to attain MER. Upon a final administrative or judicial ruling upholding such an ordered modification, any reserves left unmined (wasted) under that plan will be subject to damages as described in the first paragraph under this section.

Subject to the right to appeal hereinafter set forth, payment of the value of the royalty on such unmined recoverable coal reserves shall become due and payable upon determination by the Authorized Officer that the coal reserves have been rendered unmineable or at such time that the operator/lessee has demonstrated an unwillingness to extract the coal.

The BLM may enforce this provision either by issuing a written decision requiring payment of the Mineral Management Service demand for such royalties, or by issuing a notice of non-compliance. A decision or notice of non-compliance issued by the lessor that payment is due under this stipulation is appealable as allowed by law.

(f) ***PUBLIC LAND SURVEY
PROTECTION***

The lessee will protect all survey monuments, witness corners, reference monuments, and bearing trees against destruction, obliteration, or damage during operations on the lease areas. If any monuments, corners or accessories are destroyed, obliterated, or damaged by this operation, the lessee will hire an appropriate county surveyor or registered land surveyor to reestablish or restore the monuments, corners, or accessories at the same location, using surveying procedures in accordance with the "Manual of Surveying Instructions for the Survey of the Public Lands of the United States." The survey will be recorded in the appropriate county records, with a copy sent to the Authorized Officer.

If the NARO South, Little Thunder, and/or West Roundup LBA Tracts are leased, BLM will attach a special stipulation (g) as indicated below:

The following special stipulation (g) will be added to the NARO South LBA Tract:

(g) **RAILROAD RIGHT-OF-WAY**

No mining activity of any kind may be conducted within the Burlington Northern/Santa Fe and Union Pacific railroad right-of-way. The lessee shall recover all legally and economically recoverable coal from all leased lands not within the foregoing right-of-way. Lessee shall pay all royalties on any legally and economically recoverable coal which it fails to mine without the written permission of the Authorized Officer.

The following special stipulation (g) will be added to the Little Thunder LBA Tract:

(g) **RAILROAD AND STATE HIGHWAY RIGHT-OF-WAY**

No mining activity of any kind may be conducted within the Burlington Northern/Santa Fe and Union Pacific railroad and the Wyoming State Highway 450 rights-of-way. The lessee shall recover all legally and economically recoverable coal from all leased lands not within the foregoing rights-of-way. Lessee shall pay all royalties on any legally and economically recoverable coal which it fails to mine without the written permission of the Authorized Officer.

The following special stipulation (g) will be added to the West Roundup LBA Tract:

(g) **U.S. FOREST SERVICE
SPECIAL USE PERMIT FOR
THE NORTH ROCHELLE MINE**

No mining activity of any kind may be conducted on the lands included in the U.S. Forest Service special use permit for ancillary facilities for the North Rochelle Mine, except for those facilities which were included in the application from Triton Coal Company for the West Roundup LBA Tract. The lessee shall recover all legally and economically recoverable coal from all leased lands not within the foregoing special use permit. Lessee shall pay all royalties on any legally and economically recoverable coal which it fails to mine without the written permission of the Authorized Officer.

The NARO North, Little Thunder, and West Roundup LBA Tracts include National Forest System Lands. U.S. Forest Service will attach the following special stipulation to each of those tracts that is leased:

**NOTICE FOR LANDS OF THE NATIONAL FOREST SYSTEM UNDER
JURISDICTION OF THE DEPARTMENT OF AGRICULTURE**

The permittee must comply with all the rules and regulations of the Secretary of Agriculture set forth in Title 36, Chapter II, of the Code of Federal Regulations governing the use and management of the National Forest System when not inconsistent with the rights granted by the Secretary of the Interior in the permit. The Secretary of Agriculture's rules and regulations must be complied with for (1) all use and occupancy of the National Forest System prior to approval of an exploration plan by the Secretary of the Interior, (2) uses of all existing improvements, such as forest development roads, within and outside the area permitted by the Secretary of the Interior, and (3) use and occupancy of the National Forest System not authorized by an exploration plan approved by the Secretary of the Interior.

All matters related to this stipulation are to be addressed to:

District Ranger
2250 East Richards
Douglas, WY 82633
Telephone: 307-358-4690

who is the authorized representative of the Secretary of Agriculture.

NOTICE

The lessee or operator shall immediately bring to the attention of the U.S. Forest Service any cultural or paleontological resources or any other objects of scientific interest discovered as a result of surface operations on National Forest System lands under this lease, and shall leave such discoveries intact until directed to proceed by the U.S. Forest Service.

APPENDIX E

AIR QUALITY IMPACT TECHNICAL SUPPORT DOCUMENT

AIR QUALITY IMPACT TECHNICAL SUPPORT DOCUMENT

As discussed in Section 4.5.4, an air quality impact assessment was conducted during preparation of the *Wyoming Final EIS and Draft Planning Amendment for the PRB Oil and Gas Development Project* (BLM 2003) and the *Montana Final Statewide Oil and Gas EIS and Proposed Amendment of the Powder River and Billings RMPs* (BLM in press). These documents will be referred to as the Wyoming PRB Oil and Gas Project EIS and the Montana Statewide EIS in the following discussion. The air quality impact analysis was prepared to evaluate the impacts of proposed oil and gas development in northeastern Wyoming and Southeastern Montana on air quality in the region. This air quality impact assessment included projected coal mining operations in the Wyoming and Montana PRB, and the results are therefore included in the cumulative impact section of this EIS and this appendix. The following technical support document describes the processes used to conduct the air quality impact assessment, and provides summaries of relevant analysis data:

Argonne National Laboratory.

2002. Technical Support Document - Air Quality Impact Assessment for the Montana Final Statewide Oil and Gas EIS and Proposed Amendment of the Powder River and Billings Resource Management Plans and the Wyoming Final EIS and Planning Amendment for the Powder River Basin Oil and Gas Development Project. Prepared for the U.S. Department of the Interior, Bureau of Land Management, Montana and Wyoming State Offices, by the Environmental Assessment Division, Argonne National Laboratory. Argonne, Illinois.

Copies of this technical support document are available upon request from:

Scott Archer, Senior Air Resource Specialist
National Science and Technology Center (ST-133)
Denver Federal Center, Building 50
P.O. Box 25047
Denver, Colorado 80225-0047
303.236.6400 Voice
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Introduction

Air pollution impacts are limited by local, state, tribal and federal air quality regulations, standards, and implementation plans established under the CAA and administered by the WDEQ/AQD and the EPA. Although not applicable to the Alternatives analyzed in the Wyoming PRB Oil and Gas EIS or this EIS, the Montana Department of Environmental Quality, Air and Waste Management Bureau (MDEQ-AWM) has similar jurisdiction over potential air pollutant emission sources in Montana, which can have a cumulative impact with WDEQ/AQD approved sources.

Fugitive dust and exhaust from construction activities, along with air pollutants emitted during operation (i.e., well operations, booster [field] and pipeline [sales] compressor engines, etc.), are potential causes of air quality impacts. These issues are more likely to generate public concern where natural gas development activities occur near residential areas. The USFS, NPS and the USFWS have also expressed concerns regarding potential atmospheric deposition (acid rain) and visibility impacts within distant downwind PSD Class I and PSD Class II sensitive areas under their administration, located throughout Wyoming, Montana, southwestern North Dakota, western South Dakota, and northwestern Nebraska.

Existing Air Quality

The Project Area for the Wyoming PRB Oil and Gas Project EIS includes Campbell, Sheridan, Johnson, and northern Converse Counties. The Project Area for the Montana Statewide EIS includes all of Carter, Powder River, Big Horn, Yellowstone, Carbon, Stillwater, Sweetgrass, Wheatland, Golden Valley, Musselshell, and Treasure Counties, and portions of Rosebud and Custer Counties. The General Analysis Area for this EIS (the South PRB Coal EIS) is located in southern Campbell and northern Converse Counties, Wyoming, which lies near the southeast corner of the Project Area for the Wyoming PRB Oil and Gas Project EIS.

As described in Section 3.5.3, specific air quality monitoring is not conducted throughout most of the Project Area for the Wyoming PRB Oil and Gas Project EIS and the Montana Statewide EIS, but air quality conditions are likely to be very good, as characterized by limited air pollution emission sources (few industrial facilities and residential emissions in the relatively small communities and isolated ranches) and good atmospheric dispersion conditions, resulting in relatively low air pollutant concentrations. As part of the Air Quality Impact Assessment prepared by Argonne National Laboratory (Argonne 2002), monitoring data measured throughout northeastern Wyoming and southeastern Montana were assembled and reviewed. Although monitoring is primarily conducted in urban or industrial areas, the data selected are considered to be the best available representation of background air pollutant concentrations throughout the Project Area. Specific values presented in Table AQ-1 were used to define background conditions in the air quality impact analysis. The assumed background pollutant

concentrations are below applicable ambient air quality standards for all pollutants and averaging times. These National and Wyoming standards, and PSD increment values, are also presented in Table AQ-1.

Table AQ-1. Assumed Background Concentrations, Applicable Ambient Air Quality Standards, and PSD Increment Values (in $\mu\text{g}/\text{m}^3$).

Pollutant	Averaging Time ^a	Background Concentration	National Ambient Air Quality Standards	Wyoming Ambient Air Quality Standards	PSD Class I Increment	PSD Class II Increment
carbon monoxide	1-hour	3,500 ^b	40,000	40,000	---	---
	8-hours	1,500 ^b	10,000	10,000	---	---
lead	Quarterly	n/a	1.5	1.5	---	---
nitrogen dioxide	Annual	16.5 ^c	100	100	2.5	25
ozone	1-hour	82 ^d	235	235	---	---
	8-hours	130 ^d	157	157	---	---
PM _{2.5}	24-hours	19 ^f	65	65	---	---
	Annual	7.6 ^f	15	15	---	---
PM ₁₀	24-hours	42 ^f	150	150	8	30
	Annual	17 ^f	50	50	4	17
sulfur dioxide	3-hours	8 ^e	1,300	1,300	25	512
	24-hours	8 ^e	365	260	5	91
	Annual	3 ^e	80	60	2	20

Source: Argonne (2002)

Notes:

$\mu\text{g}/\text{m}^3$ - micrograms per cubic meter

^a Annual standards are not to be exceeded; short-term standards are not to be exceeded more than once per year.

^b Amoco Ryckman Creek collected for an 8 month period during 1978-1979, summarized in the Riley Ridge EIS (BLM 1983)

^c Data collected in Gillette, Wyoming (1996 - 1997)

^d Data collected in Pinedale, Wyoming (1992 - 1994)

^e Data collected at Devil's Tower (1983)

^f Data collected in Gillette, Wyoming (1999)

n/a - data not available

Regulatory Framework

The NAAQS and WAAQS set the absolute upper limits for specific air pollutant concentrations at all locations where the public has access. The analysis of the proposed Alternatives must demonstrate continued compliance with all applicable local, state, tribal, and federal air quality standards. Existing air quality throughout most of the Project Area for the Wyoming PRB Oil and Gas Project EIS and Montana Statewide EIS is in attainment with all ambient air quality standards, as demonstrated by the relatively low concentration levels presented in Table AQ-1. However, four areas have been designated as federal nonattainment areas where the applicable standards have been violated in the past: Sheridan, Wyoming (PM₁₀ - moderate); and Billings (CO), Lame Deer (PM₁₀ - moderate) and Laurel (SO₂ - primary), Montana. EPA Region 8 staff are concerned that PM₁₀ monitoring data collected near and south of Gillette, Wyoming, have also exceeded both the NAAQS and the available PSD Class II increment. Specific monitoring data are presented in Tables AQ-2 and AQ-3.

Table AQ-2. Annual Average PM₁₀ Monitoring Data Collected Near and South of Gillette, Wyoming (in µg/m³).

Location	Station Number	1996	1997	1998	1999	2000	2001	2002 ^a
Rochelle R0-1	869	n/a	n/a	[15.3]	24.2	20.2	22.6	[25] ^b
North Rochelle E	874	n/a	n/a	n/a	[40] ^b	[51] ^b	[50] ^b	[35] ^b
Black Thunder BTM 26-2	877	21.0	17.7	23.2	33.4	30.9	25.6	[30] ^b
Antelope Site 4	881	n/a	14.5	13.4	16.2	16.7	19.8	[12] ^b
Triton Coal / Buckskin Mine	884	11.5	12.6	12.1	12.0	17.6*	18.3	[16] ^b
Cordero Hv-2	885	14.3	15.3	15.1	14.5	26.0*	24.3*	[30] ^b
Cordero Hv-3	889	11.9	10.9	10.4	9.7	17.1	19.8	[14] ^b
Coal Creek Ccm 26	890	9.0	7.9	8.6	8.5	8.3	[2.0]	n/a
Thunder Basin Coal / BTM	891	13.8	12.0	14.4	17 ^b	24.5	37 ^b	[57] ^b
Belle Ayr Ba-4, 5n, 5s	892	15.5	14.6	14.2	15.0	20.1	25 ^b	[20] ^b
Jacob Ranch Site 4	894	28.3	24.3*	25.1*	35.4*	35.9*	30.6*	n/a
Dry Fork Coal Co	896	13.8	13.0	10.5	9.3	10.8	13.2	[13] ^b
Triton Coal / Gillette	899	21.5	22.7	15.3	17.2	19.0*	21.0	[18] ^b
AMAX Eagle Butte Eb-5	900	12.5	10.6	11.6	11.7	15.0	15 ^b	[15] ^b
Jacob Ranch Site 5	905	15.0	14.6	15.1	20.5	21.3	31.7	n/a
North Rochelle 1	907	n/a	20.6	18.4	38.6	46.8	50.8	[52] ^b
Black Thunder BTM 36-1	915	n/a	n/a	n/a	n/a	[18] ^b	26 ^b	[16] ^b
Gillette, Wyoming	1002	16.1	16.7	17.6*	19.1*	20.7*	19.9*	[17] ^b

Source: EPA (2002a)

Notes:

^a Incomplete data year; values reported through July 1, 2002.

^b Supplemental data provided by (Payton 2002).

µg/m³ - micrograms per cubic meter.

n/a - data not available.

[data] - data in brackets are not reliable due to the small number of samples collected.

data* - starred data are combined from two or more samplers operating at the same location during the same year.

Air quality regulations require certain proposed new, or modified existing, air pollutant emission sources (including CBM compression facilities) undergo a permitting review before their construction can begin. Therefore, the applicable air quality regulatory agencies have the primary authority and responsibility to review permit applications and to require emission permits, fees and control devices, prior to construction and/or operation. In addition, the U.S. Congress (through the CAA Section 116) authorized local, state, and tribal air quality regulatory agencies to establish air pollution control requirements more (but not less) stringent than federal requirements. Also, under both FLPMA and the CAA, BLM can not authorize any activity which would not conform to all applicable local, state, tribal and federal air quality laws, regulations, standards, and implementation plans.

Given the current attainment status for most of the Project Area for the Wyoming PRB Oil and Gas Project EIS and Montana Statewide EIS, future development projects which have the potential to emit more than 250 tons per year of any criteria pollutant (or certain listed sources that have the potential to emit more than 100 tons per year) would be required to undergo a site-specific regulatory PSD Increment Consumption analysis under the federal New Source Review permitting regulations. Development projects subject to the PSD regulations may also be required by the applicable air quality regulatory agencies to incorporate additional emission control measures (including a BACT analysis and determination) to ensure protection of air quality resources, and demonstrate that

the combined impacts of all PSD sources will not exceed the allowable incremental air quality impacts for NO₂, PM₁₀, and SO₂.

Table AQ-3. Second Maximum 24-hour Average PM₁₀ Monitoring Data Collected Near and South of Gillette, Wyoming (in µg/m³).

Location	Station Number	1996	1997	1998	1999	2000	2001	2002 ^a
Rochelle R0-1	869	n/a	n/a	[23]	62	46	63	[55] ^b
North Rochelle E	874	n/a	n/a		122	143	156 ^b	[124] ^b
Black Thunder BTM 26-2	877	66	44	55	125	123	101	[62] ^b
Antelope Site 4	881	n/a	32	32	35	50	54	[25] ^b
Triton Coal / Buckskin Mine	884	31	34	36	36	53*	73 ^b	[43] ^b
Cordero Hv-2	885	32	36	42	36	73*	65*	[55] ^b
Cordero Hv-3	889	30	22	25	26	46	47	[40] ^b
Coal Creek Ccm 26	890	20	16	23	25	31	n/a	n/a
Thunder Basin Coal / BTM	891	34	26	39	43 ^b	80	97 ^b	[155] ^b
Belle Ayr Ba-4, 5n, 5s	892	39	34	53	56	48	70 ^b	[35] ^b
Jacob Ranch Site 4	894	101	62*	54*	103*	88*	119 ^b	n/a
Dry Fork Coal Co	896	34	39	35	22	32	42	[34] ^b
Triton Coal / Gillette	899	85	65	37	45	54*	80 ^b	[73] ^b
AMAX Eagle Butte Eb-5	900	30	37	37	51	48	61	[36] ^b
Jacob Ranch Site 5	905	44 ^b	39	43	47	50	97	n/a
North Rochelle 1	907	n/a	39	49	100	125	268 ^b	[211] ^b
Black Thunder BTM 36-1	915	n/a	n/a	n/a	n/a	[24]	76 ^b	[31] ^b
Gillette, Wyoming	1002	46 ^b	29	36*	42*	60*	43 ^b	[35] ^b

Source: EPA (2002a)

Notes:

^a Incomplete data year; values reported through July 1, 2002.

^b Supplemental data provided by (Payton 2002).

µg/m³ - micrograms per cubic meter.

n/a - data not available.

[data] - data in brackets are not reliable due to the small number of samples collected.

data* - starred data are combined from two or more samplers operating at the same location during the same year.

A regulatory PSD Increment Consumption analysis may be conducted as part of a New Source Review, or independently. The determination of PSD increment consumption is a legal responsibility of the applicable air quality regulatory agencies, with EPA oversight. In addition, an analysis of cumulative impacts due to all existing sources and the permit applicant's sources is also required during New Source Review to demonstrate that applicable ambient air quality standards will be met during the operational lifetime of the permit applicant's operations.

Coal mining in the General Analysis Area considered in this EIS (the South PRB Coal EIS) is not currently affected by the PSD regulations for two reasons: surface coal mines are not on the EPA list of 28 major emitting facilities for PSD regulation, and point-source emissions from individual mines do not exceed the PSD emissions threshold of 250 tons per year.

Sources subject to the PSD permit review procedure are also required to demonstrate potential impacts to AQRVs. These include visibility impacts, degradation of mountain lakes from atmospheric deposition (acid rain), and effects on sensitive flora and fauna in the Class I areas. The CAA also provides specific visibility protection procedures for the mandatory federal Class I areas designated

by the U.S. Congress on August 7, 1977, which included wilderness areas greater than 5,000 acres in size, as well as national parks and national memorial parks greater than 6,000 acres in size as of that date. The Fort Peck and Northern Cheyenne tribes have also designated their lands as PSD Class I, although the national visibility regulations do not apply in these areas. The allowable incremental impacts for NO₂, PM₁₀, and SO₂ within these PSD Class I areas are very limited. The remainder of the Project Area for the Wyoming PRB Oil and Gas Project EIS and Montana Statewide EIS is designated PSD Class II with less stringent requirements.

Agency Roles And Authorities

EPA

The EPA administers the Federal CAA, (42 U.S.C. 7401 et seq.) to maintain the NAAQS that protect human health and to preserve the rural air quality in the region by assuring the PSD Class I and Class II increments for SO₂, NO₂, and PM₁₀, are not exceeded. EPA has delegated this CAA authority to the States of Montana and Wyoming.

Until the Tribes have an EPA-approved Tribal program, EPA will administer air quality requirements within Indian country. EPA is responsible for assuring that NAAQS are attained and that the Tribally-designated Northern Cheyenne Class I sensitive airshed is protected, as well as the Class II increment limits that apply on the Crow Reservation. EPA will implement an air permitting program for major sources within Indian country, including BACT analysis, where appropriate. At this time, there is no federal minor source permitting program. Therefore, EPA cannot regulate minor sources in Indian country directly unless EPA, based on the results of a PSD increment consumption model, decides to implement a Federal Implementation Plan (FIP). Based on future regulatory modeling in cooperation with MDEQ, EPA and BIA may require either Tribe to apply BACM to unimproved roads in Indian country or other control measures sufficient to avoid exceeding the Class I and Class II increment limits for PM₁₀.

Wyoming DEQ

Wyoming regulates pollutants emitted into the air through the Wyoming Environmental Quality Act (W.S. 35-11-101 et. seq.). Wyoming is also authorized by an approved State Implementation Plan (SIP) to administer all requirements of the PSD permit program under the CAA. Additionally, the approved Wyoming SIP contains a number of programs which provide for the implementation, maintenance, and enforcement of the NAAQS, including a New Source Review program for minor source permitting which requires, among other things, application of BACT for all new or modified sources regardless of size or source category. Included as well are authorities for the control of particulate emissions, including fugitive particulate emissions from haul roads, access roads, or general facility boundaries. Wyoming is also delegated responsibility to operate an approved ambient air quality monitoring network for the purpose of demonstrating compliance with the National and WAAQS.

Bureau of Land Management

NEPA requires that federal agencies consider mitigation of direct and cumulative impacts during their preparation of an EIS (BLM Land Use Planning Manual 1601). Under the CAA, federal agencies are to comply with State Implementation Plans regarding the control and abatement of air pollution. Prior to approval of RMPs or Amendments to RMPs, the State Director is to submit any known inconsistencies with SIPs to the Governor of that state. If the Governor of the State recommends changes in the proposed RMP or Amendment to meet SIP requirements, the State Director shall provide the public an opportunity to comment on those recommendations. (BLM Land Use Planning Manual at Section 1610.3-2.)

Forest Service

Three of the LBAs being considered for leasing in this EIS (NARO North, Little Thunder, and West Roundup) include lands that are part of the TBNG, which is administered by the USFS. As part of the leasing process, USFS must consent to leasing the TBNG lands included in each tract before a lease sale can be held.

The USFS also administers nine wilderness areas (WAs) that could be affected by direct effects associated with the proposed development considered in the Wyoming PRB Oil and Gas Project EIS and Montana Statewide EIS: Bridger WA; Fitzpatrick WA; North Absaroka, Absaroka-Beartooth, and Washakie WAs, next to Yellowstone NP; Teton WA; U.L. Bend WA; Cloud Peak WA; and Popo Agie WA with mandatory Class I designation. As federal land managers, the USFS could act in a consultative role to stipulate that the BLM modeling results, or any future EPA or State-administered PSD refined modeling results (if justified), triggers adverse impairment status. Should the USFS determine impairment of WAs, then BLM, the State, and/or EPA may need to mitigate this predicted adverse air quality effect.

National Park Service

Three areas administered by the NPS, Yellowstone National Park, Devils Tower National Monument, and Bighorn Canyon National Recreation Area, could be affected by direct effects associated with the proposed development considered in the Wyoming PRB Oil and Gas Project EIS and Montana Statewide EIS. As federal land managers, the Park Service could act in a consultative role to stipulate that the BLM modeling results, or any future EPA or State-administered PSD refined modeling results (if justified), triggers adverse impairment status. Should the Park Service determine impairment of NPS-administered Class I areas, then BLM, the State, and/or EPA may need to mitigate this predicted adverse air quality effect.

Air Quality Impact Assessment

Section 4.1.4 of this EIS discusses the air quality impact modeling results for each of the applicant mines considered in this EIS. Section 4.5.4 of this EIS discusses the cumulative air quality impact assessment that was conducted for the Wyoming PRB Oil and Gas Project EIS and the Montana Statewide EIS. An extensive air quality impact assessment technical support document was also prepared by Argonne National Laboratory (Argonne 2002) and is available for review. Argonne analyzed potential impacts from: individual proposed Alternatives 1, 2A, 2B, and 3 of the Wyoming PRB Oil and Gas EIS; “Other” (non-Alternative) emission sources, including surface coal mining in the Wyoming and Montana PRB; and all sources cumulatively by Alternative. Alternatives 1, 2A, and 2B of the Wyoming PRB Oil and Gas Project EIS have similar emission inventories, except half of the booster (field) compressors would be electrified under Alternative 2A, and all of the booster (field) compressors would be electrified under Alternative 2B.

The air quality impact assessment conducted for the Wyoming PRB Oil and Gas Project EIS and Montana Statewide EIS was based on the best available engineering data and assumptions, meteorology data, and dispersion modeling procedures, as well as professional and scientific judgment. However, where specific data or procedures were not available, reasonable assumptions were incorporated. For example, the air quality impact assessment assumed that the maximum CBM, conventional oil, coal and other development would occur simultaneously, whereas actual development would occur under different time schedules.

Potential air pollutant emissions from the emission sources under the proposed Alternative for the Wyoming PRB Oil and Gas Project EIS were combined with other (non-Alternative) sources to determine the total potential cumulative air quality impacts. These other (non-Alternative) sources included development associated with emission sources permitted: 1) by the WDEQ/AQD; 2) by the MDEQ-AWM; and 3) within the states of North Dakota, South Dakota, and Nebraska; plus 4) the Montana Statewide EIS Alternative sources (BLM in press).

Potential direct, indirect, and cumulative air quality impacts from the Proposed Action and Alternatives for the Wyoming PRB Oil and Gas Project EIS, and other (non-Alternative) sources, including surface coal mining in the Wyoming and Montana PRB, were analyzed and reported solely under the requirements of NEPA, in order to assess and disclose reasonably foreseeable impacts to both the public and the BLM decision maker. Due to the preliminary nature of this NEPA analysis, it should be considered an estimate of predicted impacts. Actual impacts at the time of development (subject to air pollutant emission source permitting) are likely to be different.

Given the lack of representative wind measurements throughout the CBM emphasis area, the EPA CALPUFF dispersion model was used with regional wind speed and direction values derived from the 1996 MM5 (mesoscale model) and CALMET meteorological models (Argonne 2002). Meteorological information was assembled to characterize atmospheric transport and dispersion from several

1996 data sources, including: 36 km gridded MM5 (mesoscale model) values with continuous four-dimensional data assimilation; and hourly surface observations (wind speed, wind direction, temperature, cloud cover, ceiling height, surface pressure, relative humidity, and precipitation.)

Potential air quality impacts were predicted using the EPA CALPUFF dispersion model. The meteorology data and air pollutant emission values were combined to predict maximum potential direct, indirect, and cumulative near-field air quality impacts in the vicinity of assumed CBM well and CBM pipeline compressor engine emission sources for comparison with applicable air quality standards and PSD Class II increments. Maximum potential near-field particulate matter emissions from traffic on unpaved roads and during well pad construction were used to predict the maximum annual and 24-hour average PM_{2.5}, PM₁₀, and SO₂ impacts. Maximum air pollutant emissions from each CBM well would be temporary (i.e., occurring during a 12-day construction period) and would occur in isolation, without significantly interacting with adjacent well locations. Particulate matter emissions from well pad and resource road construction would be minimized by application of water and/or chemical dust suppressants. The control efficiency of these dust suppressants was computed at 50 percent during construction. During well completion testing, natural gas could be burned (flared) up to 24 hours.

Air pollutant dispersion modeling was also performed to quantify CO, NO₂, PM_{2.5}, PM₁₀, and HAP impacts during operation. Operation emissions would primarily occur due to increased CBM pipeline compression requirements, including booster (field) and pipeline (sales) compressor stations. Since produced natural gas is nearly pure methane, with little or no liquid hydrocarbons or sulfur compounds, direct VOC emissions or objectionable odors are not likely to occur. HAP impacts were predicted based on an assumed 9,900 horsepower, six-unit, reciprocating compressor engine station operating at full load with emissions generated by a single stack.

The significance criteria for potential air quality impacts include local, state, tribal, and federally enforced legal requirements to ensure air pollutant concentrations will remain within specific allowable levels. These requirements and legal limits were presented in Table AQ-1. Where legal limits have not been established, BLM uses the best available scientific information to identify thresholds of significant adverse impacts. Thresholds have been identified for HAP exposure, potential ANC changes to sensitive lake water chemistry, and a 1.0 dv “just noticeable change” in potential visibility impacts.

Since neither the WDEQ/AQD nor EPA have established HAP standards, predicted eight-hour HAP concentrations were compared to a range of eight-hour state maximum Acceptable Ambient Concentration Levels (EPA 1997a). Pollutants which were predicted to exceed these state threshold levels were also analyzed to determine the possible incremental cancer-risk for a most likely exposure (MLE) to residents, and to a maximally exposed individual (MEI), such as compressor station workers. These cancer risks were calculated based on the maximum

predicted annual concentrations, EPA's unit risk factors for carcinogenic compounds (EPA, 1997b), and an adjustment for time spent at home or on the job.

The EPA CALPUFF dispersion model was also used to determine maximum far-field ambient air quality impacts at downwind mandatory federal PSD Class I areas, and other sensitive receptors, to: 1) determine if the PSD Class I increments might be exceeded; 2) calculate potential total sulfur and nitrogen deposition, and their related impacts to in sensitive lakes; and 3) predict potential visibility impacts (regional haze) within distant sensitive receptors.

Several lakes within five USFS designated wilderness areas were identified as being sensitive to atmospheric deposition and for which the most recent and complete data have been collected. The USFS (Fox et al. 1989) has identified the following total deposition (wet plus dry) thresholds below which no adverse impacts are likely: five kg/ha-yr for sulfur, and three kg/ha-yr for nitrogen. The USFS (2000) has also developed a screening method which identifies the following Limit of Acceptable Change regarding potential changes in lake chemistry: no more than a ten percent change in ANC for those water bodies where the existing ANC is at or above 25 $\mu\text{eq/L}$ and no more than a 1.0 $\mu\text{eq/L}$ change for those extremely sensitive water bodies where the existing ANC is below 25 $\mu\text{eq/L}$. No sensitive lakes were identified by either the NPS or USFWS.

Since the potential air pollutant emission sources constitute many small sources spread out over a very large area, discrete visible plumes are not likely to impact the distant sensitive areas, but the potential for cumulative visibility impacts (increased regional haze) is a concern. Regional haze degradation is caused by fine particles and gases scattering and absorbing light. Potential changes to regional haze are calculated in terms of a perceptible "just noticeable change" (1.0 dv) in visibility when compared to background conditions. A 1.0 dv change is considered potentially significant in mandatory federal PSD Class I areas as described in the EPA Regional Haze Regulations (40 CFR 51.300 et seq.), and as originally presented in Pitchford and Malm (1994). A 1.0 dv change is defined as about a ten percent change in the extinction coefficient (corresponding to a two to five percent change in contrast, for a black target against a clear sky, at the most optically sensitive distance from an observer), which is a small but noticeable change in haziness under most circumstances when viewing scenes in mandatory federal Class I areas.

It should be noted that a 1.0 dv change is not a "just noticeable change" in all cases for all scenes. Visibility changes less than 1.0 dv are likely to be perceptible in some cases, especially where the scene being viewed is highly sensitive to small amounts of pollution, such as due to preferential forward light scattering. Under other view-specific conditions, such as where the sight path to a scenic feature is less than the maximum visual range, a change greater than 1.0 dv might be required to be a "just noticeable change". However, this NEPA analysis is not designed to predict specific visibility impacts for specific views in specific mandatory federal Class I areas based on specific project designs, but to

characterize reasonably foreseeable visibility conditions that are representative of a fairly broad geographic region, based on emission source assumptions. This approach is consistent with both the nature of regional haze and the requirements of NEPA. At the time of a pre-construction air quality PSD permit review, the applicable air quality regulatory agency may require a much more detailed visibility impact analysis. Factors such as the magnitude of change, frequency, time of the year, and the meteorological conditions during times when predicted visibility impacts are above the 1.0 dv threshold (as well as inherent conservatism in the modeling analyses) should all be considered when assessing the significance of predicted impacts.

The USFS, NPS, and USFWS have published their “Final FLAG Phase I Report” (Federal Register, Vol. 66 No. 2, dated January 3, 2001), providing “a consistent and predictable process for assessing the impacts of new and existing sources on AQRVs” including visibility. For example, the FLAG report states “A cumulative effects analysis of new growth (defined as all PSD increment-consuming sources) on visibility impairment should be performed”, and further, “If the visibility impairment from the proposed action, in combination with cumulative new source growth, is less than a change in extinction of 10 percent (1.0 dv) for all time periods, the FLMs will not likely object to the proposed action”.

The FLAG report also recommends a two-step analysis process to evaluate potential visibility impacts from either a single proposed air pollutant emission source (the seasonal FLAG screening method) or potential cumulative visibility impacts from a group of air pollutant emission sources (the daily FLAG refined method). As described in Argonne (2002), this NEPA analysis first used the seasonal FLAG “natural background” screening method (based on both the FLAG and WDEQ/AQD reference levels) to exclude those sensitive areas where visibility impacts were not likely to occur. Since no areas were excluded using the seasonal FLAG screening method, this NEPA analysis then applied the daily FLAG refined method (based on hourly background optical extinction and relative humidity values measured in both the Badlands and Bridger wilderness areas between 1989 and 1999) to determine the average number of days a 1.0 dv “just noticeable change” would be reached annually in each sensitive area. Although the use of observed hourly optical extinction and relative humidity values is appropriate in this NEPA analysis (where the potential visibility impacts are predicted to occur based on the reasonably foreseeable background conditions), EPA’s Regional Haze Regulations are based on optical conditions reconstructed from PM_{2.5} and PM₁₀ data collected every third day under the IMPROVE program.

Estimation of Emission Factors: AP-42

Air quality impacts for various air pollutants are determined by the use of air dispersion models using specific source emission rates. For natural gas compressors, the emissions of nitrogen oxides are determined by the assumed permitted emission rate allowed by the state. For fugitive dust impacts, emission rates are obtained from EPA’s AP-42 document that is titled “Compilation of Air Pollutant Emission Factors”. An AP-42 emission factor is a representative value

that attempts to relate the quantity of a pollutant released to the atmosphere with an activity associated with the release of that pollutant. Emission factors may be appropriate to use in a number of situations such as making source-specific emission estimates for areawide inventories. These inventories have many purposes including ambient dispersion modeling and analysis, control strategy development, and in screening sources for compliance investigations. In most cases, these factors are simply averages of all available data of acceptable quality, and are generally assumed to be representative of long-term averages for all sources in a specific category.

Modeling Assumptions

When reviewing the predicted near- and far-field air quality impacts, it is important to understand that assumptions were made regarding development, emissions, meteorology, atmospheric transport and chemistry, and atmospheric deposition. For example, there is uncertainty regarding ultimate development of CBM in the Wyoming and Montana PRB (i.e., number of wells, equipment to be used, specific locations of wells, etc.).

The following assumptions were used in the analysis:

- Total predicted short-term air pollutant impact concentrations were assumed to be the sum of the assumed background concentration, plus the predicted maximum cumulative modeled concentrations, which may occur under different meteorological conditions.
- Assumed background air pollution concentrations were assumed to occur throughout the 20-year LOP at all locations in the region, even though monitoring is primarily conducted in urban or industrial areas, rather than rural areas. The uniform background PM₁₀ levels for each state are assumed to be representative of the background conditions for the entire modeled area of the PRB, based on monitoring data gathered throughout northeastern Wyoming and southeastern Montana.
- The maximum predicted air quality impacts occur only in the vicinity of the anticipated emission sources. Actual impacts would likely be less at distances beyond the predicted points of maximum impact.
- All emission sources were assumed to operate at their reasonably foreseeable maximum emission rates simultaneously throughout the LOP. Given the number of sources included in this analysis, the co-probability of such a scenario actually occurring over an entire year (or even 24-hours) is small.
- In developing the emissions inventory and model, there is uncertainty regarding ultimate oil and gas development (i.e., number of wells, equipment to be used, specific locations, etc.) Most (90 percent) proposed

CBM wells and 30 percent of conventional wells were assumed to be fully operational and remain operating (no shut ins) throughout the LOP.

- The total proposed booster (field) and pipeline (sales) compression engines were assumed to operate at their rated capacities continuously throughout the LOP (no phased increases or reductions). In reality, compression equipment would be added or removed incrementally as required by the well field operation, compressor engines would operate below full horsepower ratings, and it is unlikely all compressor stations would operate at maximum levels simultaneously.
- The HAP analyses assumed a 9,900 horsepower, six-unit, reciprocating compressor engine station would operate at full load and at maximum emission levels continuously throughout the LOP.
- The emissions inventory and model use peak years of construction and peak years of operations, which would not occur throughout the entire development region at the same time. However, it is possible that conditions close to this could occur in some isolated areas.
- The emissions inventory and model assumed a NO_x emission rate for compressor engines of 1.5 g/hp-hr in Montana and 1.0 g/hp-hr in Wyoming. Since BACT is decided on a case-by-case basis, actual emission rates could be decided to be less or more than this level by the Departments of Environmental Quality in Wyoming or Montana, and on Indian lands by EPA, for field and sales compressor engines. Actual NO_x emission rates may range from 0.7 to 2.0 g/hp-hr.
- There are no applicable local, state, tribal or federal acid deposition standards. In the absence of applicable standards, the acid deposition analysis assumed that a “limit of acceptable change” is: a 10 percent change in acid neutralizing capacity (ANC) for lakes with a background ANC greater than 25 µeq/L; or a 1.0 µeq/L change in ANC for lakes with a background ANC less than 25 µeq/L, and would be a reasonably foreseeable significant adverse impact. Further, the atmospheric deposition impact analysis assumed no other ecosystem components would affect lake chemistry for a full year (assuming no chemical buffering due to interaction with vegetation or soil materials).
- The visibility impact analysis assumed that a 1.0 dv “just noticeable change” would be a reasonably foreseeable significant adverse impact, although there are no applicable local, state, tribal, or federal regulatory visibility standards. However, some FLMs are using 0.5 dv as a screening threshold for significance.
- Mitigation measures are included in the emissions inventory and model that may not be achievable in all circumstances. However, actual mitigation decided by the developers and local and state authorities may be greater or

less than those assumed in the analysis. For example, maintaining a construction road speed limit of 15 mph may be reasonable in a construction zone but difficult to enforce elsewhere. Full (100 percent) mitigation of fugitive dust from disturbed lands may not be achievable. Further, 50 percent reduction in fugitive emissions is assumed based on construction road wetting on the unimproved access road to the pad and at the pad, but this level of effectiveness is characterized as the maximum possible. Wetting was assumed for maintenance traffic, which is not likely to occur, but this is considered to be a small effect because of limited traffic.

- Induced or secondary growth related to increases in vehicle miles traveled (VMT) (believed to be on the order of 10 percent overall) is not included in the emissions inventory and model. Not all fugitive dust emissions (including county and other collector roads) have been included in the emissions inventory and model.
- Fugitive dust emissions from roads are treated as area sources rather than line sources in the model, which may thereby reduce or increase the predicted ambient concentrations at maximum concentration receptor points near the source, depending on the inputs to the model (meteorology, terrain, etc.) By not placing modeled receptors close to emission sources (e.g., wells and roads), the model may not capture higher ambient concentrations near these sources. A more refined, regulatory model may yield higher concentrations at locations near fugitive dust sources.
- For comparisons to the PSD Class I and II increments, the emissions inventory and model included only CBM and RFFD sources. Other existing increment consuming sources such as Campbell County coal mines were not included in this comparison, as the air quality analysis does not represent a regulatory PSD increment consumption analysis. A regulatory PSD increment consumption analysis needs to identify and consider all PSD increment consuming sources to determine the level of PSD Class II increment consumption. Monitoring data in Wyoming has indicated an upward trend in PM concentrations in Campbell County since 1999, which coincides with CBM development but is also exacerbated by prolonged drought in the region.

It is important to note that before actual development could occur, the applicable air quality regulatory agencies (including the state, tribe or EPA) would review specific air pollutant emissions preconstruction permit applications that examine potential project-specific air quality impacts. As part of these permit reviews (depending on source size), the air quality regulatory agencies could require additional air quality impact analyses or mitigation measures. Thus, before development occurs, additional site-specific air quality analyses would be performed to ensure protection of air quality.

Modeling Results

The following Tables (AQ-4 through AQ-17) present the detailed atmospheric dispersion modeling results for the alternatives considered in the Wyoming PRB Oil and Gas Project EIS. These results are summarized in Section 4.5.4. As discussed in Section 4.5.4, the cumulative impacts predicted by the PRB air quality impact assessment would be the same under the Proposed Action and all of the Alternatives for leasing or not leasing federal coal considered in this EIS. This is because the air quality impact analysis used market demand predictions in order to estimate levels of coal production in the PRB for modeling purposes. There is enough coal leased to the existing mines in the PRB to supply this market demand during the time of maximum CBM development activity in the PRB, which is the time when the maximum overlapping impacts to air quality would occur.

Table AQ-4. Predicted Hazardous Air Pollutant Impacts and Significance Thresholds (in $\mu\text{g}/\text{m}^3$).

Pollutant	Averaging Time	Direct Modeled Impact	Range of State Acceptable Ambient Concentration Levels			
formaldehyde	8-hours	11.9	4.5	(FL07)	-	71 (NV01)
n-hexane	8-hours	0.6	1,800	(FL07)	-	36,000 (CT01)
benzene	8-hours	0.7	30	(FL04)	-	714 (NV01)
toluene	8-hours	4.6	1,870	(IN03)	-	8,930 (NV01)
ethyl benzene	8-hours	< 0.1	4,340	(ND01)	-	43,500 (VT01)
xylene	8-hours	0.2	2,170	(IN01)	-	10,400 (NV01)

Source: Argonne (2002)

Agencies:

CT01 - Connecticut Department of Environmental Protection; Air Compliance Unit
FL04 - Broward County Department of Natural Resource Protection (Florida)
FL07 - Pinellas County Air Pollution Control Board (Florida)
IN01 - Indiana Department of Environmental Management
IN03 - Indianapolis Air Pollution Control Division (Indiana)
ND01 - North Dakota Dept. of Health; Division of Environmental Engineering
NV01 - Nevada Division of Environmental Protection; Air Quality Control
VT01 - Vermont Dept of Environmental Conservation; Air Pollution Control Division

Table AQ-5. Wyoming PRB Oil and Gas Project EIS Alternative 1 - Predicted Criteria Pollutant Impacts and Applicable Significance Thresholds (in $\mu\text{g}/\text{m}^3$).

Pollutant	Avg Time ^a	Location	Increment	Alt 1	Other	Cum	Background	Total	National	Wyoming
carbon monoxide	1-hour	near-field	- - -	223	142	224	3,500	3,724	40,000	40,000
		far-field ¹	- - -	5	100	100	3,500	3,600	40,000	40,000
	8-hours	near-field	- - -	156	124	156	1,500	1,656	10,000	10,000
		far-field ²	- - -	19	70	78	1,500	1,578	10,000	10,000
nitrogen dioxide	Annual	near-field	25	8.0	3.3	10.5	17	27	100	100
		far-field ³	25	0.4	5.1	5.4	17	22	100	100
		far-field ²	2.5	0.3	3.9 ^b	4.2 ^b	17	21	100	100
PM _{2.5}	24-hours	near-field	- - -	16.0	8.6	24.4	19	43	65	65
		far-field ³	- - -	5.1	9.7	14.7	19	34	65	65
	Annual	near-field	- - -	1.7	0.7	2.3	8	10	15	15
		far-field ³	- - -	0.2	1.1	1.2	8	9	15	15
PM ₁₀	24-hours	near-field	30	20.2	9.3	30.8 ^b	42	73	150	150
		far-field ⁴	30	0.5	29.7	29.7	42	72	150	150
		far-field ²	8	3.9	9.4 ^b	12.8 ^b	42	55	150	150
		far-field ⁵	8	2.2	7.0	9.2 ^b	42	51	150	150
	Annual	near-field	17	3.3	0.9	4.1	17	21	50	50
		far-field ⁴	17	<0.1	2.7	2.7	17	20	50	50
sulfur dioxide	3-hours	near-field	512	3.3	4.5	4.6	8	13	1,300	1,300
		far-field ³	512	0.7	17.1	17.1	8	25	1,300	1,300
	24-hours	near-field	91	1.7	1.8	3.2	8	11	365	260
		far-field ³	91	0.3	5.3	5.3	8	13	365	260
	Annual	near-field	20	0.5	0.2	0.6	3	4	80	60
		far-field ³	20	<0.1	0.4	0.4	3	3	80	60

Source: Argonne (2002)

Notes: ^a Annual impacts are the first maximum value; short-term impacts are the second maximum value.

^b It is possible that **Other** and **Cum** emission sources could exceed the PSD Class I increment on the Northern Cheyenne Indian Reservation, and that **Cum** emission sources could exceed the PSD Class I increment in the Washakie Wilderness Area, and the PSD Class II increment near the maximum potential development; a regulatory "PSD Increment Consumption Analysis" should be conducted during permitting by the appropriate Air Quality Regulatory Agency.

Alt 1 - Direct modeled Wyoming PRB Oil and Gas EIS Alternative 1 impacts.

Other - Direct modeled "Reasonably Foreseeable Development" impacts. The impact from all air pollutant emission sources not included in **Alt 1**, including projected surface coal mining in the Wyoming and Montana PRB and the Montana Statewide EIS Alternative B/C/E sources. Potential impacts from Montana Alternatives A and D would be less.

Cum - Cumulative modeled impacts. Since these values represent the maximum cumulative impact location, they may not be a simple sum of the maximum direct **Alt 1** and **Other** impacts, which can occur at different locations.

Total - The sum of the cumulative modeled impact and the assumed background concentration.

National - Applicable National Ambient Air Quality Standard.

Wyoming - Applicable Wyoming Ambient Air Quality Standard.

Locations:

- ¹ Absaroka-Beartooth Wilderness Area
- ² Northern Cheyenne Indian Reservation
- ³ Crow Indian Reservation
- ⁴ Fort Belknap Indian Reservation
- ⁵ Washakie Wilderness Area

Table AQ-6. Wyoming PRB Oil and Gas Project EIS Alternative 1 - Predicted Atmospheric Deposition Impacts and Applicable Significance Thresholds.

Location	PSD Class	Lake	Total Sulfur Deposition (kg/ha-yr)				Total Nitrogen Deposition (kg/ha-yr)				Bkgd (ieq/l)	Acid Neutralizing Capacity (percent)			
			Alt 1	Other	Cum	Thld	Alt 1	Other	Cum	Thld		Alt 1	Other	Cum	Thld
Bridger WA	I	Black Joe	<0.01	0.01	0.01	5	0.01	0.02	0.03	3	69.0	0.7	1.9	2.6	10
		Deep	<0.01	0.01	0.01	5	0.01	0.02	0.03	3	61.0	0.8	2.1	2.9	10
		Hobbs	<0.01	0.01	0.01	5	0.01	0.01	0.02	3	68.0	0.4	1.1	1.5	10
		Upper Frozen	<0.01	0.01	0.01	5	0.01	0.02	0.03	3	5.8 ^a	0.5 ^a	1.3^a	1.8^a	1 ^a
Fitzpatrick WA	I	Ross	<0.01	0.01	0.01	5	0.01	0.02	0.02	3	61.4	0.5	1.6	2.1	10
Absaroka- Beartooth WA	II	Stepping Stone	<0.01	0.02	0.02	5	0.01	0.03	0.03	3	27.0	0.3	2.2	2.5	10
Cloud Peak WA	II	Twin Island	<0.01	0.02	0.02	5	0.01	0.03	0.03	3	36.0	0.2	1.6	1.8	10
		Emerald	<0.01	0.03	0.03	5	0.04	0.07	0.10	3	53.3	1.7	4.2	5.9	10
Popo Agie WA	II	Florence	<0.01	0.03	0.03	5	0.04	0.07	0.11	3	32.7	3.1	7.2	10.4^b	10 ^b
		Lower Saddlebag	<0.01	0.01	0.01	5	0.01	0.02	0.04	3	55.5	1.0	2.6	3.6	10

Source: Argonne (2002)

Notes: **Alt 1** - Direct modeled **Wyoming PRB Oil and Gas Project EIS** Alternative 1 impacts.

Other - Direct modeled “Reasonably Foreseeable Development” impacts. The impact from all air pollutant emission sources not included in **Alt 1**, including projected surface coal mining in the Wyoming and Montana PRB the Montana Statewide EIS Alternative B/C/E sources. Potential impacts from Montana Alternatives A and D would be less.

Cum - Cumulative modeled impacts. Since these values represent the maximum cumulative impact at a specific location, they are the sum of the maximum direct **Alt 1** and **Other** impacts.

Thld - Impact threshold. Total sulfur and nitrogen thresholds from Fox, et al. (1989); acid neutralizing capacity thresholds from USFS (2000).

WA - Wilderness Area.

^a Since the background acid neutralizing capacity at Upper Frozen Lake is less than 25 µeq/L, the applicable significance threshold is less than a 1.0 µeq/L change. This threshold is exceeded by **Other** and **Cum** emission sources. However, the background concentration is based on only six samples taken on four days between 1997 and 2001.

^b Potential changes in acid neutralizing capacity is predicted to exceed the applicable significance level by less than one percent due to **Cum** emission sources.

Table AQ-7. Wyoming PRB Oil and Gas Project EIS Alternative 1 - Daily FLAG Refined Method - Visibility Impact Analysis (number of days \$1.0 dv per year).

Sensitive Location	PSD Classification	Alt 1	Other	Cum
Badlands WA	mandatory federal Class I	3	13 to 17	24 to 28
Bridger WA	mandatory federal Class I	4	7 to 9	10 to 12
Fitzpatrick WA	mandatory federal Class I	4	6 to 9	10 to 12
Gates of the Mountains WA	mandatory federal Class I	0	3 to 4	4 to 4
Grand Teton NP	mandatory federal Class I	1	3 to 5	6 to 8
North Absaroka WA	mandatory federal Class I	4	9 to 13	12 to 15
Red Rock Lakes WA	mandatory federal Class I	0	0 to 1	1 to 3
Scapegoat WA	mandatory federal Class I	0	2 to 2	3 to 3
Teton WA	mandatory federal Class I	3	6 to 9	10 to 11
Theodore Roosevelt NMP (N)	mandatory federal Class I	0	0 to 1	2 to 3
Theodore Roosevelt NMP (S)	mandatory federal Class I	1	1 to 3	4 to 7
U.L. Bend WA	mandatory federal Class I	1	4 to 5	6 to 8
Washakie WA	mandatory federal Class I	5	10 to 14	15 to 18
Wind Cave NP	mandatory federal Class I	4	17 to 21	28 to 32
Yellowstone NP	mandatory federal Class I	3	8 to 11	11 to 13
Fort Peck IR	Tribal designated Class I	0	1 to 3	2 to 5
Northern Cheyenne IR	Tribal designated Class I	17	27 to 82	42 to 92
Absaroka-Beartooth WA	federal Class II	4	28 to 32	30 to 33
Agate Fossil Beds NM	federal Class II	2	8 to 11	15 to 19
Bighorn Canyon NRA	federal Class II	9	17 to 30	23 to 34
Black Elk WA	federal Class II	4	17 to 20	26 to 31
Cloud Peak WA	federal Class II	13	17 to 30	30 to 39
Crow IR	federal Class II	20	59 to 108	69 to 116
Devils Tower NM	federal Class II	9	17 to 25	39 to 47
Fort Belknap IR	federal Class II	1	60 to 61	61 to 62
Fort Laramie NHS	federal Class II	2	10 to 14	17 to 20
Jewel Cave NM	federal Class II	4	19 to 23	32 to 36
Mount Rushmore NMem	federal Class II	3	13 to 17	22 to 26
Popo Agie WA	federal Class II	4	7 to 9	10 to 13
Soldier Creek WA	federal Class II	2	10 to 13	18 to 21
Source:	Argonne (2002)			
Notes:	<p>Alt 1 - Direct modeled Wyoming PRB Oil and Gas Project EIS Alternative 1 impacts.</p> <p>Other - Direct modeled "Reasonably Foreseeable Development" impacts. The impact from all air pollutant emission sources not included in Alt 1, including projected surface coal mining operations in the Montana and Wyoming PRB and the Montana Statewide EIS sources. The range of values corresponds to including Montana Alternative A (low) to Montana Alternative B/C/E (high).</p> <p>Cum - Cumulative modeled impacts. Since these values represent the maximum visibility impact anywhere within the sensitive location, they may not be a simple sum of the maximum direct Alt 1 and Other impacts, which can occur at different locations.</p>			
Locations:	<p>IR - Indian Reservation. NHS - National Historic Site. NM - National Monument</p> <p>NMP - National Memorial Park NMem - National Memorial. NP - National Park.</p> <p>NRA - National Recreation Area WA - Wilderness Area.</p>			

Table AQ-8. Wyoming PRB Oil and Gas Project EIS Alternative 2A - Predicted Criteria Pollutant Impacts and Applicable Significance Thresholds (in $\mu\text{g}/\text{m}^3$).

Pollutant	Avg Time ^a	Location	Increment	Alt 2A	Other	Cum	Background	Total	National	Wyoming
carbon monoxide	1-hour	near-field	- - -	158	142	197	3,500	3,697	40,000	40,000
		far-field ¹	- - -	4	100	100	3,500	3,600	40,000	40,000
	8-hours	near-field	- - -	93	124	132	1,500	1,632	10,000	10,000
		far-field ²	- - -	14	70	76	1,500	1,576	10,000	10,000
nitrogen dioxide	Annual	near-field	25	7.2	3.3	9.6	17	27	100	100
		far-field ³	25	0.4	5.1	5.4	17	22	100	100
		far-field ²	2.5	0.2	3.9 ^b	4.1 ^b	17	21	100	100
PM _{2.5}	24-hours	near-field	- - -	13.0	8.6	21.3	19	40	65	65
		far-field ³	- - -	4.5	9.7	14.0	19	33	65	65
	Annual	near-field	- - -	1.5	0.7	2.1	8	10	15	15
		far-field ³	- - -	0.2	1.1	1.2	8	9	15	15
PM ₁₀	24-hours	near-field	30	17.5	9.3	27.7	42	70	150	150
		far-field ⁴	30	0.4	29.7	29.7	42	72	150	150
		far-field ²	8	3.4	9.4 ^b	12.4 ^b	42	54	150	150
		far-field ⁵	8	1.8	7.0	8.8 ^b	42	51	150	150
	Annual	near-field	7	3.1	0.9	3.9	17	21	50	50
		far-field ⁴	17	<0.1	2.7	2.7	17	20	50	50
sulfur dioxide	3-hours	near-field	512	3.3	4.5	4.6	8	13	1,300	1,300
		far-field ³	512	0.7	17.1	17.1	8	25	1,300	1,300
	24-hours	near-field	91	1.7	1.8	3.2	8	11	365	260
		far-field ³	91	0.3	5.3	5.3	8	13	365	260
	Annual	near-field	20	0.5	0.2	0.6	3	4	80	60
		far-field ³	20	<0.1	0.4	0.4	3	3	80	60

Source: Argonne (2002)

Notes: ^a Annual impacts are the first maximum value; short-term impacts are the second maximum value.

^b It is possible that **Other** and **Cum** emission sources could exceed the PSD Class I increment on the Northern Cheyenne Indian Reservation, and that **Cum** emission sources could exceed the PSD Class I increment in the Washakie Wilderness Area; a regulatory "PSD Increment Consumption Analysis" should be conducted during permitting by the appropriate Air Quality Regulatory Agency.

Alt 2A - Direct modeled Wyoming PRB Oil and Gas Project EIS Alternative 2A impacts.

Other - Direct modeled "Reasonably Foreseeable Development" impacts. The impact from all air pollutant emission sources not included in **Alt 2A**, including projected surface coal mining operations in the Montana and Wyoming PRB and the Montana Statewide EIS Alternative B/C/E sources. Potential impacts from Montana Alternatives A and D would be less.

Cum - Cumulative modeled impacts. Since these values represent the maximum cumulative impact location, they may not be a simple sum of the maximum direct **Alt 2A** and **Other** impacts, which can occur at different locations.

Total - The sum of the cumulative modeled impact and the assumed background concentration.

National - Applicable National Ambient Air Quality Standard.

Wyoming - Applicable Wyoming Ambient Air Quality Standard.

Locations:

- ¹ Absaroka-Beartooth Wilderness Area
- ² Northern Cheyenne Indian Reservation
- ³ Crow Indian Reservation
- ⁴ Fort Belknap Indian Reservation
- ⁵ Washakie Wilderness Area

Table AQ-9. Wyoming PRB Oil and Gas Project EIS Alternative 2A - Predicted Atmospheric Deposition Impacts and Applicable Significance Thresholds.

Location	PSD Class	Lake	Total Sulfur Deposition (kg/ha-yr)				Total Nitrogen Deposition (kg/ha-yr)				Acid Neutralizing Capacity (percent)				
			Alt 2A	Other	Cum	Thld	Alt 2A	Other	Cum	Thld	Bkgd (µeq/l)	Alt 2A	Other	Cum	Thld
Bridger WA	I	Black Joe	<0.01	0.01	0.01	5	0.01	0.02	0.03	3	69.0	0.6	1.9	2.5	10
		Deep	<0.01	0.01	0.01	5	0.01	0.02	0.03	3	61.0	0.7	2.1	2.8	10
		Hobbs	<0.01	0.01	0.01	5	0.01	0.01	0.02	3	68.0	0.3	1.1	1.5	10
		Upper Frozen	<0.01	0.01	0.01	5	0.01	0.02	0.03	3	5.8 ^a	0.5 ^a	1.3^a	1.8^a	1^a
Fitzpatrick WA	I	Ross	<0.01	0.01	0.01	5	0.01	0.02	0.02	3	61.4	0.5	1.6	2.0	10
Absaroka-	II	Stepping Stone	<0.01	0.02	0.02	5	<0.01	0.03	0.03	3	27.0	0.3	2.2	2.5	10
Beartooth WA		Twin Island	<0.01	0.02	0.02	5	<0.01	0.03	0.03	3	36.0	0.2	1.6	1.8	10
Cloud Peak WA	II	Emerald	<0.01	0.03	0.03	5	0.03	0.07	0.10	3	53.3	1.5	4.2	5.7	10
		Florence	<0.01	0.03	0.03	5	0.03	0.07	0.10	3	32.7	2.8	7.2	10.0	10
Popo Agie WA	II	Lower Saddlebag	<0.01	0.01	0.01	5	0.01	0.02	0.03	3	55.5	0.9	2.6	3.5	10

Source: Argonne (2002)

Notes: **Alt 2A** - Direct modeled Wyoming PRB Oil and Gas Project EIS Alternative 2A impacts.

Other - Direct modeled “Reasonably Foreseeable Development” impacts. The impact from all air pollutant emission sources not included in **Alt 2A**, including projected surface coal mining operations in the Wyoming and Montana PRB and the Montana Statewide EIS Alternative B/C/E sources. Potential impacts from Montana Alternatives A and D would be less.

Cum - Cumulative modeled impacts. Since these values represent the maximum cumulative impact at a specific location, they are the sum of the maximum direct **Alt 2A** and **Other** impacts.

Thld - Impact threshold. Total sulfur and nitrogen thresholds from Fox, et al. (1989); acid neutralizing capacity thresholds from USFS (2000).

WA - Wilderness Area.

^a Since the background acid neutralizing capacity at Upper Frozen Lake is less than 25 µeq/l, the applicable significance threshold is less than a 1 µeq/L change. This threshold is exceeded by **Other** and **Cum** emission sources. However, the background concentration is based on only six samples taken on four days between 1997 and 2001.

Table AQ-10. Wyoming PRB Oil and Gas EIS Alternative 2A - Daily FLAG Refined Method - Visibility Impact Analysis (number of days \$1.0 dv per year)

Sensitive Location	PSD Classification	Alt 2A	Other	Cum
Badlands WA	mandatory federal Class I	3	13 to 17	24 to 27
Bridger WA	mandatory federal Class I	4	7 to 9	10 to 12
Fitzpatrick WA	mandatory federal Class I	3	6 to 9	9 to 12
Gates of the Mountains WA	mandatory federal Class I	0	3 to 4	4 to 4
Grand Teton NP	mandatory federal Class I	1	3 to 5	6 to 7
North Absaroka WA	mandatory federal Class I	3	9 to 13	12 to 14
Red Rock Lakes WA	mandatory federal Class I	0	0 to 1	1 to 3
Scapegoat WA	mandatory federal Class I	0	2 to 2	2 to 3
Teton WA	mandatory federal Class I	3	6 to 9	9 to 11
Theodore Roosevelt NMP (N)	mandatory federal Class I	0	0 to 1	2 to 3
Theodore Roosevelt NMP (S)	mandatory federal Class I	0	1 to 3	4 to 6
U.L. Bend WA	mandatory federal Class I	1	4 to 5	5 to 8
Washakie WA	mandatory federal Class I	4	10 to 14	14 to 18
Wind Cave NP	mandatory federal Class I	3	17 to 21	27 to 30
Yellowstone NP	mandatory federal Class I	2	8 to 11	11 to 13
Fort Peck IR	Tribal designated Class I	0	1 to 3	2 to 5
Northern Cheyenne IR	Tribal designated Class I	16	27 to 82	39 to 91
Absaroka-Beartooth WA	federal Class II	3	28 to 32	29 to 33
Agate Fossil Beds NM	federal Class II	1	8 to 11	14 to 17
Bighorn Canyon NRA	federal Class II	8	17 to 30	22 to 34
Black Elk WA	federal Class II	3	17 to 20	25 to 29
Cloud Peak WA	federal Class II	12	17 to 30	28 to 38
Crow IR	federal Class II	16	59 to 108	69 to 115
Devils Tower NM	federal Class II	6	17 to 25	36 to 44
Fort Belknap IR	federal Class II	1	60 to 61	61 to 61
Fort Laramie NHS	federal Class II	2	10 to 14	17 to 19
Jewel Cave NM	federal Class II	3	19 to 23	30 to 35
Mount Rushmore NMem	federal Class II	2	13 to 17	21 to 25
Popo Agie WA	federal Class II	3	7 to 9	10 to 12
Soldier Creek WA	federal Class II	1	10 to 13	17 to 21

Source: Argonne (2002)

Notes: **Alt 2A** - Direct modeled Wyoming PRB Oil and Gas Project EIS Alternative 2A impacts.

Other - Direct modeled “Reasonably Foreseeable Development” impacts. The impact from all air pollutant emission sources not included in Wyoming PRB Oil and Gas Project EIS **Alt 2A**, including projected surface coal mining operations in the Wyoming and Montana PRB and the Montana Statewide EIS sources. The range of values corresponds to including Montana Alternative A (low) to Montana Alternative B/C/E (high).

Cum - Cumulative modeled impacts. Since these values represent the maximum visibility impact anywhere within the sensitive location, they may not be a simple sum of the maximum direct **Alt 2A** and **Other** impacts, which can occur at different locations.

Locations: **IR** - Indian Reservation **NHS** - National Historic Site **NM** - National Monument
NMP - National Memorial Park **NMem** - National Memorial. **NP** - National Park.
NRA - National Recreation Area **WA** - Wilderness Area.

Table AQ-11. Wyoming PRB Oil and Gas Project EIS Alternative 2B - Predicted Criteria Pollutant Impacts and Applicable Significance Thresholds (in $\mu\text{g}/\text{m}^3$).

Pollutant	Avg Time ^a	Location	Increment	Alt 2B	Other	Cum	Background	Total	National	Wyoming
carbon monoxide	1-hour	near-field	- - -	157	142	170	3,500	3,670	40,000	40,000
		far-field ¹	- - -	3	100	100	3,500	3,600	40,000	40,000
	8-hours	near-field	- - -	77	124	124	1,500	1,624	10,000	10,000
		far-field ²	- - -	9	70	74	1,500	1,574	10,000	10,000
nitrogen dioxide	Annual	near-field	25	6.3	3.3	8.8	17	26	100	100
		far-field ³	25	0.3	5.1	5.3	17	22	100	100
		far-field ²	2.5	0.2	3.9 ^b	4.1 ^b	17	21	100	100
PM_{2.5}	24-hours	near-field	- - -	10.7	8.6	19.0	19	38	65	65
		far-field ³	- - -	3.8	9.7	13.4	19	32	65	65
	Annual	near-field	- - -	1.3	0.7	2.0	8	10	15	15
		far-field ³	- - -	0.1	1.1	1.2	8	9	15	15
PM₁₀	24-hours	near-field	30	15.2	9.3	25.5	42	67	150	150
		far-field ⁴	30	0.4	29.7	29.7	42	72	150	150
		far-field ²	8 ^b	3.0	9.4 ^b	12.1 ^b	42	54	150	150
		far-field ⁵	8	1.5	7.0	8.5 ^b	42	50	150	150
	Annual	near-field	17	2.9	0.9	3.7	17	21	50	50
		far-field ⁴	17	<0.1	2.7	2.7	17	20	50	50
sulfur dioxide	3-hours	near-field	512	3.3	4.5	4.6	8	13	1,300	1,300
		far-field ³	512	0.7	17.1	17.1	8	25	1,300	1,300
	24-hours	near-field	91	1.7	1.8	3.2	8	11	365	260
		far-field ³	91	0.3	5.3	5.3	8	13	365	260
	Annual	near-field	20	0.5	0.2	0.6	3	4	80	60
		far-field ³	20	<0.1	0.4	0.4	3	3	80	60

Source: Argonne (2002)

Notes: ^a Annual impacts are the first maximum value; short-term impacts are the second maximum value.

^b It is possible that **Other** and **Cum** emission sources could exceed the PSD Class I increment on the Northern Cheyenne Indian Reservation, and that **Cum** emission sources could exceed the PSD Class I increment in the Washakie Wilderness Area; a regulatory "PSD Increment Consumption Analysis" should be conducted during permitting by the appropriate Air Quality Regulatory Agency.

Alt 2B - Direct modeled Wyoming PRB Oil and Gas Project EIS Alternative 2B impacts.

Other - Direct modeled "Reasonably Foreseeable Development" impacts. The impact from all air pollutant emission sources not included in **Alt 2B**, including projected surface coal mining operations in the Wyoming and Montana PRB and the Montana Statewide EIS Alternative B/C/E sources. Potential impacts from Montana Alternatives A and D would be less.

Cum - Cumulative modeled impacts. Since these values represent the maximum cumulative impact location, they may not be a simple sum of the maximum direct **Alt 2B** and **Other** impacts, which can occur at different locations.

Total - The sum of the cumulative modeled impact and the assumed background concentration.

National - Applicable National Ambient Air Quality Standard.

Wyoming - Applicable Wyoming Ambient Air Quality Standard.

Locations:

¹ Absaroka-Beartooth Wilderness Area

² Northern Cheyenne Indian Reservation

³ Crow Indian Reservation

⁴ Fort Belknap Indian Reservation

⁵ Washakie Wilderness Area

Table AQ-12. Wyoming PRB Oil and Gas Project EIS Alternative 2B - Predicted Atmospheric Deposition Impacts and Applicable Significance Thresholds.

Location	PSD Class	Lake	Total Sulfur Deposition (kg/ha-yr)				Total Nitrogen Deposition (kg/ha-yr)				Acid Neutralizing Capacity (percent)				
			Alt 2B	Other	Cum	Thld	Alt 2B	Other	Cum	Thld	Bkgd (µeq/l)	Alt 2B	Other	Cum	Thld
Bridger WA	I	Black Joe	<0.01	0.01	0.01	5	0.01	0.02	0.03	3	69.0	0.6	1.9	2.4	10
		Deep	<0.01	0.01	0.01	5	0.01	0.02	0.03	3	61.0	0.6	2.1	2.7	10
		Hobbs	<0.01	0.01	0.01	5	<0.01	0.01	0.02	3	68.0	0.3	1.1	1.4	10
		Upper Frozen	<0.01	0.01	0.01	5	0.01	0.02	0.03	3	5.8 ^a	0.4 ^a	1.3^a	1.7^a	1^a
Fitzpatrick WA	I	Ross	<0.01	0.01	0.01	5	0.01	0.02	0.02	3	61.4	0.4	1.6	2.0	10
Absaroka-Beartooth WA	II	Stepping Stone	<0.01	0.02	0.02	5	<0.01	0.03	0.03	3	27.0	0.2	2.2	2.5	10
		Twin Island	<0.01	0.02	0.02	5	<0.01	0.03	0.03	3	36.0	0.2	1.6	1.8	10
Cloud Peak WA	II	Emerald	<0.01	0.03	0.03	5	0.03	0.07	0.10	3	53.3	1.3	4.2	5.5	10
		Florence	<0.01	0.03	0.03	5	0.03	0.07	0.10	3	32.7	2.5	7.2	9.7	10
Popo Agie WA	II	Lower Saddlebag	<0.01	0.01	0.01	5	0.01	0.02	0.03	3	55.5	0.8	2.6	3.4	10

Source: Argonne (2002)

Notes: **Alt 2B** - Direct modeled Wyoming PRB Oil and Gas Project EIS Alternative 2B impacts.

Other - Direct modeled "Reasonably Foreseeable Development" impacts. The impact from all air pollutant emission sources not included in **Alt 2B**, including projected surface coal mining operations in the Wyoming and Montana PRB and the Montana Statewide EIS Alternative B/C/E sources. Potential impacts from Montana Alternatives A and D would be less.

Cum - Cumulative modeled impacts. Since these values represent the maximum cumulative impact at a specific location, they are the sum of the maximum direct **Alt 2B** and **Other** impacts.

Thld - Impact threshold. Total sulfur and nitrogen thresholds from Fox, et al. (1989); acid neutralizing capacity thresholds from USFS (2000).

WA- Wilderness Area.

^a Since the background acid neutralizing capacity at Upper Frozen Lake is less than 25 µeq/l, the applicable significance threshold is less than a 1 µeq/l change. This threshold is exceeded by **Other** sources alone, as well **Cum** sources. However, the background concentration is based on only six samples taken on four days between 1997 and 2001.

Table AQ-13. Wyoming PRB Oil and Gas Project EIS Alternative 2B - Daily FLAG Refined Method - Visibility Impact Analysis (number of days \$1.0 dv per year).

Sensitive Location	PSD Classification	Alt 2B	Other	Cum
Badlands WA	mandatory federal Class I	1	13 to 17	22 to 26
Bridger WA	mandatory federal Class I	3	7 to 9	9 to 11
Fitzpatrick WA	mandatory federal Class I	3	6 to 9	9 to 11
Gates of the Mountains WA	mandatory federal Class I	0	3 to 4	4 to 4
Grand Teton NP	mandatory federal Class I	0	3 to 5	5 to 7
North Absaroka WA	mandatory federal Class I	2	9 to 13	12 to 14
Red Rock Lakes WA	mandatory federal Class I	0	0 to 1	1 to 2
Scapegoat WA	mandatory federal Class I	0	2 to 2	2 to 3
Teton WA	mandatory federal Class I	2	6 to 9	9 to 11
Theodore Roosevelt NMP (N)	mandatory federal Class I	0	0 to 1	1 to 3
Theodore Roosevelt NMP (S)	mandatory federal Class I	0	1 to 3	3 to 6
U.L. Bend WA	mandatory federal Class I	1	4 to 5	5 to 7
Washakie WA	mandatory federal Class I	4	10 to 14	14 to 17
Wind Cave NP	mandatory federal Class I	2	17 to 21	25 to 28
Yellowstone NP	mandatory federal Class I	1	8 to 11	11 to 13
Fort Peck IR	Tribal designated Class I	0	1 to 3	2 to 4
Northern Cheyenne IR	Tribal designated Class I	14	27 to 82	38 to 90
Absaroka-Beartooth WA	federal Class II	3	28 to 32	29 to 33
Agate Fossil Beds NM	federal Class II	0	8 to 11	3 to 16
Bighorn Canyon NRA	federal Class II	7	17 to 30	21 to 33
Black Elk WA	federal Class II	2	17 to 20	24 to 28
Cloud Peak WA	federal Class II	9	17 to 30	27 to 37
Crow IR	federal Class II	14	59 to 108	68 to 115
Devils Tower NM	federal Class II	5	17 to 25	34 to 42
Fort Belknap IR	federal Class II	1	60 to 61	61 to 61
Fort Laramie NHS	federal Class II	1	10 to 14	16 to 19
Jewel Cave NM	federal Class II	2	19 to 23	29 to 33
Mount Rushmore NMem	federal Class II	1	13 to 17	21 to 24
Popo Agie WA	federal Class II	3	7 to 9	10 to 12
Soldier Creek WA	federal Class II	1	10 to 13	16 to 20

Source: Argonne (2002)

Notes: **Alt 2B** - Direct modeled Wyoming PRB Oil and Gas EIS Alternative 2B impacts.

Other- Direct modeled “Reasonably Foreseeable Development” impacts. The impact from all air pollutant emission sources not included in **Alt 2B**, including projected surface coal mining operations in the Wyoming and Montana PRB and the Montana Statewide EIS sources. The range of values corresponds to including Montana Alternative A (low) to Montana Alternative B/C/E (high).

Cum - Cumulative modeled impacts. Since these values represent the maximum visibility impact anywhere within the sensitive location, they may not be a simple sum of the maximum direct **Alt 2B** and **Other** impacts, which can occur at different locations.

Locations: **IR** - Indian Reservation. **NHS** - National Historic Site. **NM** - National Monument
NMP - National Memorial Park **NMem** - National Memorial. **NP** - National Park.
NRA - National Recreation Area **WA** - Wilderness Area.

Table AQ-14. Wyoming PRB Oil and Gas Project EIS Alternative 3 - Predicted Criteria Pollutant Impacts and Applicable Significance Thresholds (in $\mu\text{g}/\text{m}^3$).

Pollutant	Avg Time ^a	Location	Increment	Alt 3	Other	Cum	Background	Total	National	Wyoming
carbon monoxide	1-hour	near-field	- - -	261	142	261	3,500	3,761	40,000	40,000
		far-field ¹	- - -	2	100	100	3,500	3,600	40,000	40,000
	8-hours	near-field	- - -	183	124	183	1,500	1,683	10,000	10,000
		far-field ²	- - -	8	70	75	1,500	1,575	10,000	10,000
nitrogen dioxide	Annual	near-field	25	3.0	3.3	5.8	17	23	100	100
		far-field ³	25	0.3	5.1	5.3	17	22	100	100
		far-field ²	2.5	0.1	3.9 ^b	4.1 ^b	17	21	100	100
PM _{2.5}	24-hours	near-field	- - -	5.7	8.6	13.5	19	32	65	65
		far-field ⁴	- - -	0.2	12.7	12.7	19	32	65	65
	Annual	near-field	- - -	0.7	0.7	1.3	8	9	15	15
		far-field ⁴	- - -	0.0	1.2	1.2	8	9	15	15
PM ₁₀	24-hours	near-field	30	7.1	9.3	15.6	42	58	150	150
		far-field ⁴	30	0.2	29.7	29.7	42	72	150	150
		far-field ²	8	1.5	9.4 ^b	10.7 ^b	42	53	150	150
		far-field ⁵	8	0.9	7.0	7.8	42	50	150	150
	Annual	near-field	17	1.2	0.9	1.9	17	19	50	50
		far-field ⁴	7	<0.1	2.7	2.7	17	20	50	50
sulfur dioxide	3-hours	near-field	512	1.2	4.5	4.6	8	13	1,300	1,300
		far-field ³	512	0.3	17.1	17.1	8	25	1,300	1,300
	24-hours	near-field	91	0.6	1.8	2.2	8	10	365	260
		far-field ³	91	0.1	5.3	5.3	8	13	365	260
	Annual	near-field	20	0.2	0.2	0.3	3	3	80	60
		far-field ³	20	<0.1	0.4	0.4	3	3	80	60

Source: Argonne (2002)

Notes: ^a Annual impacts are the first maximum value; short-term impacts are the second maximum value.

^b It is possible that **Other** and **Cum** emission sources could exceed the PSD Class I increment on the Northern Cheyenne Indian Reservation; a regulatory "PSD Increment Consumption Analysis" should be conducted during permitting by the appropriate Air Quality Regulatory Agency.

Alt 3 - Direct modeled Wyoming PRB Oil and Gas Project EIS Alternative 3 impacts.

Other - Direct modeled "Reasonably Foreseeable Development" impacts. The impact from all air pollutant emission sources not included in **Alt 3**, including projected surface coal mining operations in the Wyoming and Montana PRB and the Montana Statewide EIS Alternative B/C/E sources. Potential impacts from Montana Alternatives A and D would be less.

Cum - Cumulative modeled impacts. Since these values represent the maximum cumulative impact location, they may not be a simple sum of the maximum direct **Alt 3** and **Other** impacts, which can occur at different locations.

Total - The sum of the cumulative modeled impact and the assumed background concentration.

National - Applicable National Ambient Air Quality Standard.

Wyoming - Applicable Wyoming Ambient Air Quality Standard.

Locations:

¹ Absaroka-Beartooth Wilderness Area

² Northern Cheyenne Indian Reservation

³ Crow Indian Reservation

⁴ Fort Belknap Indian Reservation

⁵ Washakie Wilderness Area

Table AQ-15. Wyoming PRB Oil and Gas Project EIS Alternative 3 - Predicted Atmospheric Deposition Impacts and Applicable Significance Thresholds.

			Total Sulfur Deposition (kg/ha-yr)				Total Nitrogen Deposition (kg/ha-yr)				Acid Neutralizing Capacity (percent)				
Location	PSD Class	Lake	Alt 3	Other	Cum	Thld	Alt 3	Other	Cum	Thld	Bkgd (µeq/l)	Alt 3	Other	Cum	Thld
Bridger WA	I	Black Joe	<0.01	0.01	0.01	5	<0.01	0.02	0.03	3	69.0	0.3	1.9	2.1	10
		Deep	<0.01	0.01	0.01	5	<0.01	0.02	0.02	3	61.0	0.3	2.1	2.4	10
		Hobbs	<0.01	0.01	0.01	5	<0.01	0.01	0.02	3	68.0	0.2	1.1	1.3	10
		Upper Frozen	<0.01	0.01	0.01	5	<0.01	0.02	0.02	3	5.8 ^a	0.2 ^a	1.3 ^a	1.5 ^a	1 ^a
Fitzpatrick WA	I	Ross	<0.01	0.01	0.01	5	<0.01	0.02	0.02	3	61.4	0.2	1.6	1.7	10
Absaroka-Beartooth WA	II	Stepping Stone	<0.01	0.02	0.02	5	<0.01	0.03	0.03	3	27.0	0.1	2.2	2.4	10
		Twin Island	<0.01	0.02	0.02	5	<0.01	0.03	0.03	3	36.0	0.1	1.6	1.7	10
Cloud Peak WA	II	Emerald	<0.01	0.03	0.03	5	0.01	0.07	0.08	3	53.3	0.7	4.2	4.9	10
		Florence	<0.01	0.03	0.03	5	0.02	0.07	0.08	3	32.7	1.3	7.2	8.5	10
Popo Agie WA	II	Lower Saddlebag	<0.01	0.01	0.01	5	<0.01	0.02	0.03	3	55.5	0.4	2.6	3.0	10

Source: Argonne (2002)

Notes: **Alt 3** - Direct modeled Wyoming PRB Oil and Gas Project EIS Alternative 3 impacts.

Other - Direct modeled “Reasonably Foreseeable Development” impacts. The impact from all air pollutant emission sources not included in **Alt 3**, including projected surface coal mining operations in the Wyoming and Montana PRB and the Montana Statewide EIS Alternative B/C/E sources. Potential impacts from Montana Alternatives A and D would be less.

Cum - Cumulative modeled impacts. Since these values represent the maximum cumulative impact at a specific location, they are the sum of the maximum direct **Alt 3** and **Other** impacts.

Thld - Impact threshold. Total sulfur and nitrogen thresholds from Fox, et al. (1989); acid neutralizing capacity thresholds from USFS (2000).

WA - Wilderness Area.

^a Since the background acid neutralizing capacity at Upper Frozen Lake is less than 25 µeq/L, the applicable significance threshold is less than a 1 µeq/L change. This threshold is exceeded by **Other** sources alone, as well **Cum** sources. However, the background concentration is based on only six samples taken on four days between 1997 and 2001.

Table AQ-16. Wyoming PRB Oil and Gas Project EIS Alternative 3 - Daily FLAG Refined Method - Visibility Impact Analysis (number of days \$1.0 dv per year).

Sensitive Location	PSD Classification	Alt 3	Other	Cum
Badlands WA	mandatory federal Class I	0	13 to 17	18 to 21
Bridger WA	mandatory federal Class I	1	7 to 9	8 to 10
Fitzpatrick WA	mandatory federal Class I	1	6 to 9	8 to 10
Gates of the Mountains WA	mandatory federal Class I	0	3 to 4	3 to 4
Grand Teton NP	mandatory federal Class I	0	3 to 5	4 to 6
North Absaroka WA	mandatory federal Class I	0	9 to 13	11 to 13
Red Rock Lakes WA	mandatory federal Class I	0	0 to 1	0 to 2
Scapegoat WA	mandatory federal Class I	0	2 to 2	2 to 3
Teton WA	mandatory federal Class I	0	6 to 9	7 to 10
Theodore Roosevelt NMP (N)	mandatory federal Class I	0	0 to 1	1 to 2
Theodore Roosevelt NMP (S)	mandatory federal Class I	0	1 to 3	2 to 4
U.L. Bend WA	mandatory federal Class I	0	4 to 5	5 to 6
Washakie WA	mandatory federal Class I	1	10 to 14	12 to 16
Wind Cave NP	mandatory federal Class I	0	17 to 21	22 to 25
Yellowstone NP	mandatory federal Class I	0	8 to 11	9 to 12
Fort Peck IR	Tribal designated Class I	0	1 to 3	2 to 4
Northern Cheyenne IR	Tribal designated Class I	7	27 to 82	33 to 87
Absaroka-Beartooth WA	federal Class II	0	28 to 32	28 to 32
Agate Fossil Beds NM	federal Class II	0	8 to 11	10 to 14
Bighorn Canyon NRA	federal Class II	3	17 to 30	19 to 32
Black Elk WA	federal Class II	0	17 to 20	20 to 24
Cloud Peak WA	federal Class II	3	17 to 30	23 to 35
Crow IR	federal Class II	10	59 to 108	65 to 113
Devils Tower NM	federal Class II	1	17 to 25	26 to 34
Fort Belknap IR	federal Class II	0	60 to 61	61 to 61
Fort Laramie NHS	federal Class II	0	10 to 14	13 to 16
Jewel Cave NM	federal Class II	0	19 to 23	24 to 28
Mount Rushmore NMem	federal Class II	0	13 to 17	17 to 20
Popo Agie WA	federal Class II	1	7 to 9	8 to 11
Soldier Creek WA	federal Class II	0	10 to 13	13 to 16

Source: Argonne (2002)

Notes: **Alt 3** - Direct modeled Wyoming PRB Oil and Gas Project EIS Alternative 3 impacts.

Other - Direct modeled "Reasonably Foreseeable Development" impacts. The impact from all air pollutant emission sources not included in **Alt 3**, including projected surface coal mining operations in the Wyoming and Montana PRB and the Montana Statewide EIS sources. The range of values corresponds to including Montana Alternative A (low) to Montana Alternative B/C/E (high).

Cum - Cumulative modeled impacts. Since these values represent the maximum visibility impact anywhere within the sensitive location, they may not be a simple sum of the maximum direct **Alt 3** and **Other** impacts, which can occur at different locations.

Locations: **IR** - Indian Reservation. **NHS** - National Historic Site. **NM** - National

Monument

NMP - National Memorial Park **NMem** - National Memorial.

NP - National Park.

NRA - National Recreation Area **WA** - Wilderness Area.

Table AQ-17. Predicted Visibility Impacts in Class I Areas - Daily FLAG Refined Method (Maximum cumulative deciview change).

Class I area	Alt 1	Alt 2	Alt 2b	Alt 3
Badlands Wilderness Area ¹	10.91	10.67	10.43	9.46
Bridger Wilderness Area	13.28	12.67	12.21	11.15
Fitzpatrick Wilderness Area	16.57	15.83	15.21	14.01
Gates of the Mtns Wilderness Area	14.99	14.61	14.22	13.17
Grand Teton National Park	6.95	6.67	6.44	5.8
North Absaroka Wilderness Area	14.89	14.12	13.51	12.21
Red Rock Lakes Wilderness Area	2.85	2.75	2.67	2.37
Scapegoat Wilderness Area	9.89	9.58	9.35	8.55
Teton Wilderness Area	14.59	13.97	13.46	12.38
Theodore Roosevelt NMP ² (North Unit)	3.65	3.46	3.29	2.75
Theodore Roosevelt NMP ² (South Unit)	4.62	4.37	4.14	3.51
U.L. Bend Wilderness Area	29.05	27.97	26.97	24.01
Washakie Wilderness Area	24.79	23.82	22.96	21.48
Wind Cave National Park	9.05	8.81	8.59	8.06
Yellowstone National Park	12.79	12.19	11.59	10.25
Northern Cheyenne Reservation ³	54.75	52.8	50.71	45.02

Mitigation Options

Mitigation may be applied to fugitive dust and nitrogen oxide (NO_x) impacts. Fugitive dust refers to any particulate matter that is not deliberately emitted by a well-defined source. Fugitive dust sources typically include windblown dust from unvegetated lands and unpaved roads. Table AQ-18 shows several fugitive dust mitigation options available. Other mitigation measures that are utilized by surface coal mines in Wyoming to control fugitive dust emissions are listed in Section 3.5.4

Nitrogen oxide emissions are associated with combustion. Table AQ-19 shows several options available to mitigate NO_x impacts related to production of oil and gas, including CBM. Mitigation measures that the mines have instituted or that WDEQ may require related to coal mining operations are listed in Section 3.5.5.

Table AQ-18. Fugitive Dust Mitigation Measures (PM₁₀), Effectiveness and Cost.

	Dust Sources					
	Disturbed Areas	Unpaved Roads¹				
Mitigation Options	Establish plant cover for all disturbed lands by certain time (re-vegetation)	Water roads to attain certain percent moisture ²	Apply soil stabilizer	Set and enforce speed limit	Gravel roads	Pave road
Effectiveness	Level proportional to percentage of land cover	0 - 50 percent reduction in uncontrolled dust emissions	33 to 100 percent control efficiency	80 percent for 15 mph ³ 65 percent for 20 mph ³ 25 percent for 30 mph ³	30 percent reduction	90 percent reduction
Estimated Cost		\$4000/mile	\$2,000 to \$4,000/mile per year	Unknown	\$9,000/mile	\$11,000 to \$60,000/mile

Notes: ¹ Improved and County roads.

² Wetting of construction roads during the construction period. Wetting of construction roads not required for once a month maintenance trips to well pads.

³ Reductions assume 40 mile per hour base speed.

Table AQ-19. Nitrogen Oxides (NO_x) Mitigation Measures Efficiency.

	NO_x Emissions Sources			
	Field Compressors	Sales Compressors	Temporary Diesel Generators¹	
Mitigation Options/Efficiency	Implement Best Available Control Technology Typically results in a NO _x emission rate of about 1 g/bhp-hr	Implement Best Available Control Technology Typically results in a NO _x emission rate of about 1 g/bhp-hr	Register with State; WDEQ regulate as appropriate	Voluntary use of diesel engines

Notes: ¹ Wyoming is currently registering these generators to determine if NO_x emissions are significant.

² BACT could include electric compression.

APPENDIX F

NON-MINE GROUNDWATER AND
SURFACE WATER RIGHTS WITHIN AND
ADJACENT TO THE NARO NORTH, NARO SOUTH
LITTLE THUNDER, WEST ROUNDUP AND WEST ANTELOPE
LBA TRACTS

GROUNDWATER RIGHTS FOR NARO NORTH LBA TRACT											
Permit No.	Priority	Tns	Rng	Sec	qg	Applicant	Facility Name	Status	Uses	Yld Act	T.D.
P8998P	06/07/68	41	70	2	SWSE	USFS	TECKLA #T B 133		STO	4	395
P25607P	01/14/74	41	70	6	NWSE	PAUL & EDITH RUTH WILKINSON	WILKINSON #3		STO	4	805
P2314W	07/18/51	41	70	9	SWNW	JOHN C. DILTS, JR.	DILTS #21		STO	4	700
P62724W	12/01/82	41	70	12	NWNE	PHILLIPS PETROLEUM COMPANY	ENL OF MORGAN RIKER #1	CAN	MIS	50	1820
P80718W	08/28/89	41	70	12	NWNE	PHILLIPS PETROLEUM COMPANY	MORGAN RIKER #1	CAN	MIS	150	1820
P61524W	07/29/82	41	70	12	NWNE	PHILLIPS PETROLEUM COMPANY	MORGAN RIKER #1	CAN	MIS	100	1820
P86949W	12/30/91	41	70	12	NWNE	USFS	MORGAN RIKER #TB 250	CAN	STO		
P33290W	05/17/76	41	70	18	SENW	USFS	BELL #T B 199 (DEEPENED)		STO	10	644
P108419W	12/16/97	41	71	1	NWSW	REDSTONE RESOURCES, INC	FEDERAL 13AC-111	UNA	STO,MIS,CBM		
P71738W	01/14/86	41	71	1	SWNW	USFS	WILKINSON SPRING TB #55	UNA	STO		
P57759W	07/07/81	41	71	2	NENE	VALENTINE CONSTRUCTION, INC.	THUNDER CREEK #1	CAN	MIS	80	480
P95332W	02/12/86	41	71	2	NENE	FRANCES PUTNAM	JINX #3	UNA	DOM,STO	20	480
P95333W	07/30/81	41	71	2	NENE	FRANCES PUTNAM	JINX #2	UNA	DOM,STO	6	360
P57757W	07/30/81	41	71	2	SENE	HARRY G. PUTNAM	JINX #1	CAN	STO,DOM		
P95331W	02/12/86	41	71	2	SENE	HARRY G. PUTNAM	JINX #1	CAN	DOM,STO		
P12754P	12/30/51	41	71	3	NESW	USFS	MATHESON #TB 42		STO	4	122
P44330W	07/20/78	41	71	3	NWSE	USFS	MARG #5		STO	3	163
P108190W	12/04/97	41	71	8	SWNE	JERRY DILTS** KEY PRODUCTION CO. INC.	SAPELO #1	UNA	STO,MIS	80	780
P70729W	07/23/85	41	71	10	SESW	JERRY DILTS	BRIDLE BIT RANCH #3	ABA	STO	0	270
P58121W	05/18/81	41	71	11	NENE	BIG HORN FRACTIONATION	B H FRAC #1		MIS	25	396
P67807W	06/27/84	41	71	13	NWNW	USFS	WILKINSON SPRING #T B 39		STO	0.5	8
P44331W	07/20/78	41	71	14	SESE	USFS	MARG #6		STO	3	605
P129458W	09/18/00	41	71	2	NENE	INDEPENDENT PRODUCTION CO., INC.	SEARCHLIGHT #41-2	UNA	STO,CBM		
P129461W	09/18/00	41	71	2	NESE	INDEPENDENT PRODUCTION CO., INC.	SEARCHLIGHT #43-2	UNA	STO,CBM		
P129452W	09/18/00	41	71	2	NWNE	INDEPENDENT PRODUCTION CO., INC.	SEARCHLIGHT #31-2	UNA	STO,CBM		
P129447W	09/18/00	41	71	2	NWSE	INDEPENDENT PRODUCTION CO., INC.	SEARCHLIGHT #33-2	UNA	STO,CBM		
P129460W	09/18/00	41	71	2	SENE	INDEPENDENT PRODUCTION CO., INC.	SEARCHLIGHT #42-2	UNA	STO,CBM		
P129455W	09/18/00	41	71	2	SESE	INDEPENDENT PRODUCTION CO., INC.	SEARCHLIGHT #44-2	UNA	STO,CBM		
P129454W	09/18/00	41	71	2	SWNE	INDEPENDENT PRODUCTION CO., INC.	SEARCHLIGHT #32-2	UNA	STO,CBM		
P129456W	09/18/00	41	71	2	SWSE	INDEPENDENT PRODUCTION CO., INC.	SEARCHLIGHT #34-2	UNA	STO,CBM		
P129457W	09/18/00	41	71	11	NENE	INDEPENDENT PRODUCTION CO., INC.	SEARCHLIGHT #41-11	UNA	STO,CBM		
P129449W	09/18/00	41	71	11	NENW	INDEPENDENT PRODUCTION CO., INC.	SEARCHLIGHT #21-11	UNA	STO,CBM		
P129451W	09/18/00	41	71	11	NWNE	INDEPENDENT PRODUCTION CO., INC.	SEARCHLIGHT #31-11	UNA	STO,CBM		
P129453W	09/18/00	41	71	11	NWNW	INDEPENDENT PRODUCTION CO., INC.	SEARCHLIGHT #11-11	UNA	STO,CBM		
P129459W	09/18/00	41	71	11	SENE	INDEPENDENT PRODUCTION CO., INC.	SEARCHLIGHT #42-11	UNA	STO,CBM		
P129450W	09/18/00	41	71	11	SENW	INDEPENDENT PRODUCTION CO., INC.	SEARCHLIGHT #22-11	UNA	STO,CBM		
P129462W	09/18/00	41	71	11	SWNE	INDEPENDENT PRODUCTION CO., INC.	SEARCHLIGHT #32-11	UNA	STO,CBM		
P129448W	09/18/00	41	71	11	SWNW	INDEPENDENT PRODUCTION CO., INC.	SEARCHLIGHT #12-11	UNA	STO,CBM		
P123124W	02/07/00	41	71	15	NESW	BARRETT RESOURCES CORP.	MATHESON 23-15-4171	UNA	CBM		
P109370W	03/25/98	41	71	17	NESW	W.S.B.L.C.** YATES PETROLEUM CORP.	SAPELO FEDERAL #1	A&C	STO,MIS,CBM		
P5865P	08/31/66	42	70	7	SENE	RENO LIVESTOCK CORP.**NAN HENDERSON	HEARTSPEAR 11		STO	1.5	75
P69514W	03/04/85	42	70	8	SESE	USFS	SHELL #TB 259	CAN	STO		
P78847W	01/03/89	42	70	8	SESE	USFS	TB 259	UNA	STO		
P50557W	10/31/79	42	70	9	NWSE	SHELL OIL COMPANY	9-10		MON,MIS	0	390
P49894W	09/19/79	42	70	9	SWSE	SHELL OIL COMPANY	9-15	A&C	MON,MIS	0	440
P49896W	09/19/79	42	70	10	NENW	SHELL OIL COMPANY	10-3		MON,MIS	0	360

GROUNDWATER RIGHTS FOR NARO NORTH LBA TRACT											
Permit No.	Priority	Tns	Rng	Sec	qg	Applicant	Facility Name	Status	Uses	Yld Act	T.D.
P50249W	10/04/79	42	70	10	NWSE	SHELL OIL COMPANY	10-10		MON,MIS	0	320
P49897W	09/19/79	42	70	10	NWSW	SHELL OIL COMPANY	10-12		MON,MIS	0	420
P49898W	09/19/79	42	70	10	NWSW	SHELL OIL COMPANY	11-5	ABA & CAN	MON	0	280
P54783W	11/20/80	42	70	11	NWNW	CABALLO ROJO INC.			MON,MIS	0	335
P50250W	10/04/79	42	70	11	NWNW	SHELL OIL COMPANY	11-4		MON,MIS	0	260
P49900W	09/19/79	42	70	11	SENW	SHELL OIL COMPANY	11-6	A&C	MON,MIS	0	197
P49899W	09/19/79	42	70	11	SENW	SHELL OIL COMPANY	11-6	A&C	MON,MIS	0	200
P8894W	04/23/71	42	70	11	SWNE	RENO LIVESTOCK CORPORATION	HEARTSPEAR 19	ADJ	STO	25	80
P49891W	09/19/79	42	70	14	NWNE	SHELL OIL COMPANY	14-2	UNA	MON,MIS	0	300
P50251W	10/04/79	42	70	14	NWNW	SHELL OIL COMPANY	14-4		MON,MIS	0	340
P49895W	09/19/79	42	70	15	NENW	SHELL OIL COMPANY	15-3		MON,MIS	0	400
P50555W	10/31/79	42	70	15	SENE	SHELL OIL COMPANY	15-8		MON,MIS	0	320
P50556W	10/31/79	42	70	15	SWNW	SHELL OIL COMPANY	15-5		MON,MIS	0	420
P10798W	10/27/71	42	70	15	SWNW	JOE D. BANKS		CAN	IND	72.5	590
P8951P	03/20/61	42	70	15	SWSW	USFS	RENO #T B 52		STO	4	435
P8981P	08/02/66	42	70	18	NWSE	USFS	WILKINSON #T B 107		STO	4	110
P25605P	01/14/74	42	70	19	NESW	PAUL & EDITH RUTH WILKINSON	WILKINSON #1		STO,DOM	5	12
P42620W	03/10/78	42	70	21	SESE	USFS	SEAM MONITOR WELL #23		MON,MIS	0	200
P40092W	08/22/77	42	70	21	SWSE	USFS	SEAM MONITORING WELL #1-D		MON,MIS	0	255
P40093W	08/22/77	42	70	21	SWSE	USFS	SEAM MONITORING WELL #1-F		MON,MIS	0	200
P42617W	03/10/78	42	70	21	SWSW	USFS	SEAM MONITOR WELL #20	CAN	MIS		
P67797W	06/26/84	42	70	23	NESE	USFS	RENO SPRING #T B 17		STO	1	8
P12746P	12/30/50	42	70	25	NESW	USFS	EDWARDS #TB 32		STO	4	98
P8960P	07/31/64	42	70	26	SWSW	USFS	EDWARDS #T B 84		STO	4	464
P39795W	07/29/77	42	70	27	NWNE	USFS	USFS MONITOR WELL #1		MON,MIS	0	165
P42632W	03/10/78	42	70	27	SESE	USFS	SEAM MONITOR WELL #35		MON,MIS	0	35
P40097W	08/22/77	42	70	27	SESE	USFS	SEAM MONITORING WELL #2-J		MON,MIS	0	35
P40091W	08/22/77	42	70	27	SESE	USFS	SEAM MONITORING WELL #1-B		MON,MIS	0	165
P42628W	03/10/78	42	70	27	SWSE	USFS	SEAM MONITOR WELL #31		MON,MIS	0	200
P9561W	06/17/71	42	70	27	SWSE	USFS	EDWARDS #TB 154	CAN	STO,MIS		
P42629W	03/10/78	42	70	27	SWSW	USFS	SEAM MONITOR WELL #32		MON,MIS	0	200
P25764W	01/22/74	42	70	28	NENW	MEADOWLARK FARMS, INC.** ROBERT R. & DOROTHY YVONNE MACKEY	MACKEY #42	CAN	MON,MIS		
P25763W	01/22/74	42	70	28	SESE	MEADOWLARK FARMS, INC.** ROBERT R. & DOROTHY YVONNE MACKEY	MACKEY #41	CAN	MON,MIS		
P25768W	01/22/74	42	70	28	SWNE	MEADOWLARK FARMS, INC.** ROBERT R. & DOROTHY YVONNE MACKEY	MACKEY #88	CAN	MON,MIS		
P25762W	01/22/74	42	70	28	SWSW	MEADOWLARK FARMS, INC.** ROBERT R. & DOROTHY YVONNE MACKEY	MACKEY #40	ABA	MON,MIS	-1	440
P60275W	03/12/82	42	70	32	NENW	ENERCOR INC.	ENERCOR #1	CAN	MIS	80	485
P25766W	01/22/74	42	70	32	NWNW	MEADOWLARK FARMS, INC.**	MACKEY #44	ABA	MON,MIS	-1	420
P25767W	01/22/74	42	70	32	NWSW	MEADOWLARK FARMS, INC.** ROBERT R. & DOROTHY YVONNE MACKEY	MACKEY #45	ABA	MON,MIS	-1	400
P25765W	01/22/74	42	70	32	SESE	MEADOWLARK FARMS, INC.** ROBERT R. & DOROTHY YVONNE MACKEY	MACKEY #43	CAN	MON,MIS		
P25769W	01/22/74	42	70	32	SWNE	MEADOWLARK FARMS, INC.** ROBERT R. & DOROTHY YVONNE MACKEY	MACKEY #89	CAN	MON,MIS		

GROUNDWATER RIGHTS FOR NARO NORTH LBA TRACT											
Permit No.	Priority	Tns	Rng	Sec	qq	Applicant	Facility Name	Status	Uses	Yld Act	T.D.
P42623W	03/10/78	42	70	33	NESW	USFS	SEAM MONITORING WELL #26	CAN	MON,MIS		
P42618W	03/10/78	42	70	33	NWNW	USFS	SEAM MONITOR WELL #21	CAN	MIS		
P40098W	08/22/77	42	70	33	SENE	USFS	SEAM MONITORING WELL #2-L		MON,MIS	0	50
P40102W	08/22/77	42	70	33	SENE	USFS	SEAM MONITORING WELL #3-P		MON,MIS	0	80
P40101W	08/22/77	42	70	33	SENE	USFS	SEAM MONITORING WELL #3 D		MON,MIS	0	260
P40099W	08/22/77	42	70	33	SESE	USFS	SEAM MONITORING WELL #3-M		MON,MIS	0	220
P40094W	08/22/77	42	70	33	SESE	USFS	SEAM MONITORING WELL #1-H		MON,MIS	0	80
P42630W	03/10/78	42	70	33	SESE	USFS	SEAM MONITOR WELL #33		MON,MIS	0	80
P42626W	03/10/78	42	70	33	SESE	USFS	SEAM MONITOR WELL #29		MON,MIS	0	264
P42624W	03/10/78	42	70	33	SESE	USFS	SEAM MONITORING WELL #27		MON,MIS	0	80
P42622W	03/10/78	42	70	33	SESE	USFS	SEAM MONITOR WELL #25		MON,MIS	0	220
P42625W	03/10/78	42	70	33	SESE	USFS	SEAM MONITOR WELL #28		MON,MIS	0	160
P40100W	08/22/77	42	70	33	SESE	USFS	SEAM MONITORING WELL #3-N		MON,MIS	0	260
P40096W	08/22/77	42	70	33	SESE	USFS	SEAM MONITORING WELL #2-J		MON,MIS	0	50
P42619W	03/10/78	42	70	33	SESE	USFS	SEAM MONITOR WELL #22	CAN	MIS		
P42627W	03/10/78	42	70	33	SESE	USFS	SEAM MONITOR WELL #30		MON,MIS	0	255
P42621W	03/10/78	42	70	33	SESE	USFS	SEAM MONITOR WELL #24	CAN	MON,MIS		
P40095W	08/22/77	42	70	34	SESE	USFS	SEAM MONITORING WELL #2-1		MON,MIS	0	160
P42633W	03/10/78	42	70	34	SESE	USFS	SEAM MONITOR WELL #37	CAN	MON,MIS		
P42631W	03/10/78	42	70	34	SESE	USFS	SEAM MONITOR WELL #34	CAN	MIS		
P61483W	07/19/82	42	70	36	SESE	J. C. DILTS	WADE #1	CAN	STO		
P63168W	01/27/83	42	70	36	SESE	W.S.B.L.C. PHILLIPS PETROLEUM CO.	JACK'S GAMBLE #1	CAN	MIS	25	760
P102631W	06/06/96	42	70	36	SESE	W.S.B.L.C.** DANIEL/JOYCE TRACY** MARC/TAMALA TRACY	JACK'S GAMBLE #1	UNA	STO	25	760
P129220W	07/03/00	42	70	36	SENE	W.S.B.L.C.** YATES PETROLEUM CORPORATION	SCHOOL CREEK CS STATE #1	UNA	CBM		
P63972W	04/29/83	42	71	8	NENE	BRIDLE BIT RANCH CO.	BRIDLE BIT #2	CAN	STO		
P98861W	04/21/95	42	71	10	NWNE	JERRY DILTS	BBRC BIRDSALL #1	UNA	STO	20	380
P25580W	01/09/74	42	71	11	NWNE	USFS	STUART #T B 174	CAN	STO		
P32145W	02/10/76	42	71	11	SENE	USFS	STUART #T.B. 174		STO	10	380
P8987P	07/13/61	42	71	12	SESE	USFS	STUART #T B 115		STO	4	172
P12755P	12/30/50	42	71	13	SESE	USFS	STUART #TB 36		STO	4	121
P12759P	12/30/50	42	71	22	NWSE	USFS	MATHESON #TB 34	CAN	STO	4	169
P61754W	08/11/82	42	71	24	NWSE	USFS	PCC WILKINSON RANCH #1		STO	5	110
P25606P	01/14/74	42	71	26	NESE	PAUL & EDITH RUTH WILKINSON	WILKINSON #2		STO,DOM	2.5	220
P25608P	01/14/74	42	71	26	SENE	PAUL & EDITH RUTH WILKINSON	WILKINSON #4		STO	4	110
P5848W	06/16/70	42	71	26	SENE	PAUL WILKINSON	MIDDLE PASTURE #1		STO	2.5	140
P29746W	05/07/75	42	71	27	NENE	USFS	WRIGHT #T B 195		STO	10	175
P53195W	08/04/81	42	71	32	NWNW	DILTS BROS.	DILTS BROS. #1		STO	10	735
P12758P	12/30/63	42	71	33	SENE	USFS	MATHESON #TB 72		STO	4	UNK
P44329W	07/20/78	42	71	34	NWSE	USFS	MARG #4		STO	3	183
P12756P	12/30/66	42	71	35	SESE	USFS	WILKINSON #TB 129		STO	4	20

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Permit No.	Priority	Tns	Rng	Sec	qq	Applicant	Facility Name	Status	Uses	Yld Act	T.D.
P8998P	06/07/68	41	70	2	SWSE	USFS	TECKLA #T B 133		STO	4	395
P25607P	01/14/74	41	70	6	NWSE	PAUL & EDITH RUTH WILKINSON	WILKINSON #3		STO	4	805
P2314W	07/18/51	41	70	9	SWNW	JOHN C. DILTS, JR.	DILTS #21		STO	4	700
P62724W	12/01/82	41	70	12	NWNE	PHILLIPS PETROLEUM COMPANY	ENL OF MORGAN RIKER #1	CAN	MIS	50	1820
P80718W	08/28/89	41	70	12	NWNE	PHILLIPS PETROLEUM COMPANY	MORGAN RIKER #1	CAN	MIS	150	1820
P61524W	07/29/82	41	70	12	NWNE	PHILLIPS PETROLEUM CO	MORGAN RIKER #1	CAN	MIS	100	1820
P86949W	12/30/91	41	70	12	NWNE	USFS	MORGAN RIKER #TB 250	CAN	STO		
P112G	07/25/51	41	70	16	SESE	JOHN C. DILTS, JR.	JOHN DILTS #3 WELL	UNA	STO	6	260
P33290W	05/17/76	41	70	18	SENW	USFS	BELL #T B 199 (DEEPENED)		STO	10	644
P41369W	06/17/77	41	70	20	NESE	USFS	DOW 108 ANTELOPE	CAN	MIS		
P41370W	06/17/77	41	70	20	NESE	USFS	SOW 107 ANTELOPE	ABA	MON,MIS		
P41367W	06/17/77	41	70	20	SWSW	USFS	DOW-110-ANTELOPE	CAN	MON,MIS		
P41368W	06/17/77	41	70	20	SWSW	USFS	SOW 109 ANTELOPE	CAN	MIS		
P8980P	08/16/66	41	70	25	SWSW	USFS	IRWIN #T B 106		STO	4	160
P25936W	02/19/74	41	70	27	NWNE	JOHN C. DILTS, JR.	DILTS #27-41-70		STO	5	845
P44496W	08/08/78	41	70	31	NESE	INDUSTRIAL PIPELINES SOUTH CENTRAL INC.	BN #2	CAN	MIS	35	23
P44497W	08/08/78	41	70	31	NESE	INDUSTRIAL PIPELINES SOUTH CENTRAL INC.	BN #3	CAN	MIS		
P44499W	08/08/78	41	70	31	NESE	INDUSTRIAL PIPELINES SOUTH CENTRAL INC.	BN #5	CAN	MIS		
P44498W	08/08/78	41	70	31	NESE	INDUSTRIAL PIPELINES SOUTH CENTRAL INC.	BN #4	CAN	MIS		
P2301W	04/14/50	41	70	33	NESW	JOHN C. DILTS, JR.	DILTS #8		STO	15	540
P172G	11/17/52	41	70	35	NWSW	JOHN C. DILTS, JR.	JOHN DILTS #4 WELL	UNA	STO,IRR	78	600
P108419W	12/16/97	41	71	1	NWSW	REDSTONE RESOURCES, INC	FEDERAL 13AC-111	UNA	STO,MIS,CBM		
P71738W	01/14/86	41	71	1	SWNW	USFS	WILKINSON SPRING TB #55	UNA	STO		
P57759W	07/07/81	41	71	2	NENE	VALENTINE CONSTRUCTION INC.	THUNDER CREEK #1	CAN	MIS	80	480
P95332W	02/12/86	41	71	2	NENE	FRANCES PUTNAM	JINX #3	UNA	DOM,STO	20	480
P95333W	07/30/81	41	71	2	NENE	FRANCES PUTNAM	JINX #2	UNA	DOM,STO	6	360
P57757W	07/30/81	41	71	2	SENE	HARRY G. PUTNAM	JINX #1	CAN	STO,DOM		
P95331W	02/12/86	41	71	2	SENE	HARRY G. PUTNAM	JINX #1	CAN	DOM,STO		
P12754P	12/30/51	41	71	3	NESW	USFS	MATHESON #TB 42		STO	4	122
P44330W	07/20/78	41	71	3	NWSE	USFS	MARG #5		STO	3	163
P70729W	07/23/85	41	71	10	SESW	JERRY DILTS	BRIDLE BIT RANCH #3	ABA	STO	0	270
P58121W	05/18/81	41	71	11	NENE	BIG HORN FRACTIONATION	B H FRAC #1		MIS	25	396
P67807W	06/27/84	41	71	13	NWNW	USFS	WILKINSON SPRING #T B 39		STO	0.5	8
P44331W	07/20/78	41	71	14	SESE	USFS	MARG #6		STO	3	605
P96882W	08/24/94	41	71	24	NENW	WESCO, INC	WESCO #1	UNA	MIS	18	596
P63112W	02/11/83	41	71	24	SWNE	BRIDLE BIT RANCH	BRIDLE BIT RANCH #1		STO	6	442
P129458W	09/18/00	41	71	2	NENE	INDEPENDENT PRODUCTION CO., INC.	SEARCHLIGHT #41-2	UNA	STO,CBM		
P129461W	09/18/00	41	71	2	NESE	INDEPENDENT PRODUCTION CO., INC.	SEARCHLIGHT #43-2	UNA	STO,CBM		
P129452W	09/18/00	41	71	2	NWNE	INDEPENDENT PRODUCTION CO., INC.	SEARCHLIGHT #31-2	UNA	STO,CBM		
P129447W	09/18/00	41	71	2	NWSE	INDEPENDENT PRODUCTION CO., INC.	SEARCHLIGHT #33-2	UNA	STO,CBM		
P129460W	09/18/00	41	71	2	SENE	INDEPENDENT PRODUCTION CO., INC.	SEARCHLIGHT #42-2	UNA	STO,CBM		
P129455W	09/18/00	41	71	2	SESE	INDEPENDENT PRODUCTION CO., INC.	SEARCHLIGHT #44-2	UNA	STO,CBM		
P129454W	09/18/00	41	71	2	SWNE	INDEPENDENT PRODUCTION CO., INC.	SEARCHLIGHT #32-2	UNA	STO,CBM		

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Permit No.	Priority	Tns	Rng	Sec	qq	Applicant	Facility Name	Status	Uses	Yld Act	T.D.
P129456W	09/18/00	41	71	2	SWSE	INDEPENDENT PRODUCTION CO., INC.	SEARCHLIGHT #34-2	UNA	STO,CBM		
P129457W	09/18/00	41	71	11	NENE	INDEPENDENT PRODUCTION CO., INC.	SEARCHLIGHT #41-11	UNA	STO,CBM		
P129449W	09/18/00	41	71	11	NENW	INDEPENDENT PRODUCTION CO., INC.	SEARCHLIGHT #21-11	UNA	STO,CBM		
P129451W	09/18/00	41	71	11	NWNE	INDEPENDENT PRODUCTION CO., INC.	SEARCHLIGHT #31-11	UNA	STO,CBM		
P129453W	09/18/00	41	71	11	NWNW	INDEPENDENT PRODUCTION CO., INC.	SEARCHLIGHT #11-11	UNA	STO,CBM		
P129459W	09/18/00	41	71	11	SENE	INDEPENDENT PRODUCTION CO., INC.	SEARCHLIGHT #42-11	UNA	STO,CBM		
P129450W	09/18/00	41	71	11	SENW	INDEPENDENT PRODUCTION CO., INC.	SEARCHLIGHT #22-11	UNA	STO,CBM		
P129462W	09/18/00	41	71	11	SWNE	INDEPENDENT PRODUCTION CO., INC.	SEARCHLIGHT #32-11	UNA	STO,CBM		
P129448W	09/18/00	41	71	11	SWNW	INDEPENDENT PRODUCTION CO., INC.	SEARCHLIGHT #12-11	UNA	STO,CBM		
P123124W	02/07/00	41	71	15	NESW	BARRETT RESOURCES CORP.	MATHESON 23-15-4171	UNA	CBM		
P67899W	07/10/84	41	71	27	NESW	USFS	ISENBERGER SPRING #T B 63		STO	0.5	8
P23605P	07/25/73	41	71	27	SWSW	PATRICIA L. ISENBERGER	SPRING #10		STO	25	8
P23594W	07/25/73	41	71	34	SWNE	PATRICIA L. ISENBERGER	ARTESIAN #3		STO	10	640
P23596P	07/25/73	41	71	35	NENE	PATRICIA L. ISENBERGER	ARTESIAN #4		STO,DOM	5	Unknown
P11652W	08/01/54	41	71	35	SENE	ROBERT E. ISENBERGER	COAL MINE #1		STO	25	30
P4762W	06/12/69	41	71	35	SENE	WAYNE P. BRANNAN** KANE RANCHES	BRANNAN #1	CAN	IND		
P16602W	09/01/72	41	71	35	SWNW	W.S.B.L.C.**H. R. MATHESON	STATE-MATHESON #1		IND	500	50
P4763W	06/12/69	41	71	35	SWNW	STATE OF WYOMING**WAYNE P. BRANNAN	BRANNAN #2	CAN	IND		
P23597P	07/25/73	41	71	35	SWSE	PATRICIA L. ISENBERGER	SCHOOL HOUSE #1		STO,DOM	6	550
P46168W	12/14/78	41	71	36	NESW	W.S.B.L.C.**PATRICIA EISENBERGER	EISENBERGER-STATE #1		STO		
P60832W	05/13/82	40	70	6	NENW	DAVIS OIL COMPANY	DAVIS HERON #1	CAN	MIS		
P44332W	07/20/78	40	70	6	NWSE	USFS	MARG #7		STO	8	722
P67800W	06/27/84	40	70	9	SENE	USFS	MORTON SPRING #T.B. 32	UNA	STO	1.5	8
P40313W	10/05/77	40	70	11	NENE	ADOBE OIL & GAS CORP.	ADOBE FENTON #1	CAN	MIS	0	725
P50130W	11/17/78	40	70	11	NENE	USFS	MORTON #T B 211		STO	18	725
P8968P	07/20/65	40	70	11	NWSW	USFS	MORTON #T B 94		STO	4	709
P8967P	05/01/65	40	71	1	SESE	USFS	MORTON #T B 93		STO	4	565
P37364W	04/19/77	40	71	3	NESW	USFS	ISENBERGER # TB 206		STO	10	585

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P5857P	07/31/66	42	70	4	SWSW	ATLANTIC RICHFIELD COMPANY	HEARTSPEAR 3	CAN	STO	2	233
P97862W	11/07/94	42	70	4	SWSW	ATLANTIC RICHFIELD COMPANY	ENL. HEARTSPEAR 3		STO,IND,MIS		
P5865P	08/31/66	42	70	7	SENE	RENO LIVESTOCK CORPORATION **NAN HENDERSON	HEARTSPEAR 11		STO	1.5	
P69514W	03/04/85	42	70	8	SESE	USFS	SHELL #TB 259	CAN	STO		75
P78847W	01/03/89	42	70	8	SESE	USFS	TB 259	UNA	STO		
P50557W	10/31/79	42	70	9	NWSE	SHELL OIL COMPANY	9-10		MON,MIS	0	390
P49894W	09/19/79	42	70	9	SWSE	SHELL OIL COMPANY	9-15	A&C	MON,MIS	0	440
P12757P	12/30/50	42	70	2	NENW	USFS	REVLAND #TB 35		STO	4	
P44327W	07/20/78	42	70	2	NWSW	USFS	MARG #2		STO	3	
P101801W	03/20/96	42	70	3	NESW	BRIDLE BIT RANCH CO.	BBRC BLACK BUTTE #1	UNA	STO	20	
P123478W	02/22/00	42	70	7	NESW	PRIMA OIL/GAS COMPANY	PORCUPINE-TUIT #7-31	UNA	STO,CBM		
P123475W	02/22/00	42	70	7	NWNW	PRIMA OIL/GAS COMPANY	PORCUPINE-TUIT #7-22	UNA	STO,CBM		
P123482W	02/22/00	42	70	7	NWSE	PRIMA OIL/GAS COMPANY	PORCUPINE-TUIT #7-42	UNA	STO,CBM		
P123479W	02/22/00	42	70	7	NWSW	PRIMA OIL/GAS COMPANY	PORCUPINE-TUIT #7-32	UNA	STO,CBM		
P123477W	02/22/00	42	70	7	SENW	PRIMA OIL/GAS COMPANY	PORCUPINE-TUIT #7-24	UNA	STO,CBM		
P123481W	02/22/00	42	70	7	SESW	PRIMA OIL/GAS COMPANY	PORCUPINE-TUIT #7-34	UNA	STO,CBM		
P123474W	02/22/00	42	70	7	SWNE	PRIMA OIL/GAS COMPANY	PORCUPINE-TUIT #7-13	UNA	STO,CBM		
P123476W	02/22/00	42	70	7	SWNW	PRIMA OIL/GAS COMPANY	PORCUPINE-TUIT #7-23	UNA	STO,CBM		
P123483W	02/22/00	42	70	7	SWSE	PRIMA OIL/GAS COMPANY	PORCUPINE-TUIT #7-43	UNA	STO,CBM		
P78879W	01/23/89	42	70	7	SWSW	BRIDLE BIT RANCH CO.	BRIDLE BIT RANCH #3H		DOM	25	
P123480W	02/22/00	42	70	7	SWSW	PRIMA OIL/GAS COMPANY	PORCUPINE-TUIT #7-33	UNA	STO,CBM		
P63972W	04/29/83	42	70	8	NENE	BRIDLE BIT RANCH CO.	BRIDLE BIT #2	CAN	STO		
P98861W	04/21/95	42	70	10	NWNE	JERRY DILTS	BBRC BIRDSALL #1	UNA	STO	20	
P25580W	01/09/74	42	70	11	NWNE	USFS	STUART #T.B. 174	CAN	STO		
P32145W	02/10/76	42	70	11	SWNE	USFS	STUART #T.B. 174		STO	10	
P74933W	06/19/87	43	70	4	SENEW	JACOBS LAND & LIVESTOCK COMPANY	JRM 4 1C	UNA	MON	0	290.8
P74932W	06/19/87	43	70	4	SWSE	JACOBS LAND & LIVESTOCK COMPANY	JRM 4 1W	UNA	MON	0	225
P120261W	11/01/99	43	70	4	NWSW	RIM OPERATING, INC	CBM H #13-04	UNA	STO,CBM		
P120260W	11/01/99	43	70	4	NWNW	RIM OPERATING, INC	CBM H #11-04	UNA	STO,CBM		
P120268W	11/01/99	43	70	5	SESE	RIM OPERATING, INC	CBM H #44-05	UNA	STO,CBM		
P120264W	11/01/99	43	70	5	SESW	RIM OPERATING, INC	CBM H #24-05	UNA	STO,CBM		
P120266W	11/01/99	43	70	5	NESE	RIM OPERATING, INC	CBM H #33-05	UNA	STO,CBM		
P120263W	11/01/99	43	70	5	NWSW	RIM OPERATING, INC	CBM H #13-05	UNA	STO,CBM		
P120267W	11/01/99	43	70	5	SENE	RIM OPERATING, INC	CBM H #42-05	UNA	STO,CBM		
P120262W	11/01/99	43	70	5	NWNW	RIM OPERATING, INC	CBM H #11-05	UNA	STO,CBM		
P121849W	12/27/99	43	70	5	NENW	RIM OPERATING, INC	CBM H #22-05	UNA	STO,CBM		
P120265W	11/01/99	43	70	5	NWNE	RIM OPERATING, INC	CBM H #31-05	UNA	STO,CBM		
P120274W	11/01/99	43	70	6	NWSE	RIM OPERATING, INC	CBM H #33-06	UNA	STO,CBM		
P120269W	11/01/99	43	70	6	NWNW	RIM OPERATING, INC	CBM H #11-06	UNA	STO,CBM		
P120270W	11/01/99	43	70	6	NWSW	RIM OPERATING, INC	CBM H #13-06	UNA	STO,CBM		
P120271W	11/01/99	43	70	6	SENW	RIM OPERATING, INC	CBM H #22-06	UNA	STO,CBM		
P120272W	11/01/99	43	70	6	SESW	RIM OPERATING, INC	CBM H #24-06	UNA	STO,CBM		
P120276W	11/01/99	43	70	6	SESE	RIM OPERATING, INC	CBM H #44-06	UNA	STO,CBM		
P120273W	11/01/99	43	70	6	NWNE	RIM OPERATING, INC	CBM H #31-06	UNA	STO,CBM		

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P120275W	11/01/99	43	70	6	SENE	RIM OPERATING, INC	CBM H #42-06	UNA	STO,CBM		
P128063W	08/04/00	43	70	7	SESW	RIM OPERATING, INC	CBM H 24-07	UNA	STO,CBM		
P126215W	06/09/00	43	70	7	NWNE	RIM OPERATING, INC	CBM H #31-07	UNA	STO,CBM		
P120279W	11/01/99	43	70	7	SENE	RIM OPERATING, INC	CBM H #42-07	UNA	STO,CBM		
P120278W	11/01/99	43	70	7	SENW	RIM OPERATING, INC	CBM H #22-07	UNA	STO,CBM		
P120277W	11/01/99	43	70	7	NWNW	RIM OPERATING, INC	CBM H #11-07	UNA	STO,CBM		
P20495W	04/09/73	43	70	20	SESE	ATLANTIC RICHFIELD COMPANY	BTW-WW #6	A&C	MON	0	172
P20494W	04/09/73	43	70	20	SESE	ATLANTIC RICHFIELD COMPANY	BTR-WW #8	A&C	MON	0	260
P20491W	04/09/73	43	70	21	NENE	ATLANTIC RICHFIELD COMPANY	BTR-WW #6	A&C	MON	0	226
P32382W	03/04/76	43	70	21	NWNW	ATLANTIC RICHFIELD COMPANY	BTR-WW-#5	A&C	RES,MIS	25	185
P37606W	02/18/77	43	70	21	NWNW	ATLANTIC RICHFIELD COMPANY	ENL BTR-WW #5	A&C	RES,MIS	12	185
P20488W	04/09/73	43	70	21	NWNW	ATLANTIC RICHFIELD COMPANY	BTR-WW #5	A&C	MON	-1	185
P20501W	04/09/73	43	70	28	SWSW	ATLANTIC RICHFIELD COMPANY	BTW-WW #8	A&C	MON	0	135
P20500W	04/09/73	43	70	28	SWSW	ATLANTIC RICHFIELD COMPANY	BTR-WW #11	A&C	MON	0	226
P25125W	12/10/73	43	70	33	SWSE	ATLANTIC RICHFIELD COMPANY	BTW-WW #10A	A&C	MON	0	143
P128064W	08/04/00	43	71	1	NWSE	USFS** RIM OPERATING, INC	CBM D 33-01R	UNA	STO,CBM		
P125923W	05/25/00	43	71	1	NWNW	RIM OPERATING, INC	CBM D #11-01	UNA	STO,CBM	25	395
P123659W	02/28/00	43	71	1	NWNE	RIM OPERATING, INC	CBM C #31-01	UNA	STO,CBM		
P121847W	12/27/99	43	71	1	SENE	RIM OPERATING, INC	CBM D #42-01	UNA	STO,CBM		
P121848W	12/27/99	43	71	1	SENW	RIM OPERATING, INC	CBM D #22-01	UNA	STO,CBM		
P120248W	11/01/99	43	71	1	SESE	RIM OPERATING, INC	CBM D #44-01	UNA	STO,CBM		
P120247W	11/01/99	43	71	1	NWSE	RIM OPERATING, INC	CBM D #33-01	UNA	STO,CBM		
P120246W	11/01/99	43	71	1	SESW	RIM OPERATING, INC	CBM D #24-01	UNA	STO,CBM		
P120245W	11/01/99	43	71	1	NWSW	RIM OPERATING, INC	CBM D #13-01	UNA	STO,CBM		
P128467W	08/17/00	43	71	3	SWNW	BARRETT RESOURCES CORP.	STUART FEDERAL 12-3-4371	UNA	CBM		
P128468W	08/17/00	43	71	3	SWSW	BARRETT RESOURCES CORP.	STUART FEDERAL 14-3-4371	UNA	CBM		
P128469W	08/17/00	43	71	3	NESW	BARRETT RESOURCES CORP.	STUART FEDERAL 23-3-4371	UNA	CBM		
P128470W	08/17/00	43	71	3	SWSE	BARRETT RESOURCES CORP.	STUART FEDERAL 34-3-4371	UNA	CBM		
P128473W	08/17/00	43	71	4	SWNE	BARRETT RESOURCES CORP.	STUART FEDERAL 32-4-4371	UNA	CBM		
P128472W	08/17/00	43	71	4	NENW	BARRETT RESOURCES CORP.	STUART FEDERAL 21-4-4371	UNA	CBM		
P128474W	08/17/00	43	71	4	NENE	BARRETT RESOURCES CORP.	STUART FEDERAL 41-4-4371	UNA	CBM		
P128471W	08/17/00	43	71	4	SWNW	BARRETT RESOURCES CORP.	STUART FEDERAL 12-4-4371	UNA	CBM		
P118160W	08/06/99	43	71	4	NWSW	BARRETT RESOURCES CORP.	STUART 13-4	UNA	CBM		
P118161W	08/06/99	43	71	4	SESW	BARRETT RESOURCES CORP.	STUART 24-4	UNA	CBM		
P118162W	08/06/99	43	71	4	NWSE	BARRETT RESOURCES CORP.	STUART 33-4	UNA	CBM		
P118163W	08/06/99	43	71	4	SESE	BARRETT RESOURCES CORP.	STUART 44-4	UNA	CBM		
P118166W	08/06/99	43	71	5	NWSE	BARRETT RESOURCES CORP.	STUART 33-5	UNA	CBM		
P118168W	08/06/99	43	71	5	NESE	BARRETT RESOURCES CORP.	STUART 44-5	UNA	CBM		
P118167W	08/06/99	43	71	5	SENE	BARRETT RESOURCES CORP.	STUART 42-5	UNA	CBM		
P118165W	08/06/99	43	71	5	SESW	BARRETT RESOURCES CORP.	STUART 24-5	UNA	CBM		
P121878W	12/29/99	43	71	5	NWNW	BARRETT RESOURCES CORP.	STUART 11-5	UNA	CBM		
P121879W	12/29/99	43	71	5	NWSW	BARRETT RESOURCES CORP.	STUART 13-5-4371	UNA	CBM		
P121880W	12/29/99	43	71	5	NWNE	BARRETT RESOURCES CORP.	STUART 31-5-4371	UNA	CBM		
P118164W	08/06/99	43	71	5	SENW	BARRETT RESOURCES CORP.	STUART 22-5	UNA	CBM		
P128477W	08/17/00	43	71	8	SWSW	USFS** BARRETT RESOURCES CORP.	FEDERAL 14-8-4371	UNA	CBM		

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Permit No.	Priority	Tns	Rng	Sec	qq	Applicant	Facility Name	Status	Uses	Yld Act	T.D.
P128478W	08/17/00	43	71	8	NENW	USFS** BARRETT RESOURCES CORP.	FEDERAL 21-8-4371	UNA	CBM		
P128479W	08/17/00	43	71	8	NESW	USFS** BARRETT RESOURCES CORP.	FEDERAL 23-8-4371	UNA	CBM		
P128480W	08/17/00	43	71	8	SWNE	USFS** BARRETT RESOURCES CORP.	FEDERAL 32-8-4371	UNA	CBM		
P128481W	08/15/00	43	71	8	NENE	BARRETT RESOURCES CORP.	FEDERAL 41-8-4371	UNA	CBM		
P128476W	08/17/00	43	71	8	SWNW	USFS** BARRETT RESOURCES CORP.	FEDERAL 12-8-4371	UNA	CBM		
P128484W	08/17/00	43	71	9	SWNE	BARRETT RESOURCES CORP.	STUART FEDERAL 32-9-4371	UNA	CBM		
P128483W	08/17/00	43	71	9	NENW	BARRETT RESOURCES CORP.	ARCH FEDERAL 21-9-4371	UNA	CBM		
P128485W	08/17/00	43	71	9	NESE	BARRETT RESOURCES CORP.	STUART FEDERAL 43-9-4371	UNA	CBM		
P128482W	08/17/00	43	71	9	SWNW	BARRETT RESOURCES CORP.	ARCH FEDERAL 12-9-4371	UNA	CBM		
P107568W	07/28/97	43	71	9	NENE	BARRETT RESOURCES CORP.	STUART 1-41-9	UNA	MIS,CBM	35	540
P110773W	06/22/98	43	71	9	NESE	BARRETT RESOURCES CORP.	STUART FEDERAL 42-9	UNA	CBM	41	542
P115199W	04/16/99	43	71	9	NENE	BARRETT RESOURCES CORP.	ENL STUART FED. 1-41-9	UNA	CBM	50	540
P128486W	08/17/00	43	71	10	SWSW	BARRETT RESOURCES CORP.	STUART FEDERAL 14-10-4371	UNA	CBM		
P128487W	08/17/00	43	71	10	SWNW	BARRETT RESOURCES CORP.	STUART FEDERAL 12-10-4371	UNA	CBM		
P128488W	08/17/00	43	71	10	SWNE	USFS** BARRETT RESOURCES CORP.	STUART FEDERAL 32-10-4371	UNA	CBM		
P128489W	08/17/00	43	71	10	SWSE	USFS** BARRETT RESOURCES CORP.	STUART FEDERAL 34-10-4371	UNA	CBM		
P128490W	08/17/00	43	71	10	NENE	USFS** BARRETT RESOURCES CORP.	STUART FEDERAL 41-10-4371	UNA	CBM		
P118169W	08/06/99	43	71	10	NESW	BARRETT RESOURCES CORP.	STUART 23-10	UNA	CBM		
P128491W	08/17/00	43	71	11	NESW	USFS** BARRETT RESOURCES CORP.	FEDERAL 23-11-4371	UNA	CBM		
P121917W	12/30/99	43	71	11	NESE	BARRETT RESOURCES CORP.	ZIMMER 43-11	UNA	CBM		
P121916W	12/30/99	43	71	11	SWSE	BARRETT RESOURCES CORP.	ZIMMER 34-11	UNA	CBM		
P120249W	11/01/99	43	71	12	NWNW	RIM OPERATING, INC	CBM D #11-12	UNA	STO,CBM		
P120254W	11/01/99	43	71	12	NWSE	RIM OPERATING, INC	CBM D #33-12	UNA	STO,CBM		
P120250W	11/01/99	43	71	12	NWSW	RIM OPERATING, INC	CBM D #13-12	UNA	STO,CBM		
P120253W	11/01/99	43	71	12	NWNE	RIM OPERATING, INC	CBM D #31-12	UNA	STO,CBM		
P120256W	11/01/99	43	71	12	SESE	RIM OPERATING, INC	CBM D #44-12	UNA	STO,CBM		
P120251W	11/01/99	43	71	12	SENW	RIM OPERATING, INC	CBM D #22-12	UNA	STO,CBM		
P120255W	11/01/99	43	71	12	SENE	RIM OPERATING, INC	CBM D #42-12	UNA	STO,CBM		
P120252W	11/01/99	43	71	12	SESW	RIM OPERATING, INC	CBM D #24-12	UNA	STO,CBM		
P112580W	10/30/98	43	71	13	NWNW	BARRETT RESOURCES CORP.	YOUNG 11-13	UNA	CBM	29	410
P123115W	02/07/00	43	71	13	SESE	BARRETT RESOURCES CORP.	HOPKINS TRUST 44-13-4371	UNA	CBM		
P123116W	02/07/00	43	71	13	NWSE	BARRETT RESOURCES CORP.	ARCH 33-13-4371	UNA	CBM		
P121919W	12/30/99	43	71	13	SENW	BARRETT RESOURCES CORP.	ARCH 22-13	UNA	CBM		
P121920W	12/30/99	43	71	13	SESW	BARRETT RESOURCES CORP.	ARCH 22-13	UNA	CBM		
P121989W	12/31/99	43	71	13	NWSW	BARRETT RESOURCES CORP.	ARCH 13-13	UNA	CBM		
P128492W	08/17/00	43	71	14	SWNE	USFS** BARRETT RESOURCES CORP.	FEDERAL 32-14-4371	UNA	CBM		
P128493W	08/17/00	43	71	14	SWSE	USFS** BARRETT RESOURCES CORP.	FEDERAL 34-14-4371	UNA	CBM		
P123114W	02/07/00	43	71	14	SWNW	BARRETT RESOURCES CORP.	REVLAND TRUST 12-14-4371	UNA	CBM		
P123112W	02/07/00	43	71	14	NENW	BARRETT RESOURCES CORP.	REVLAND TRUST 21-14-4371	UNA	CBM		
P123111W	02/07/00	43	71	14	NESW	BARRETT RESOURCES CORP.	REVLAND TRUST 23-14-4371	UNA	CBM		
P123113W	02/07/00	43	71	14	SWSW	BARRETT RESOURCES CORP.	REVLAND TRUST 14-14-4371	UNA	CBM		
P121921W	12/30/99	43	71	14	SENE	BARRETT RESOURCES CORP.	ARCH 42-14	UNA	CBM		
P121922W	12/30/99	43	71	14	SESE	BARRETT RESOURCES CORP.	ARCH 44-14	UNA	CBM		
P128141W	08/08/00	43	71	16	NENE	W.S.B.L.C.** M & K OIL COMPANY, INC.	MILLS STATE 16-1	UNA	CBM		
P128142W	08/08/00	43	71	16	SWNE	W.S.B.L.C.** M & K OIL COMPANY, INC.	MILLS STATE 16-2	UNA	CBM		

GROUNDWATER RIGHTS FOR LITTLE THUNDER LBA TRACT											
Permit No.	Priority	Tns	Rng	Sec	qq	Applicant	Facility Name	Status	Uses	Yld Act	T.D.
P129244W	09/05/00	43	71	16	NESE	W.S.B.L.C.** COLEMAN OIL & GAS, INC.	EDWARDS STATE #3-16	UNA	STO,CBM		
P123110W	02/07/00	43	71	16	SWNW	W.S.B.L.C.** BARRETT RESOURCES CORP.	STATE 12-16-4371	UNA	CBM		
P123109W	02/07/00	43	71	16	SWSW	W.S.B.L.C.** BARRETT RESOURCES CORP.	STATE 14-16-4371	UNA	CBM		
P123108W	02/07/00	43	71	16	NENW	W.S.B.L.C.** BARRETT RESOURCES CORP.	STATE 21-16-4371	UNA	CBM		
P123107W	02/07/00	43	71	16	NESW	W.S.B.L.C.** BARRETT RESOURCES CORP.	STATE 23-16-4371	UNA	CBM		
P123106W	02/07/00	43	71	16	SWSE	W.S.B.L.C.** BARRETT RESOURCES CORP.	STATE 34-16-4371	UNA	CBM		
P123019W	01/19/00	43	71	17	NESW	BARRETT RESOURCES CORP.	ARKLAND 23-17-4371	UNA	CBM		
P123020W	01/19/00	43	71	17	SWSE	BARRETT RESOURCES CORP.	ARKLAND 34-17-4371	UNA	CBM		
P123018W	01/19/00	43	71	17	NENW	BARRETT RESOURCES CORP.	ARKLAND 21-17-4371	UNA	CBM		
P123021W	01/19/00	43	71	17	NESE	BARRETT RESOURCES CORP.	ARKLAND 43-17-4371	UNA	CBM		
P123104W	02/07/00	43	71	20	NWNW	BARRETT RESOURCES CORP.	ARCH STATE 11-20-4371	UNA	CBM		
P124922W	04/19/00	43	71	21	SWSE	BARRETT RESOURCES CORP.** USFS	FEDERAL 34-21	UNA	CBM		
P124923W	04/19/00	43	71	21	NESE	BARRETT RESOURCES CORP.** USFS	FEDERAL 43-21	UNA	CBM		
P128526W	08/17/00	43	71	22	SWSW	BARRETT RESOURCES CORP.** USFS	BRC FEDERAL 14-22R-4371	UNA	CBM		
P128498W	08/17/00	43	71	22	NWNW	BARRETT RESOURCES CORP.** USFS	BRC FEDERAL 11-22-4371	UNA	CBM		
P128499W	08/17/00	43	71	22	SENW	BARRETT RESOURCES CORP.** USFS	BRC FEDERAL 22-22-4371	UNA	CBM		
P128500W	08/17/00	43	71	22	NESW	BARRETT RESOURCES CORP.** USFS	BRC FEDERAL 23-22r-4371	UNA	CBM		
P124924W	04/19/00	43	71	22	NESW	BARRETT RESOURCES CORP.** USFS	FEDERAL 23-22	UNA	CBM		
P121924W	12/30/99	43	71	22	SWSE	BARRETT RESOURCES CORP.	ARCH 34-22	UNA	CBM		
P121925W	12/30/99	43	71	22	NENE	BARRETT RESOURCES CORP.	ARCH 41-22	UNA	CBM		
P121926W	12/30/99	43	71	22	NESE	BARRETT RESOURCES CORP.	ARCH 43-22	UNA	CBM		
P121923W	12/30/99	43	71	22	SWNE	BARRETT RESOURCES CORP.	ARCH 32-22	UNA	CBM		
P128502W	08/17/00	43	71	23	NENW	BARRETT RESOURCES CORP.** USFS	BRC FEDERAL 21-23-4371	UNA	CBM		
P128504W	08/17/00	43	71	23	SWNE	BARRETT RESOURCES CORP.** USFS	BRC FEDERAL 32-23-4371	UNA	CBM		
P128501W	08/17/00	43	71	23	SWSW	BARRETT RESOURCES CORP.** USFS	BRC FEDERAL 14-23	UNA	CBM		
P128505W	08/17/00	43	71	23	SWSE	BARRETT RESOURCES CORP.** USFS	BRC FEDERAL 34-23	UNA	CBM		
P128506W	08/17/00	43	71	23	NENE	BARRETT RESOURCES CORP.** USFS	BRC FEDERAL 41-23-4371	UNA	CBM		
P128507W	08/17/00	43	71	23	NESE	BARRETT RESOURCES CORP.** USFS	BRC FEDERAL 43-23-4371	UNA	CBM		
P128525W	08/17/00	43	71	23	SWNW	BARRETT RESOURCES CORP.** USFS	BRC FEDERAL 12-23-4371	UNA	CBM		
P128503W	08/17/00	43	71	23	NESW	BARRETT RESOURCES CORP.** USFS	BRC FEDERAL 23-23-4371	UNA	CBM		
P124926W	04/19/00	43	71	23	SWSE	BARRETT RESOURCES CORP.** USFS	FEDERAL 34-23	UNA	CBM		
P124925W	04/19/00	43	71	23	SWSW	BARRETT RESOURCES CORP.** USFS	FEDERAL 14-23	UNA	CBM		
P128509W	08/17/00	43	71	24	SWSW	BARRETT RESOURCES CORP.** USFS	BRC FEDERAL 14-24	UNA	CBM		
P128510W	08/17/00	43	71	24	NESW	BARRETT RESOURCES CORP.** USFS	BRC FEDERAL 23-24-4371	UNA	CBM		
P128508W	08/17/00	43	71	24	SWNW	BARRETT RESOURCES CORP.** USFS	BRC FEDERAL 12-24-4371	UNA	CBM		
P128511W	08/17/00	43	71	24	SWSE	BARRETT RESOURCES CORP.** USFS	BRC FEDERAL 34-24-4371	UNA	CBM		
P124927W	04/19/00	43	71	24	SWSW	BARRETT RESOURCES CORP.** USFS	FEDERAL 14-24	UNA	CBM		
P121927W	12/30/99	43	71	24	SENW	BARRETT RESOURCES CORP.	ARCH 22-24	UNA	CBM		
P121928W	12/30/99	43	71	24	NWNE	BARRETT RESOURCES CORP.	ARCH 31-24	UNA	CBM		
P112564W	10/30/98	43	71	25	NWNW	BARRETT RESOURCES CORP.	FEDERAL 11-25	UNA	CBM	24	398
P112565W	10/30/98	43	71	25	SWNW	BARRETT RESOURCES CORP.	FEDERAL 12-25	UNA	CBM	32	375
P112566W	10/30/98	43	71	25	SENW	BARRETT RESOURCES CORP.	FEDERAL 22-25	UNA	CBM	12	370
P112569W	10/30/98	43	71	26	SWSE	BARRETT RESOURCES CORP.	FEDERAL 34-26	UNA	CBM	15	428
P113855W	02/01/99	43	71	26	SENW	BARRETT RESOURCES CORP.	ARCH 22-26	UNA	STO,CBM	30	465
P112567W	10/30/98	43	71	26	SWNE	BARRETT RESOURCES CORP.	FEDERAL 32-26	UNA	CBM	20	449

GROUNDWATER RIGHTS FOR LITTLE THUNDER LBA TRACT											
Permit No.	Priority	Tns	Rng	Sec	qq	Applicant	Facility Name	Status	Uses	Yld Act	T.D.
P112572W	10/30/98	43	71	26	SESE	BARRETT RESOURCES CORP.	FEDERAL 44-26	UNA	CBM	20	427
P112571W	10/30/98	43	71	26	NESE	ENERNET OF WYOMING LLC	FEDERAL 43-26	UNA	CBM	30	420
P112570W	10/30/98	43	71	26	SENE	BARRETT RESOURCES CORP.	FEDERAL 42-26	UNA	CBM	14	395
P113320W	12/14/98	43	71	26	SWSW	BARRETT RESOURCES CORP.	ARCH 14-26	UNA	CBM	20	452
P113321W	12/14/98	43	71	26	SWNW	BARRETT RESOURCES CORP.	ARCH 12-26	UNA	CBM	25	444
P113322W	12/14/98	43	71	26	NESW	BARRETT RESOURCES CORP.	ARCH 23-26	UNA	CBM	20	451
P112568W	10/30/98	43	71	26	NWSE	BARRETT RESOURCES CORP.	FEDERAL 33-26	UNA	CBM	20	420
P128514W	08/17/00	43	71	27	NESW	USFS** BARRETT RESOURCES CORP.	BTP 23-27 FEDERAL	UNA	CBM		
P128513W	08/17/00	43	71	27	SWSW	USFS** BARRETT RESOURCES CORP.	BTP 14-27 FEDERAL	UNA	CBM		
P128512W	08/17/00	43	71	27	SWNW	USFS** BARRETT RESOURCES CORP.	BTP 12-27 FEDERAL	UNA	CBM		
P112579W	10/30/98	43	71	27	NENW	BARRETT RESOURCES CORP.	FEDERAL 21-27	UNA	CBM	50	550
P113676W	12/30/98	43	71	27	SENE	BARRETT RESOURCES CORP.	ARCH 42-27	UNA	CBM	20	463
P113678W	12/30/98	43	71	27	SWSE	BARRETT RESOURCES CORP.	ARCH 34-27	UNA	CBM, STO	20	479
P113677W	12/30/98	43	71	27	SWNE	BARRETT RESOURCES CORP.	ARCH 32-27	UNA	CBM, STO	20	459
P113675W	12/30/98	43	71	27	NESE	BARRETT RESOURCES CORP.	ARCH 43-27	UNA	CBM, STO	20	461
P116994W	06/28/99	43	71	27	SENE	BARRETT RESOURCES CORP.	ENL ARCH 42-27	UNA	CBM	50	463
P116993W	06/28/99	43	71	27	SWNE	BARRETT RESOURCES CORP.	ENL ARCH 34-27	UNA	CBM	50	479
P116992W	06/28/99	43	71	27	SWNE	BARRETT RESOURCES CORP.	ENL ARCH 32-27	UNA	CBM	50	459
P116995W	06/28/99	43	71	27	NESE	BARRETT RESOURCES CORP.	ENL ARCH 43-27	UNA	CBM	50	461
P124262W	03/23/00	43	71	28	SWSW	BARRETT RESOURCES CORP.	SMITH 14-28-4371	UNA	CBM		
P128515W	08/17/00	43	71	33	SWNE	BARRETT RESOURCES CORP.	MATHESON FEDERAL 32-33-4371	UNA	CBM		
P128517W	08/17/00	43	71	33	NENE	BARRETT RESOURCES CORP.	MATHESON FEDERAL 41-33-4371	UNA	CBM		
P128518W	08/17/00	43	71	33	NESE	USFS** BARRETT RESOURCES CORP.	MATHESON FEDERAL 43-33-4371	UNA	CBM		
P128516W	08/17/00	43	71	33	SWSE	BARRETT RESOURCES CORP.	MATHESON FEDERAL 34-33-4371	UNA	CBM		
P124257W	03/23/00	43	71	33	SWNW	BARRETT RESOURCES CORP.	MATHESON 12-33-4371	UNA	CBM		
P124256W	03/23/00	43	71	33	NENW	BARRETT RESOURCES CORP.	MATHESON 21-33-4371	UNA	CBM		
P128520W	08/17/00	43	71	34	NESE	BARRETT RESOURCES CORP.	ARCH FEDERAL 43-34-4371	UNA	CBM		
P128519W	08/17/00	43	71	34	SWSE	USFS** BARRETT RESOURCES CORP.	ARCH FEDERAL 34-34-4371	UNA	CBM		
P113785W	01/25/99	43	71	34	NESW	BARRETT RESOURCES CORP.	DILTS 23-34	UNA	STO,CBM	20	566
P113674W	12/30/98	43	71	34	NWNW	BARRETT RESOURCES CORP.	DILTS 11-34	UNA	CBM, STO	20	489
P113784W	01/25/99	43	71	34	NWSW	BARRETT RESOURCES CORP.	DILTS 13-34	UNA	STO,CBM	20	570
P114640W	03/18/99	43	71	34	NENW	BARRETT RESOURCES CORP.	DILTS 21-34	UNA	CBM	20	471
P116996W	06/28/99	43	71	34	NWNW	BARRETT RESOURCES CORP.	ENL DILTS 11-34	UNA	CBM	50	489
P116997W	06/28/99	43	71	34	NWSW	BARRETT RESOURCES CORP.	ENL DILTS 13-34	UNA	CBM	50	570
P116998W	06/28/99	43	71	34	NENW	BARRETT RESOURCES CORP.	ENL DILTS 21-34	UNA	CBM	50	471
P116999W	06/28/99	43	71	34	NESW	BARRETT RESOURCES CORP.	ENL DILTS 23-34	UNA	CBM	50	566
P116808W	06/28/99	43	71	34	SWNE	BARRETT RESOURCES CORP.	FEDERAL 32-34	UNA	STO,CBM	55	515
P116809W	06/28/99	43	71	34	NENE	BARRETT RESOURCES CORP.	FEDERAL 41-34	UNA	STO,CBM	55	515
P128521W	08/17/00	43	71	35	SWSW	USFS** BARRETT RESOURCES CORP.	FEDERAL 14-35-4371	UNA	CBM		
P128522W	08/17/00	43	71	35	NESW	USFS** BARRETT RESOURCES CORP.	FEDERAL 23-35-4371	UNA	CBM		
P128523W	08/17/00	43	71	35	SWSE	USFS** BARRETT RESOURCES CORP.	FEDERAL 34-35-4371	UNA	CBM		
P128524W	08/17/00	43	71	35	NESE	USFS** BARRETT RESOURCES CORP.	BRC FEDERAL 43-35	UNA	CBM		
P112578W	10/30/98	43	71	35	SWNE	BARRETT RESOURCES CORP.	FEDERAL 32-35	UNA	CBM	22	423
P112563W	10/30/98	43	71	35	NENE	BARRETT RESOURCES CORP.	FEDERAL 41-25	UNA	CBM	0	0
P112577W	10/30/98	43	71	35	NWNE	BARRETT RESOURCES CORP.	FEDERAL 31-35	UNA	CBM	22	428

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Permit No.	Priority	Tns	Rng	Sec	qq	Applicant	Facility Name	Status	Uses	Yld Act	T.D.
P112576W	10/30/98	43	71	35	SENW	BARRETT RESOURCES CORP.	FEDERAL 22-35	UNA	CBM	22	489
P124928W	04/19/00	43	71	35	NESE	USFS** BARRETT RESOURCES CORP.	FEDERAL 43-35	UNA	CBM		
P112575W	10/30/98	43	71	35	SENE	BARRETT RESOURCES CORP.	FEDERAL 21-35	UNA	CBM	30	478
P112574W	10/30/98	43	71	35	SWNW	BARRETT RESOURCES CORP.	FEDERAL 12-35	UNA	CBM	27	508
P112573W	10/30/98	43	71	35	NWNW	BARRETT RESOURCES CORP.	FEDERAL 11-35	UNA	CBM	11	480
P112562W	10/30/98	43	71	35	SENE	BARRETT RESOURCES CORP.	FEDERAL 42-35	UNA	CBM	20	422
P113671W	12/30/98	43	71	35	NENE	BARRETT RESOURCES CORP.	FEDERAL 41-35	UNA	CBM	20	387
P111368W	08/07/98	43	71	36	SENW	W.S.B.L.C.** YATES PETROLEUM CORP.	RENO CS STATE #1	UNA	STO,MIS,CBM	25	376
P112081W	09/30/98	43	71	36	SENW	W.S.B.L.C.** YATES PETROLEUM CORP.	ENL RENO CS STATE #1	UNA	STO,MIS,CBM	25	376
P117264W	04/12/99	43	71	36	SESW	YATES PETROLEUM CORP.** W.S.B.L.C.	RENO CS STATE #14	UNA	STO,CBM	100	394
P117263W	04/12/99	43	71	36	NWSW	YATES PETROLEUM CORP.** W.S.B.L.C.	RENO CS STATE #12	UNA	STO,CBM	100	389
P117267W	04/12/99	43	71	36	SWNW	YATES PETROLEUM CORP.** W.S.B.L.C.	RENO CS STATE #4	UNA	STO,CBM	100	395
P115174W	04/12/99	43	71	36	NENW	YATES PETROLEUM CORP.** W.S.B.L.C.	RENO CS STATE #2	UNA	STO,CBM	100	375
P117266W	04/12/99	43	71	36	SESE	YATES PETROLEUM CORP.** W.S.B.L.C.	RENO CS STATE #11	UNA	STO,CBM	100	359
P117265W	04/12/99	43	71	36	SWSW	YATES PETROLEUM CORP.** W.S.B.L.C.	RENO CS STATE #13	UNA	STO,CBM	100	394
P115180W	04/12/99	43	71	36	NESE	YATES PETROLEUM CORP.** W.S.B.L.C.	RENO CS STATE #10	UNA	STO,CBM	100	355
P115179W	04/12/99	43	71	36	SENE	YATES PETROLEUM CORP.** W.S.B.L.C.	RENO CS STATE #9	UNA	STO,CBM	100	357
P115178W	04/12/99	43	71	36	NWNE	YATES PETROLEUM CORP.** W.S.B.L.C.	RENO CS STATE #8	UNA	STO,CBM	100	380
P115177W	04/12/99	43	71	36	NENE	YATES PETROLEUM CORP.** W.S.B.L.C.	RENO CS STATE #7	UNA	STO,CBM	100	364
P115176W	04/12/99	43	71	36	SWSE	YATES PETROLEUM CORP.** W.S.B.L.C.	RENO CS STATE #6	UNA	STO,CBM	100	377
P115175W	04/12/99	43	71	36	NWNW	YATES PETROLEUM CORP.** W.S.B.L.C.	RENO CS STATE #3	UNA	STO,CBM	100	397
P117268W	04/12/99	43	71	36	NESW	YATES PETROLEUM CORP.** W.S.B.L.C.	RENO CS STATE #5	UNA	STO,CBM	100	382
P59111W	12/29/81	44	70	29	SENE	JACOBS LAND & LIVESTOCK	JACOBS #1		STO,DOM	7	620
P28611P	12/03/74	44	70	29	SENE	JACOBS LAND & LIVESTOCK CO.	JACOBS 29 1		STO,DOM	5	292
P2974P	06/21/35	44	70	30	SWNE	MILLS LAND & LIVESTOCK CO., INC.	MILLS #23		STO	5	60
P2974P	06/21/35	44	70	30	NESW	MILLS LAND & LIVESTOCK CO., INC.	MILLS #23		STO	5	60
P2974P	06/21/35	44	70	30	NWSE	MILLS LAND & LIVESTOCK CO., INC.	MILLS #23		STO	5	60
P2974P	06/21/35	44	70	30	SENW	MILLS LAND & LIVESTOCK CO., INC.	MILLS #23		STO	5	60
P2975P	12/21/34	44	70	31	SWNW	MILLS LAND & LIVESTOCK CO., INC.	MILLS #24		STO	5	60
P28617P	12/03/74	44	70	32	SESE	JACOBS LAND & LIVESTOCK CO.	JACOBS 32 1		STO	10	273
P44616W	08/22/78	44	70	32	SWSW	ATLANTIC RICHFIELD COMPANY	BTR-29	CAN	MON,MIS		
P50924W	11/28/79	44	70	32	SWSW	ATLANTIC RICHFIELD COMPANY	BTR 29	ABA	MON,MIS	0	299
P89324W	09/01/92	44	70	32	SESE	JACOBS LAND & LIVESTOCK CO.	REYNOLD'S #1	UNA	STO	7	300
P28616P	12/03/74	44	70	33	NESW	JACOBS LAND & LIVESTOCK CO.	JACOBS 33 1		STO	15	110
P107775W	10/06/1997	44	71	13	SENE	RIM OPERATING, INC	CBM C #42-13	UNA	MIS,CBM		
P107770W	10/06/1997	44	71	13	NWNW	RIM OPERATING, INC	CBM C #11-13	UNA	MIS,CBM		
CU2/171A	10/27/1971	44	71	13	NWNW	INEXCO OIL CO.	CENTRAL-WSW #5-1 WELL	PU	IND		
CU2/294A	10/27/1971	44	71	13	NWNW	INEXCO OIL CO.	CENTRAL WSW #5-2 WELL	PU	IND		
P107771W	10/06/1997	44	71	13	SENW	RIM OPERATING, INC	CBM C #22-13	UNA	MIS,CBM		
P2970P	12/21/1939	44	71	13	NESW	MILLS LAND & LIVESTOCK CO., INC.	MILLS #19	PUW	STO		190
P107774W	10/06/1997	44	71	13	NWSE	RIM OPERATING, INC	CBM C #33-13	UNA	MIS,CBM		
P6348W	08/17/1970	44	71	14	SWNW	CARL J. SPRINGEN	SPRINGEN #1	PUW	STO		104
P106972W	08/01/1997	44	71	14	NESE	BARRETT RESOURCES CORP.	DURHAM RANCH FED. 43-14A	UNA	MON		820
P122968W	01/19/2000	44	71	15	NENE	BARRETT RESOURCES CORP.	MILLS 41-15-4471	UNA	CBM		
P122967W	01/19/2000	44	71	15	SWNE	BARRETT RESOURCES CORP.	MILLS 32-15-4471	UNA	CBM		

GROUNDWATER RIGHTS FOR LITTLE THUNDER LBA TRACT											
Permit No.	Priority	Tns	Rng	Sec	qq	Applicant	Facility Name	Status	Uses	Yld Act	T.D.
P122965W	01/19/2000	44	71	15	NWNW	BARRETT RESOURCES CORP.	MILLS 11-15-4471	UNA	CBM		
P122966W	01/19/2000	44	71	15	SENW	BARRETT RESOURCES CORP.	MILLS 22-15-4471	UNA	CBM		
P128535W	8/17/2000	44	71	15	NESW	BARRETT RESOURCES CORP.	MILLS FEDERAL 23-15-4471	UNA	CBM		
P128534W	8/17/2000	44	71	15	SWSW	BARRETT RESOURCES CORP.	MILLS FEDERAL 14-15-4471	UNA	CBM		
P46040W	12/04/1978	44	71	15	SESW	AMOCO PRODUCTION COMPANY**DALE MILLS	ROCKY HILLS FEDERAL #1	PUW	MIS		500
P122972W	01/19/2000	44	71	16	NENE	W.S.B.L.C.** BARRETT RESOURCES CORP.	STATE 41-16-4471	UNA	CBM		750
P41842W	02/16/1978	44	71	16	NENE	EARL A. BOLLER	PRAIRIE DOG #1	PU	STO		232
P52364W	03/28/1980	44	71	16	NENE	W.S.B.L.C.**ATLANTIC RICHFIELD COMPANY	ROCKY HILL W 2	PUW	MON,MIS		
P52365W	03/28/1980	44	71	16	NENE	W.S.B.L.C.** THUNDER BASIN COAL COMPANY	RH W1	PUW	MON,MIS		750
P41842W	02/16/1978	44	71	16	NWNE	EARL A. BOLLER	PRAIRIE DOG #1	PU	STO		232
P41844W	02/16/1978	44	71	16	NWNE	W.S.B.L.C.**ATLANTIC RICHFIELD COMPANY	RH 1 MCA 6	PUW	MON,MIS		
P52579W	06/23/1980	44	71	16	NWNE	W.S.B.L.C.**ATLANTIC RICHFIELD COMPANY	ROCKY HILL W 8	PUW	MON,MIS		
P52580W	06/23/1980	44	71	16	NWNE	W.S.B.L.C.**ATLANTIC RICHFIELD COMPANY	ROCKY HILL W 9	PUW	MON,MIS		
P52581W	06/23/1980	44	71	16	NWNE	W.S.B.L.C.**ATLANTIC RICHFIELD COMPANY	ROCKY HILL W 10	PUW	MON,MIS		
P52582W	06/23/1980	44	71	16	NWNE	W.S.B.L.C.**ATLANTIC RICHFIELD COMPANY	ROCKY HILL W-11	PUW	MON,MIS		
P52583W	06/23/1980	44	71	16	NWNE	W.S.B.L.C.**ATLANTIC RICHFIELD COMPANY	ROCKY HILL S 3	PUW	MON,MIS		
P52584W	06/23/1980	44	71	16	NWNE	W.S.B.L.C.**ATLANTIC RICHFIELD COMPANY	ROCKY HILL S 4	PUW	MON,MIS		
P122971W	01/19/2000	44	71	16	SWNE	W.S.B.L.C.** BARRETT RESOURCES CORP.	STATE 32-16-4471	UNA	CBM		810
P41842W	02/16/1978	44	71	16	SWNE	EARL A. BOLLER	PRAIRIE DOG #1	PU	STO		232
P122970W	01/19/2000	44	71	16	NENW	W.S.B.L.C.** BARRETT RESOURCES CORP.	STATE 21-16-4471	UNA	CBM		823
P52363W	03/28/1980	44	71	16	NWNW	W.S.B.L.C.**ATLANTIC RICHFIELD COMPANY	ROCKY HILL W 1	PUW	MON,MIS		
P53545W	09/07/1980	44	71	16	NWNW	W.S.B.L.C.**ATLANTIC RICHFIELD COMPANY	ROCKY HILL WA-7	PUW	MON,MIS		
P122969W	01/19/2000	44	71	16	SWNW	W.S.B.L.C.** BARRETT RESOURCES CORP.	STATE 12-16-4471	UNA	CBM		710
P53542W	08/07/1981	44	71	16	SWNW	W.S.B.L.C.**ATLANTIC RICHFIELD COMPANY	ROCKY HILL SA-1	PUW	MON,MIS		
P53543W	09/07/1980	44	71	16	SWNW	W.S.B.L.C.**ATLANTIC RICHFIELD COMPANY	ROCKY HILL SA-2	PUW	MON,MIS		
P53545W	09/07/1980	44	71	16	SWNW	W.S.B.L.C.**ATLANTIC RICHFIELD COMPANY	ROCKY HILL WA-7	PU	MON,MIS		
P40773W	11/07/1977	44	71	16	SENW	W.S.B.L.C.**ATLANTIC RICHFIELD COMPANY	WCH 2G	PUW	MON,MIS		
P41842W	02/16/1978	44	71	16	SENW	EARL A. BOLLER	PRAIRIE DOG #1	PU	STO		232
P41861W	02/16/1978	44	71	16	SENW	W.S.B.L.C.**ATLANTIC RICHFIELD COMPANY	RH 1-MCA-3	PUW	MON,MIS		
P42325W	03/10/1978	44	71	16	SENW	W.S.B.L.C.**ATLANTIC RICHFIELD COMPANY	RH1 IW 9	PUW	MON,MIS		
P42326W	03/10/1978	44	71	16	SENW	W.S.B.L.C.**ATLANTIC RICHFIELD COMPANY	RH1 IW 10	PUW	MON,MIS		
P42327W	03/10/1978	44	71	16	SENW	W.S.B.L.C.**ATLANTIC RICHFIELD COMPANY	RH1 IW 11	PUW	MON,MIS		
P49662W	08/17/1979	44	71	16	SENW	W.S.B.L.C.	RH1-P-2-B	PUW	MON,MIS		750
P121863W	12/29/1999	44	71	16	NESW	BARRETT RESOURCES CORP.** W.S.B.L.C.	STATE 23-16-4471	UNA	CBM		690
P41859W	02/16/1978	44	71	16	NESW	W.S.B.L.C.**ATLANTIC RICHFIELD COMPANY	RH 1-MUA-5	PU	MON,MIS		
P121862W	12/29/1999	44	71	16	SWSW	BARRETT RESOURCES CORP.** W.S.B.L.C.	STATE 14-16-4471	UNA	CBM		692
P52366W	03/28/1980	44	71	16	SWSW	W.S.B.L.C.**ATLANTIC RICHFIELD COMPANY	RH-W2	PUW	MON,MIS		
P122973W	01/19/2000	44	71	16	NESE	W.S.B.L.C.** BARRETT RESOURCES CORP.	STATE 43-16-4471	UNA	CBM		735
P122973W	01/19/2000	44	71	16	NESE	W.S.B.L.C.** BARRETT RESOURCES CORP.	STATE 43-16-4471	UNA	CBM		735
P54646W	11/20/1980	44	71	16	NESE	W.S.B.L.C.**EARL BOLLER	JUMPOFF #1	PUW	MON,STO,MIS		325
P46040W	12/04/1978	44	71	16	NWSE	AMOCO PRODUCTION COMPANY**DALE MILLS	ROCKY HILLS FEDERAL #1	PU	MIS		500
P121864W	12/29/1999	44	71	16	SWSE	BARRETT RESOURCES CORP.** W.S.B.L.C.	STATE 34-16-4471	UNA	CBM		702
P40361W	08/26/1977	44	71	16	SWSE	W.S.B.L.C.**ATLANTIC RICHFIELD COMPANY	WCH-2C	PUW	MON,MIS		
P123996W	3/13/2000	44	71	17	SWNW	BARRETT RESOURCES CORP.	DURHAM RANCH 12-17-4471	UNA	CBM		
P128536W	8/17/2000	44	71	17	NESW	BARRETT RESOURCES CORP.	BOLLER MILLS FED 23-17-4471	UNA	CBM		

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P128537W	8/17/2000	44	71	17	NESE	BARRETT RESOURCES CORP.	BOLLER MILLS FED 43-17-4471	UNA	CBM		
P122974W	01/19/2000	44	71	17	SWSE	BARRETT RESOURCES CORP.	BOLLER MILLS 34-17-4471	UNA	CBM		
P121867W	12/29/1999	44	71	20	SWNE	BARRETT RESOURCES CORP.	BOLLER-MILLS 32-20-4471	UNA	CBM		722
P121865W	12/29/1999	44	71	20	NENW	BARRETT RESOURCES CORP.	BOLLER-MILLS 21-20-4471	UNA	CBM		802
P121866W	12/29/1999	44	71	20	NESW	BARRETT RESOURCES CORP.	BOLLER-MILLS 23-20-4471	UNA	CBM		747
P13289P	12/31/1943	44	71	20	NWSW	DURHAM MEAT CO.	DURHAM MEAT #36	PUW	STO		108
P121868W	12/29/1999	44	71	20	SWSW	BARRETT RESOURCES CORP.	BOLLER-MILLS 34-20-4471	UNA	CBM		686
P123995W	3/13/2000	44	71	20	SWSW	BARRETT RESOURCES CORP.	DURHAM RANCH 14-20-4471	UNA	CBM		
P121869W	12/29/1999	44	71	20	NESE	BARRETT RESOURCES CORP.	BOLLER-MILLS 43-20-4471	UNA	CBM		642
P121876W	12/29/1999	44	71	21	NENE	BARRETT RESOURCES CORP.	DOROUGH TRUST 41-21-4471	UNA	CBM		763
P46040W	12/04/1978	44	71	21	NWNE	AMOCO PRODUCTION COMPANY**DALE MILLS	ROCKY HILLS FEDERAL #1	PU	MIS		500
P121874W	12/29/1999	44	71	21	SWNE	BARRETT RESOURCES CORP.	DOROUGH TRUST 32-21-4471	UNA	CBM		630
P121872W	12/29/1999	44	71	21	NENW	BARRETT RESOURCES CORP.	DOROUGH TRUST 21-21-4471	UNA	CBM		661
P121870W	12/29/1999	44	71	21	SWNW	BARRETT RESOURCES CORP.	DOROUGH TRUST 12-21-4471	UNA	CBM		630
P121873W	12/29/1999	44	71	21	NESW	BARRETT RESOURCES CORP.	DOROUGH TRUST 23-21-4471	UNA	CBM		590
P121871W	12/29/1999	44	71	21	SWSW	BARRETT RESOURCES CORP.	DOROUGH TRUST 14-21-4471	UNA	CBM		623
P121877W	12/29/1999	44	71	21	NESE	BARRETT RESOURCES CORP.	DOROUGH TRUST 43-21-4471	UNA	CBM		650
P121875W	12/29/1999	44	71	21	SWSE	BARRETT RESOURCES CORP.	DOROUGH TRUST 34-21-4471	UNA	CBM		580
P33051W	05/03/1976	44	71	21	SWSE	EARL A. BOLLER	BOLLER #2	PUW	DOM,STO		
P128463W	8/17/2000	44	71	22	NENW	BARRETT RESOURCES CORP.	MILLS FEDERAL 21-22-4471	UNA	CBM		
P128464W	8/17/2000	44	71	22	SWNW	BARRETT RESOURCES CORP.	MILLS FEDERAL 12-22-4471	UNA	CBM		
P3214P	08/24/1928	44	71	22	SESE	FERIBA F. FERGUSON	FERGUSON #1	PUW	DOM,STO		50
P121842W	12/27/1999	44	71	23	NWNE	RIM OPERATING, INC	CBM C #31-23	UNA	STO,CBM		
P2971P	12/21/1938	44	71	23	NWNE	MILLS LAND & LIVESTOCK CO., INC.	MILLS #20	PUW	STO		90
P2972P	09/03/1963	44	71	23	SWNE	MILLS LAND & LIVESTOCK CO., INC.	MILLS #21	PUW	STO		42
P123655W	2/28/2000	44	71	23	SENE	RIM OPERATING, INC	CBM C #42-23	UNA	STO,CBM		
P2972P	09/03/1963	44	71	23	SENW	MILLS LAND & LIVESTOCK CO., INC.	MILLS #21	PUW	STO		42
P2972P	09/03/1963	44	71	23	NESW	MILLS LAND & LIVESTOCK CO., INC.	MILLS #21	PUW	STO		42
P121841W	12/27/1999	44	71	23	NWSE	RIM OPERATING, INC	CBM C #33-23	UNA	STO,CBM		
P2972P	09/03/1963	44	71	23	NWSE	MILLS LAND & LIVESTOCK CO., INC.	MILLS #21	PUW	STO		42
P123654W	2/28/2000	44	71	23	SESE	RIM OPERATING, INC	CBM C #44-23	UNA	STO,CBM		
P123653W	2/28/2000	44	71	24	NWNW	RIM OPERATING, INC	CBM C #11-24	UNA	STO,CBM		
P128297W	8/14/2000	44	71	24	SENW	RIM OPERATING, INC	CBM C #22-24	UNA	STO,CBM		
P132543W	02/08/2001	44	71	24	NESW	RIM OPERATING, INC	CBM C # 23-24	UNA	STO,CBM		
P19252P	12/31/1920	44	71	24	NESW	ARK LAND COMPANY	REVLAND #4	UNA	STO		75
P123656W	2/28/2000	44	71	24	NWSW	RIM OPERATING, INC	CBM C #13-24	UNA	STO,CBM		
P123892W	3/6/2000	44	71	24	SESW	RIM OPERATING, INC	CBM C #24-24	UNA	STO,CBM		
P128289W	8/14/2000	44	71	24	NWSE	RIM OPERATING, INC	CBM C #33-24	UNA	STO,CBM		
P128290W	8/14/2000	44	71	24	SESE	RIM OPERATING, INC	CBM C #44-24	UNA	STO,CBM		
P121840W	12/27/1999	44	71	25	NWNE	RIM OPERATING, INC	CBM C #31-25	UNA	STO,CBM		
P128291W	8/14/2000	44	71	25	SENE	RIM OPERATING, INC	CBM C #42-25	UNA	STO,CBM		
P128291W	8/14/2000	44	71	25	SENE	RIM OPERATING, INC	CBM C #42-25	UNA	STO,CBM		
P2973P	12/31/1946	44	71	25	SENE	MILLS LAND & LIVESTOCK CO., INC.	MILLS #22	PUW	STO		90
P123657W	2/28/2000	44	71	25	NWNW	RIM OPERATING, INC	CBM C #11-25	UNA	STO,CBM		327
P123893W	3/6/2000	44	71	25	SENW	RIM OPERATING, INC	CBM C #22-25	UNA	STO,CBM		

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P123658W	2/28/2000	44	71	25	NWSW	RIM OPERATING, INC	CBM C #13-25	UNA	STO,CBM		
P123891W	3/6/2000	44	71	25	SESW	RIM OPERATING, INC	CBM C #24-25	UNA	STO,CBM		
P121839W	12/27/1999	44	71	25	NWSE	RIM OPERATING, INC	CBM C #33-25	UNA	STO,CBM		
P128292W	8/14/2000	44	71	25	SESE	RIM OPERATING, INC	CBM C #44-25	UNA	STO,CBM		
P121838W	12/27/1999	44	71	26	NWNE	RIM OPERATING, INC	CBM C #31-26	UNA	STO,CBM		
P128069W	8/4/2000	44	71	26	SENE	RIM OPERATING, INC	CBM C 42-26	UNA	STO,CBM		
P128293W	8/14/2000	44	71	26	NWNW	RIM OPERATING, INC	CBM C #11-26	GST	STO,CBM		422
P135823W	06/15/2001	44	71	26	NWNW	RIM OPERATING, INC	ENL CBM C # 11-26	GST	STO,CBM		422
P128295W	8/14/2000	44	71	26	SENW	RIM OPERATING, INC	CBM C #22-26	UNA	STO,CBM		407
P128294W	8/14/2000	44	71	26	NWSW	RIM OPERATING, INC	CBM C #13-26	GST	STO,CBM		437
P135822W	06/15/2001	44	71	26	NWSW	RIM OPERATING, INC	ENL CBM C # 13-26	GST	STO,CBM		437
P4046W	12/18/1969	44	71	26	NWSW	AXEL R. OSTLUND**F. F. FERGUSON	OSTLUND #1	PUW	MIS		210
P128296W	8/14/2000	44	71	26	SESW	RIM OPERATING, INC	CBM C #24-26	GST	STO,CBM		427
P135821W	06/15/2001	44	71	26	SESW	RIM OPERATING, INC	ENL CBM C # 24-26	GST	STO,CBM		427
P128070W	8/4/2000	44	71	26	NWSE	RIM OPERATING, INC	CBM C 33-26	UNA	STO,CBM		405
P128068W	8/4/2000	44	71	26	SESE	RIM OPERATING, INC	CBM C 44-26	UNA	STO,CBM		
P3215P	07/16/1930	44	71	27	SENE	W. L. FERGUSON	FERGUSON #1	PUW	DOM		24
P3216P	10/17/1944	44	71	27	SENE	W. L. FERGUSON	FERGUSON #2	PUW	DOM,STO		100
P131376W	12/04/2000	44	71	27	NENW	DAVID D. FERGUSON, ET AL. ** COLEMAN OIL & GAS, INC.	FERGUSON #21-27	UNA	STO,CBM		
P131375W	12/04/2000	44	71	27	SWNW	DAVID D. FERGUSON, ET AL. ** COLEMAN OIL & GAS, INC.	FERGUSON #12-27	UNA	STO,CBM		
P118864W	09/01/1999	44	71	27	NESW	BARRETT RESOURCES CORP.	CHITTENDEN 23-27	UNA	CBM		
P118863W	09/01/1999	44	71	27	SWSW	BARRETT RESOURCES CORP.	CHITTENDEN 14-27	UNA	CBM		503
P128585W	8/22/2000	44	71	27	NESE	BARRETT RESOURCES CORP.	FERGUSON 43-27-4471	UNA	CBM		
P128584W	8/22/2000	44	71	27	SWSE	BARRETT RESOURCES CORP.	FERGUSON 34-27-4471	UNA	CBM		
P121905W	12/29/1999	44	71	28	NENE	BARRETT RESOURCES CORP.	SNODGRASS 41-28-4471	UNA	CBM		583
P46040W	12/04/1978	44	71	28	NENE	AMOCO PRODUCTION COMPANY**DALE MILLS	ROCKY HILLS FEDERAL #1	PU	MIS		500
P118170W	08/06/1999	44	71	28	SWNE	BARRETT RESOURCES CORP.	STUART 14-28	UNA	CBM		607
P118171W	08/06/1999	44	71	28	SWNE	BARRETT RESOURCES CORP.	STUART 21-28	UNA	CBM		582
P121904W	12/29/1999	44	71	28	SWNE	BARRETT RESOURCES CORP.	SNODGRASS 32-28-4471	UNA	CBM		565
P121903W	12/29/1999	44	71	28	NENW	BARRETT RESOURCES CORP.	SNODGRASS 21-28-4471	UNA	CBM		609
P121902W	12/29/1999	44	71	28	SWNW	BARRETT RESOURCES CORP.	SNODGRASS 12-28-4471	UNA	CBM		622
P118171W	08/06/1999	44	71	28	NESW	BARRETT RESOURCES CORP.	STUART 21-28	UNA	CBM		582
P118170W	08/06/1999	44	71	28	SWSW	BARRETT RESOURCES CORP.	STUART 14-28	UNA	CBM		607
C27/359A	11/30/1906	44	71	28	SESW	JOHN MORTON SHEEP CO.	THUNDER BASIN #1 RES	PUO	STO		
P118866W	09/01/1999	44	71	28	NESE	BARRETT RESOURCES CORP.	CHITTENDEN 43-28	UNA	CBM		542
P118865W	09/01/1999	44	71	28	SWSE	BARRETT RESOURCES CORP.	CHITTENDEN 34-28	UNA	CBM		557
P118866W	09/01/1999	44	71	28	SWSE	BARRETT RESOURCES CORP.	CHITTENDEN 43-28	UNA	CBM		542
P121911W	12/29/1999	44	71	29	NENE	BARRETT RESOURCES CORP.	STUART 41-29-4471	UNA	CBM		662
P121910W	12/29/1999	44	71	29	SWNE	BARRETT RESOURCES CORP.	STUART 32-29-4471	UNA	CBM		642
P121908W	12/29/1999	44	71	29	NENW	BARRETT RESOURCES CORP.	STUART 21-29-4471	UNA	CBM		682
P121906W	12/29/1999	44	71	29	SWNW	BARRETT RESOURCES CORP.	STUART 12-29-4471	UNA	CBM		742
P121909W	12/29/1999	44	71	29	NESW	BARRETT RESOURCES CORP.	STUART 23-29-4471	UNA	CBM		690
P121907W	12/29/1999	44	71	29	SWSW	BARRETT RESOURCES CORP.	STUART 14-29-4471	UNA	CBM		722

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P118173W	08/06/1999	44	71	29	NESE	BARRETT RESOURCES CORP.	STUART 43-29	UNA	CBM		642
P118172W	08/06/1999	44	71	29	SWSE	BARRETT RESOURCES CORP.	STUART 34-29	UNA	CBM		683
P92738W	09/03/1993	44	71	29	SESE	JAMES R. AND IRENE STUART	ALICE #2	UNA	STO		100
P118175W	08/06/1999	44	71	32	NENE	BARRETT RESOURCES CORP.	STUART 41-32	UNA	CBM		622
P118174W	08/06/1999	44	71	32	SWNE	BARRETT RESOURCES CORP.	STUART 32-32	UNA	CBM		640
P118869W	09/01/1999	44	71	32	NENW	BARRETT RESOURCES CORP.	STUART 21-32	UNA	CBM		692
P118868W	09/01/1999	44	71	32	SWNW	BARRETT RESOURCES CORP.	STUART 12-32	UNA	CBM		710
P118185W	08/06/1999	44	71	32	NESW	BARRETT RESOURCES CORP.	FLOCCHINI 23-32	UNA	CBM		695
P118184W	08/06/1999	44	71	32	SWSW	BARRETT RESOURCES CORP.	FLOCCHINI 14-32	UNA	CBM		730
P118186W	08/06/1999	44	71	32	SESW	BARRETT RESOURCES CORP.	FLOCCHINI 34-32	UNA	CBM		652
P118187W	08/06/1999	44	71	32	NESE	BARRETT RESOURCES CORP.	FLOCCHINI 43-32	UNA	CBM		620
P118186W	08/06/1999	44	71	32	SWSE	BARRETT RESOURCES CORP.	FLOCCHINI 34-32	UNA	CBM		652
P118174W	08/06/1999	44	71	32	SESE	BARRETT RESOURCES CORP.	STUART 32-32	UNA	CBM		640
P118187W	08/06/1999	44	71	32	SESE	BARRETT RESOURCES CORP.	FLOCCHINI 43-32	UNA	CBM		620
P118182W	08/06/1999	44	71	33	NENE	BARRETT RESOURCES CORP.	STUART 41-33	UNA	CBM		580
P118180W	08/06/1999	44	71	33	SWNE	BARRETT RESOURCES CORP.	STUART 32-33	UNA	CBM		560
P118183W	08/06/1999	44	71	33	SENE	BARRETT RESOURCES CORP.	STUART 43-33	UNA	CBM		
P118178W	08/06/1999	44	71	33	NENW	BARRETT RESOURCES CORP.	STUART 21-33	UNA	CBM		610
P118172W	08/06/1999	44	71	33	SWNW	BARRETT RESOURCES CORP.	STUART 34-29	UNA	CBM		683
P118175W	08/06/1999	44	71	33	SWNW	BARRETT RESOURCES CORP.	STUART 41-32	UNA	CBM		622
P118176W	08/06/1999	44	71	33	SWNW	BARRETT RESOURCES CORP.	STUART 12-33	UNA	CBM		620
P118178W	08/06/1999	44	71	33	NESW	BARRETT RESOURCES CORP.	STUART 21-33	UNA	CBM		610
P118179W	08/06/1999	44	71	33	NESW	BARRETT RESOURCES CORP.	STUART 23-33	UNA	CBM		579
P118180W	08/06/1999	44	71	33	NESW	BARRETT RESOURCES CORP.	STUART 32-33	UNA	CBM		560
P118182W	08/06/1999	44	71	33	NESW	BARRETT RESOURCES CORP.	STUART 41-33	UNA	CBM		580
P118177W	08/06/1999	44	71	33	SWSW	BARRETT RESOURCES CORP.	STUART 14-33	UNA	CBM		577
P118179W	08/06/1999	44	71	33	SESW	BARRETT RESOURCES CORP.	STUART 23-33	UNA	CBM		579
P118181W	08/06/1999	44	71	33	SESW	BARRETT RESOURCES CORP.	STUART 34-33	UNA	CBM		505
P118183W	08/06/1999	44	71	33	NESE	BARRETT RESOURCES CORP.	STUART 43-33	UNA	CBM		
P118181W	08/06/1999	44	71	33	SWSE	BARRETT RESOURCES CORP.	STUART 34-33	UNA	CBM		505
P128454W	8/17/2000	44	71	34	NENW	BARRETT RESOURCES CORP.	STUART FEDERAL 21-34-4471	UNA	CBM		
P128456W	8/17/2000	44	71	34	SWNW	BARRETT RESOURCES CORP.	STUART FEDERAL 12-34-4471	UNA	CBM		
P128453W	08/17/2000	44	71	34	NESW	BARRETT RESOURCES CORP.	STUART FEDERAL 23-34-4471	UNA	CBM		
P128455W	8/17/2000	44	71	34	SWSW	BARRETT RESOURCES CORP.	STUART FEDERAL 14-34-4471	UNA	CBM		
P5971W	05/29/1970	44	71	34	NESE	STUART BROTHERS INC.	SWP #1	PUW	STO		245
P5972W	05/29/1970	44	71	34	NESE	STUART BROTHERS INC.	SWP #2	PUW	STO		250
P92345W	07/20/1993	44	71	34	SWSE	JAMES R. AND IRENE STUART	ALICE #1	UNA	DOM		630
P30419W	07/16/1975	44	71	35	NENE	ARK LAND COMPANY	REVLAND #1	UNA	DOM,STO		303
P128067W	8/4/2000	44	71	35	NWNE	RIM OPERATING, INC	CBM C 31-35	UNA	STO,CBM		
P128066W	8/4/2000	44	71	35	SENE	RIM OPERATING, INC	CBM C 42-35	UNA	STO,CBM		
P19250P	12/31/1961	44	71	35	SENE	ARK LAND COMPANY	REVLAND #5	UNA	DOM,STO		125
P33644W	06/02/1976	44	71	36	NENE	W.S.B.L.C.** THUNDER BASIN COAL CO., LLC	ECH 6	UNA	MON,MIS		395
P121835W	12/27/1999	44	71	36	NWNE	RIM OPERATING, INC	CBM C #31-36	UNA	STO,CBM		296
P125924W	5/25/2000	44	71	36	SENE	RIM OPERATING, INC** W.S.B.L.C.	CBM C #42-36	UNA	STO,CBM		
P121846W	12/27/1999	44	71	36	NWNW	RIM OPERATING, INC** W.S.B.L.C.	CBM C #11-36	UNA	STO,CBM		

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P125925W	5/25/2000	44	71	36	SENW	RIM OPERATING, INC** W.S.B.L.C.	CBM C #22-36	UNA	STO,CBM		355
P121845W	12/27/1999	44	71	36	NWSW	RIM OPERATING, INC** W.S.B.L.C.	CBM C #13-36	UNA	STO,CBM		
P125926W	5/25/2000	44	71	36	SESW	RIM OPERATING, INC** W.S.B.L.C.	CBM C #24-36	UNA	STO,CBM		
P121844W	12/27/1999	44	71	36	NWSE	RIM OPERATING, INC** W.S.B.L.C.	CBM C #33-36	UNA	STO,CBM		
P128065W	8/4/2000	44	71	36	SESE	W.S.B.L.C.** RIM OPERATING, INC	CBM C 44-36	UNA	STO,CBM		

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Permit No.	Priority	Tns	Rng	Sec	qq	Applicant	Facility Name	Status	Uses	Yld Act	T.D.
P111943W	04/01/98	42	69	6	NESW NESW NESW	TWO ELK GENERATION PARTNERS, TWO ELK GENERATION PARTNERS, LIMITED PARTNERSHIP	GRASS 5	UNA UNA	IND	11	120
P111942W	04/01/98	42	69	7	SESW SESW SESW	NORTH AMERICAN LAND & LIVESTOCK TWO ELK GENERATION PARTNERS, LIMITED PARTNERSHIP	RENO SPRING #T B 13	UNA	STO	1 2	8 1
P5855P	12/31/30	42	69	7	NWNW	RENO LIVESTOCK CORPORATION	GW42R11	UNA	MON,MIS	0	347
P67794W	06/26/84	42	69	7	NENE	USFS	NORTH TECKLA SPRING #T B 48		STO	0.5	8
P111939W	04/01/98	42	70	1	SWSW	TWO ELK GENERATION PARTNERS TWO ELK GENERATION PARTNERS, LIMITED PARTNERSHIP	GRASS 1	UNA	IND		
P5858P	06/08/62	42	70	2	SWSW	RENO LIVESTOCK CORPORATION	HEARTSPEAR 4		STO	2	255
P49892W	09/19/79	42	70	3	SESE	SHELL OIL COMPANY	3-16		MON,MIS	0	360
P50558W	10/31/79	42	70	3	SWSE	SHELL OIL COMPANY	3-15		MON,MIS	0	320
P50559W	10/31/79	42	70	3	SESW	SHELL OIL COMPANY	3-14		MON,MIS	0	340
P5857P	07/31/66	42	70	4	SWSW	ATLANTIC RICHFIELD COMPANY	HEARTSPEAR 3	UNA	STO	2	233
P5859P	12/31/70	42	70	6	SWSW	RENO LIVESTOCK CORPORATION	HEARTSPEAR 5		STO	2	UNK
P5865P	08/31/66	42	70	7	SENE	RENO LIVESTOCK CORPORATION**NAN HENDERSON	HEARTSPEAR 11		STO	1.5	75
P78847W	01/03/89	42	70	8	SESE	USFS	TB 259	UNA	STO		
P50557W	10/31/79	42	70	9	NWSE	SHELL OIL COMPANY	9-10		MON,MIS	0	390
P49896W	09/19/79	42	70	10	NENW	SHELL OIL COMPANY	10-3		MON,MIS	0	360
P49897W	09/19/79	42	70	10	NWSW	SHELL OIL COMPANY	10-12		MON,MIS	0	420
P50249W	10/04/79	42	70	10	NWSE	SHELL OIL COMPANY	10-10		MON,MIS	0	320
P50250W	10/04/79	42	70	11	NWNW	SHELL OIL COMPANY	11-4		MON,MIS	0	260
P54783W	11/20/80	42	70	11	NWNW	CABALLO ROJO INC.			MON,MIS	0	335
P8894W	04/23/71	42	70	11	SWNE	RENO LIVESTOCK CORPORATION	HEARTSPEAR 19	ADJ	STO	25	80
P49891W	09/19/79	42	70	14	NWNE	SHELL OIL COMPANY	14-2	UNA	MON,MIS	0	300
P50251W	10/04/79	42	70	14	NWNW	SHELL OIL COMPANY	14-4		MON,MIS	0	340
P49895W	09/19/79	42	70	15	NENW	SHELL OIL COMPANY	15-3		MON,MIS	0	400
P50555W	10/31/79	42	70	15	SENE	SHELL OIL COMPANY	15-8		MON,MIS	0	320
P50556W	10/31/79	42	70	15	SWNW	SHELL OIL COMPANY	15-5		MON,MIS	0	420
P8951P	03/20/61	42	70	15	SWSW	USFS	RENO #T B 52		STO	4	435
P116248W	06/04/99	42	70	16	SENE	MANX OIL CORPORATION** W.S.L.B.C.	BRADLEY CBM #16-1-2	UNA	STO,CBM		
P116249W	06/04/99	42	70	16	NWNE	MANX OIL CORPORATION** W.S.L.B.C.	BRADLEY CBM #16-2-1	UNA	STO,CBM		
P116821W	07/08/99	42	70	16	NENE	MANX OIL CORPORATION** W.S.L.B.C.	BRADLEY CBM #16-1-1	UNA	STO,CBM		
P116822W	07/08/99	42	70	16	SWNE	MANX OIL CORPORATION** W.S.L.B.C.	BRADLEY CBM #16-2-2	UNA	STO,CBM		
P8981P	08/02/66	42	70	18	NWSE	USFS	WILKINSON #T B 107		STO	4	110
P25605P	01/14/74	42	70	19	NESW	PAUL & EDITH RUTH WILKINSON	WILKINSON #1		STO,DOM	5	12
P40092W	08/22/77	42	70	21	SWSE	USFS	SEAM MONITORING WELL #1-D		MON,MIS	0	255
P40093W	08/22/77	42	70	21	SWSE	USFS	SEAM MONITORING WELL #1-F		MON,MIS	0	200
P42620W	03/10/78	42	70	21	SESE	USFS	SEAM MONITOR WELL #23		MON,MIS	0	200
P67797W	06/26/84	42	70	23	NESE	USFS	RENO SPRING #T B 17		STO	1	8
P12746P	12/30/50	42	70	25	NESW	USFS	EDWARDS #TB 32		STO	4	98
P8960P	07/31/64	42	70	26	SWSW	USFS	EDWARDS #T B 84		STO	4	464
P39795W	07/29/77	42	70	27	NWNE	USFS	SEAM MONITORING WELL #1		MON,MIS	0	165
P40091W	08/22/77	42	70	27	SESE	USFS	SEAM MONITORING WELL #1-B		MON,MIS	0	165
P40097W	08/22/77	42	70	27	SESE	USFS	SEAM MONITORING WELL #2-J		MON,MIS	0	35
P42628W	03/10/78	42	70	27	SWSE	USFS	SEAM MONITOR WELL #31		MON,MIS	0	200
P42629W	03/10/78	42	70	27	SWSW	USFS	SEAM MONITOR WELL #32		MON,MIS	0	200

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P42632W	03/10/78	42	70	27	SESE	USFS	SEAM MONITOR WELL #35		MON,MIS	0	35
P12757P	12/30/50	42	71	2	NENW	USFS	REVLAND #TB 35		STO	4	165
P44327W	07/20/78	42	71	2	NWSW	USFS	MARG #2		STO	3	373
P101801W	03/20/96	42	71	3	NESW	BRIDLE BIT RANCH CO.	BBRC BLACK BUTTE #1	UNA	STO	20	264
P98861W	04/21/95	42	71	10	NWNE	JERRY DILTS	BBRC BIRDSALL #1	UNA	STO	20	380
P32145W	02/10/76	42	71	11	SWNE	USFS	STUART #T.B. 174		STO	10	380
P8987P	07/13/61	42	71	12	SESE	USFS	STUART #T.B. 115		STO	4	172
P12755P	12/30/50	42	71	13	SWSW	USFS	STUART #T.B. 36		STO	4	121
P61754W	08/11/82	42	71	24	NWSE	USFS	PCC WILKINSON RANCH #1		STO	5	110
P25606P	01/14/74	42	71	26	NESE	PAUL & EDITH RUTH WILKINSON	WILKINSON #2		STO,DOM	2.5	220
P25608P	01/14/74	42	71	26	SWNW	PAUL & EDITH RUTH WILKINSON	WILKINSON #4		STO	4	110
P5848W	06/16/70	42	71	26	SWNW	PAUL WILKINSON	MIDDLE PASTURE #1		STO	2.5	140
P29746W	05/07/75	42	71	27	NENW	USFS	WRIGHT #T.B.195		STO	10	175
P34482W	08/12/76	43	70	15	NWSW	WRRI	LTB-5A		MON,MIS	0	18
P34486W	08/12/76	43	70	15	NWSW	WRRI	LTB-5B		MON,MIS	0	18
P34490W	08/12/76	43	70	15	NWSW	WRRI	LTB-5C		MON,MIS	0	20
P67506W	05/31/84	43	70	15	NESW	JACOBS LAND & LIVESTOCK COMPANY	JRM 15 2R	UNA	MON	0	83
P34493W	08/12/76	43	70	16	NESE	WRRI	LTB-5D	UNA	MON,MIS	0	14
P34495W	08/12/76	43	70	16	NESE	WRRI	LTB-5E		MON,MIS	0	14
P4393W	01/20/70	43	70	19	NESE	USFS	RENO LIVESTOCK #T B 146		STO	5	390
P25120W	12/10/73	43	70	22	SWSE	ATLANTIC RICHFIELD COMPANY	BTR-WW #10A		MON,MIS	0	142
P34503W	08/12/76	43	70	22	SESE	WRRI	LTB-12		MON,MIS	0	57
P5864P	12/31/24	43	70	22	NENE	WRRI** W.S.B.L.C.	HEARTSPEAR 10		STO	2	UNK
P34481W	08/12/76	43	70	26	SENW	WRRI** W.S.B.L.C.	LTB-4A	UNA	MON,MIS	0	20
P34485W	08/12/76	43	70	26	NENW	WRRI** W.S.B.L.C.	LTB-4B	UNA	MON,MIS	0	25
P34489W	08/12/76	43	70	26	SENW	WRRI** W.S.B.L.C.	LTB-4C	UNA	MON,MIS	0	22
P34492W	08/12/76	43	70	26	SENW	WRRI** W.S.B.L.C.	LTB-4D	UNA	MON,MIS	0	20
P34494W	08/12/76	43	70	26	SENW	WRRI** W.S.B.L.C.	LTB-4E	UNA	MON,MIS	0	20
P34496W	08/12/76	43	70	26	SENW	WRRI** W.S.B.L.C.	LTB 4F	UNA	MON,MIS	0	20
P34497W	08/12/76	43	70	26	NENW	WRRI** W.S.B.L.C.	LTB-6	UNA	MON,MIS	0	49
P34498W	08/12/76	43	70	26	SENW	WRRI** W.S.B.L.C.	LTB-7	UNA	MON,MIS	0	25
P34499W	08/12/76	43	70	26	SWNW	WRRI** W.S.B.L.C.	LTB-8	UNA	MON,MIS	0	9
P34500W	08/12/76	43	70	26	NWNE	WRRI** W.S.B.L.C.	LTB-9	UNA	MON,MIS	0	28
P34501W	08/12/76	43	70	26	NWNW	WRRI** W.S.B.L.C.	LTB-10	UNA	MON,MIS	0	19
P26431W	04/08/74	43	70	27	SENE	ATLANTIC RICHFIELD COMPANY	BTR WW-24		MON,MIS	0	40
P34502W	08/12/76	43	70	27	NENE	WRRI	LTB-11		MON,MIS	0	90
P34480W	08/12/76	43	70	29	SENW	WRRI	LTB-3A		MON,MIS	0	16
P34484W	08/12/76	43	70	29	SENW	WRRI	LTB-3B		MON,MIS	0	14
P34488W	08/12/76	43	70	29	SENW	WRRI	LTB-3C		MON,MIS	0	14
P5861P	08/31/66	43	70	32	NWSE	RENO LIVESTOCK CORPORATION	HEARTSPEAR 7		STO	2	233
P7408W	12/15/70	43	70	32	SWNE	RENO LIVESTOCK CORPORATION	HEARTSPEAR 17		STO	25	130
P132395W	01/29/01	43	70	36	NESE	SPECTRUM EXPLORATION, INC** W.S.B.L.C.	TB 1	UNA	MON		
P132396W	01/29/01	43	70	36	NWNE	SPECTRUM EXPLORATION, INC** W.S.B.L.C.	TB 2	UNA	MON		
P132397W	01/29/01	43	70	36	SENW	SPECTRUM EXPLORATION, INC** W.S.B.L.C.	TB 3	UNA	MON		
P111940W	04/01/98	43	70	36	SWNW	W.S.B.L.C.** NORTH AMERICAN LAND & LIVESTOCK LLC** TWO ELK GENERATION PARTNERS,	GRASS 2	UNA	IND		
P132625W	02/20/01	43	70	36	NESE	O'KEEFE DRILLING CO., INC.** W.S.B.L.C.	MW 2	UNA	MON		
P132626W	02/20/01	43	70	36	NESE	O'KEEFE DRILLING CO., INC.** W.S.B.L.C.	MW 3	UNA	MON		
P132624W	02/20/01	43	70	36	NESE	O'KEEFE DRILLING CO., INC.** W.S.B.L.C.	MW 1	UNA	MON		

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P132648W	02/26/01	43	70	36	SWNW	O'KEEFE DRILLING CO., INC.** W.S.B.L.C.	MW4	UNA	MON		
P132545W	02/08/01	43	71	13	NENE	RIM OPERATING, INC	CBM D # 41-13	UNA	STO,CBM		
P112580W	10/30/98	43	71	13	NWNW	BARRETT RESOURCES CORP.	YOUNG 11-13	UNA	CBM	29	410
P121919W	12/30/99	43	71	13	SENW	BARRETT RESOURCES CORP.	ARCH 22-13	UNA	CBM		
P121920W	12/30/99	43	71	13	SESW	BARRETT RESOURCES CORP.	ARCH 22-13	UNA	CBM		
P121989W	12/31/99	43	71	13	NWSW	BARRETT RESOURCES CORP.	ARCH 13-13	UNA	CBM		
P123115W	02/07/00	43	71	13	SESE	BARRETT RESOURCES CORP.	HOPKINS TRUST 44-13-4371	UNA	CBM		
P123116W	02/07/00	43	71	13	NWSE	BARRETT RESOURCES CORP.	ARCH 33-13-4371	UNA	CBM		
P5862P	08/31/68	43	71	13	NESW	RENO LIVESTOCK CORPORATION	HEARTSPEAR 8		STO	2	324
P121921W	12/30/99	43	71	14	SENE	BARRETT RESOURCES CORP.	ARCH 42-14	UNA	CBM		
P121922W	12/30/99	43	71	14	SESE	BARRETT RESOURCES CORP.	ARCH 44-14	UNA	CBM		
P123111W	02/07/00	43	71	14	NESW	BARRETT RESOURCES CORP.	REVLAND TRUST 23-14-4371	UNA	CBM		
P123112W	02/07/00	43	71	14	NENW	BARRETT RESOURCES CORP.	REVLAND TRUST 21-14-4371	UNA	CBM		
P123113W	02/07/00	43	71	14	SWSW	BARRETT RESOURCES CORP.	REVLAND TRUST 14-14-4371	UNA	CBM		
P123114W	02/07/00	43	71	14	SWNW	BARRETT RESOURCES CORP.	REVLAND TRUST 12-14-4371	UNA	CBM		
P19253P	12/31/50	43	71	14	SENW	KENNETH & SYLVIA REVLAND	REVLAND #3		STO	7.5	80
P128492W	08/17/00	43	71	14	SWNE	USFS** BARRETT RESOURCES CORP.	FEDERAL 32-14-4371	UNA	CBM		
P128493W	08/17/00	43	71	14	SWSE	USFS** BARRETT RESOURCES CORP.	FEDERAL 34-14-4371	UNA	CBM		
P124922W	04/19/00	43	71	21	SWSE	USFS** BARRETT RESOURCES CORP.	FEDERAL 34-21	UNA	CBM		
P124923W	04/19/00	43	71	21	NESE	USFS** BARRETT RESOURCES CORP.	FEDERAL 43-21	UNA	CBM		
P32088W	01/16/76	43	71	21	SENE	UNIVERSITY OF WYOMING WRRI	LTB 2A		MON,MIS	0	100
P32089W	01/16/76	43	71	21	SENE	UNIVERSITY OF WYOMING WRRI	LTB 2B		MON,MIS	0	200
P32090W	01/16/76	43	71	21	SENE	UNIVERSITY OF WYOMING WRRI	LTB 2C		MON,MIS	0	574
P84348W	02/05/91	43	71	21	SENE	USFS	EDWARDS #T.B. 266	UNA	STO	2.5	574
P124924W	04/19/00	43	71	22	NESW	USFS** BARRETT RESOURCES CORP.	FEDERAL 23-22	UNA	CBM		
P121923W	12/30/99	43	71	22	SWNE	BARRETT RESOURCES CORP.	ARCH 32-22	UNA	CBM	45	541
P121924W	12/30/99	43	71	22	SWSE	BARRETT RESOURCES CORP.	ARCH 34-22	UNA	CBM	45	540
P121925W	12/30/99	43	71	22	NENE	BARRETT RESOURCES CORP.	ARCH 41-22	UNA	CBM	45	531
P121926W	12/30/99	43	71	22	NESE	BARRETT RESOURCES CORP.	ARCH 43-22	UNA	CBM	45	514
P8912W	05/04/71	43	71	22	NWNW	USFS	RENO #T.B. 152		STO	4	UNK
P8913W	05/24/71	43	71	22	SWNW	USFS	RENO #T.B. 153		STO	5	UNK
P128498W	08/17/00	43	71	22	NWNW	USFS** BARRETT RESOURCES CORP.	BRC FEDERAL 11-22-4371	UNA	CBM		
P128499W	08/17/00	43	71	22	SENW	USFS** BARRETT RESOURCES CORP.	BRC FEDERAL 22-22-4371	UNA	CBM		
P128499W	08/17/00	43	71	22	SENW	USFS** BARRETT RESOURCES CORP.	BRC FEDERAL 22-22-4371	UNA	CBM		
P128500W	08/17/00	43	71	22	NESW	USFS** BARRETT RESOURCES CORP.	BRC FEDERAL 23-22r-4371	UNA	CBM		
P128526W	08/17/00	43	71	22	SWSW	USFS** BARRETT RESOURCES CORP.	BRC FEDERAL 14-22R-4371	UNA	CBM		
P124926W	04/19/00	43	71	23	SWSE	USFS** BARRETT RESOURCES CORP.	FEDERAL 34-23	UNA	CBM		
P124925W	04/19/00	43	71	23	SWSW	USFS** BARRETT RESOURCES CORP.	FEDERAL 14-23	UNA	CBM		
P44326W	07/20/78	43	71	23	SWSW	USFS	MARG #1		STO	3	375
P128501W	08/17/00	43	71	23	SWSW	USFS** BARRETT RESOURCES CORP.	BRC FEDERAL 14-23	UNA	CBM		
P128502W	08/17/00	43	71	23	NENW	USFS** BARRETT RESOURCES CORP.	BRC FEDERAL 21-23-4371	UNA	CBM		
P128503W	08/17/00	43	71	23	NESW	USFS** BARRETT RESOURCES CORP.	BRC FEDERAL 23-23-4371	UNA	CBM		
P128504W	08/17/00	43	71	23	SWNE	USFS** BARRETT RESOURCES CORP.	BRC FEDERAL 32-23-4371	UNA	CBM		
P128505W	08/17/00	43	71	23	SWSE	USFS** BARRETT RESOURCES CORP.	BRC FEDERAL 34-23	UNA	CBM		
P128506W	08/17/00	43	71	23	NENE	USFS** BARRETT RESOURCES CORP.	BRC FEDERAL 41-23-4371	UNA	CBM		
P128507W	08/17/00	43	71	23	NESE	USFS** BARRETT RESOURCES CORP.	BRC FEDERAL 43-23-4371	UNA	CBM		
P128525W	08/17/00	43	71	23	SWNW	USFS** BARRETT RESOURCES CORP.	BRC FEDERAL 12-23-4371	UNA	CBM		
P124927W	04/19/00	43	71	24	SWSW	USFS** BARRETT RESOURCES CORP.	FEDERAL 14-24	UNA	CBM		
P121927W	12/30/99	43	71	24	SENW	BARRETT RESOURCES CORP.	ARCH 22-24	UNA	CBM		
P121928W	12/30/99	43	71	24	NWNE	BARRETT RESOURCES CORP.	ARCH 31-24	UNA	CBM		

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Permit No.	Priority	Tns	Rng	Sec	qq	Applicant	Facility Name	Status	Uses	Yld Act	T.D.
P128508W	08/17/00	43	71	24	SWNW	USFS** BARRETT RESOURCES CORP.	BRC FEDERAL 12-24-4371	UNA	CBM		
P128509W	08/17/00	43	71	24	SWSW	USFS** BARRETT RESOURCES CORP.	BRC FEDERAL 14-24	UNA	CBM		
P128510W	08/17/00	43	71	24	NESW	USFS** BARRETT RESOURCES CORP.	BRC FEDERAL 23-24-4371	UNA	CBM		
P128511W	08/17/00	43	71	24	SWSE	USFS** BARRETT RESOURCES CORP.	BRC FEDERAL 34-24-4371	UNA	CBM		
P112564W	10/30/98	43	71	25	NWNW	BARRETT RESOURCES CORP.	FEDERAL 11-25	UNA	CBM	24	398
P112565W	10/30/98	43	71	25	SWNW	BARRETT RESOURCES CORP.	FEDERAL 12-25	UNA	CBM	32	375
P112566W	10/30/98	43	71	25	SENW	BARRETT RESOURCES CORP.	FEDERAL 22-25	UNA	CBM	12	370
P5860P	12/31/30	43	71	25	SESE	RENO LIVESTOCK CORPORATION	HEARTSPEAR 6		STO	1.5	UNK
P112567W	10/30/98	43	71	26	SWNE	BARRETT RESOURCES CORP.	FEDERAL 32-26	UNA	CBM	20	449
P112568W	10/30/98	43	71	26	NWSE	BARRETT RESOURCES CORP.	FEDERAL 33-26	UNA	CBM	20	420
P112569W	10/30/98	43	71	26	SWSE	BARRETT RESOURCES CORP.	FEDERAL 34-26	UNA	CBM	15	428
P112570W	10/30/98	43	71	26	SENE	BARRETT RESOURCES CORP.	FEDERAL 42-26	UNA	CBM	14	395
P112571W	10/30/98	43	71	26	NESE	ENERNET OF WYOMING LLC	FEDERAL 43-26	UNA	CBM	30	420
P112572W	10/30/98	43	71	26	SESE	BARRETT RESOURCES CORP.	FEDERAL 44-26	UNA	CBM	20	427
P113320W	12/14/98	43	71	26	SWSW	BARRETT RESOURCES CORP.	ARCH 14-26	UNA	CBM	20	452
P113321W	12/14/98	43	71	26	SWNW	BARRETT RESOURCES CORP.	ARCH 12-26	UNA	CBM	25	444
P113322W	12/14/98	43	71	26	NESW	BARRETT RESOURCES CORP.	ARCH 23-26	UNA	CBM	20	451
P113855W	02/01/99	43	71	26	SENW	BARRETT RESOURCES CORP.	ARCH 22-26	UNA	STO,CBM	30	465
P112579W	10/30/98	43	71	27	NENW	BARRETT RESOURCES CORP.	FEDERAL 21-27	UNA	CBM	50	550
P113675W	12/30/98	43	71	27	NESE	BARRETT RESOURCES CORP.	ARCH 43-27	UNA	CBM, STO	20	461
P113676W	12/30/98	43	71	27	SENE	BARRETT RESOURCES CORP.	ARCH 42-27	UNA	CBM	20	463
P113677W	12/30/98	43	71	27	SWNE	BARRETT RESOURCES CORP.	ARCH 32-27	UNA	CBM, STO	20	459
P113678W	12/30/98	43	71	27	SWSE	BARRETT RESOURCES CORP.	ARCH 34-27	UNA	CBM, STO	20	479
P116992W	06/28/99	43	71	27	SWNE	BARRETT RESOURCES CORP.	ENL ARCH 32-27	UNA	CBM	50	459
P116993W	06/28/99	43	71	27	SWNE	BARRETT RESOURCES CORP.	ENL ARCH 34-27	UNA	CBM	50	479
P116994W	06/28/99	43	71	27	SENE	BARRETT RESOURCES CORP.	ENL ARCH 42-27	UNA	CBM	50	463
P116995W	06/28/99	43	71	27	NESE	BARRETT RESOURCES CORP.	ENL ARCH 43-27	UNA	CBM	50	461
P128512W	08/17/00	43	71	27	SWNW	USFS** BARRETT RESOURCES CORP.	BTP 12-27 FEDERAL	UNA	CBM		
P128513W	08/17/00	43	71	27	SWSW	USFS** BARRETT RESOURCES CORP.	BTP 14-27 FEDERAL	UNA	CBM		
P128514W	08/17/00	43	71	27	NESW	USFS** BARRETT RESOURCES CORP.	BTP 23-27 FEDERAL	UNA	CBM		
P124262W	03/23/00	43	71	28	SWSW	BARRETT RESOURCES CORP.	SMITH 14-28-4371	UNA	CBM		
P101905W	03/26/96	43	71	28	SWNW	BRIDLE BIT RANCH CO.	BBRC BLACK BUTTE #2	UNA	STO	5	184
P124256W	03/23/00	43	71	33	NENW	BARRETT RESOURCES CORP.	MATHESON 21-33-4371	UNA	CBM		
P124257W	03/23/00	43	71	33	SWNW	BARRETT RESOURCES CORP.	MATHESON 12-33-4371	UNA	CBM		
P128515W	08/17/00	43	71	33	SWNE	BARRETT RESOURCES CORP.	MATHESON FEDERAL 32-33-4371	UNA	CBM		
P128516W	08/17/00	43	71	33	SWSE	BARRETT RESOURCES CORP.	MATHESON FEDERAL 34-33-4371	UNA	CBM		
P128517W	08/17/00	43	71	33	NENE	BARRETT RESOURCES CORP.	MATHESON FEDERAL 41-33-4371	UNA	CBM		
P128518W	08/17/00	43	71	33	NESE	USFS** BARRETT RESOURCES CORP.	MATHESON FEDERAL 43-33-4371	UNA	CBM		
P113674W	12/30/98	43	71	34	NWNW	BARRETT RESOURCES CORP.	DILTS 11-34	UNA	CBM, STO	20	489
P113784W	01/25/99	43	71	34	NWSW	BARRETT RESOURCES CORP.	DILTS 13-34	UNA	STO,CBM	20	570
P113785W	01/25/99	43	71	34	NESW	BARRETT RESOURCES CORP.	DILTS 23-34	UNA	STO,CBM	20	566
P114640W	03/18/99	43	71	34	NENW	BARRETT RESOURCES CORP.	DILTS 21-34	UNA	CBM	20	471
P116808W	06/28/99	43	71	34	SWNE	BARRETT RESOURCES CORP.	FEDERAL 32-34	UNA	STO,CBM	55	515
P116809W	06/28/99	43	71	34	NENE	BARRETT RESOURCES CORP.	FEDERAL 41-34	UNA	STO,CBM	55	515
P116996W	06/28/99	43	71	34	NWNW	BARRETT RESOURCES CORP.	ENL DILTS 11-34	UNA	CBM	50	489
P116997W	06/28/99	43	71	34	NWSW	BARRETT RESOURCES CORP.	ENL DILTS 13-34	UNA	CBM	50	570
P116998W	06/28/99	43	71	34	NENW	BARRETT RESOURCES CORP.	ENL DILTS 21-34	UNA	CBM	50	471
P116999W	06/28/99	43	71	34	NESW	BARRETT RESOURCES CORP.	ENL DILTS 23-34	UNA	CBM	50	566
P44328W	07/20/78	43	71	34	NWSE	USFS	MARG #3		STO	60	353
P128519W	08/17/00	43	71	34	SWSE	USFS** BARRETT RESOURCES CORP.	ARCH FEDERAL 34-34-4371	UNA	CBM		

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Permit No.	Priority	Tns	Rng	Sec	qq	Applicant	Facility Name	Status	Uses	Yld Act	T.D.
P128520W	08/17/00	43	71	34	NESE	BARRETT RESOURCES CORP.	ARCH FEDERAL 43-34-4371	UNA	CBM		
P124928W	04/19/00	43	71	35	NESE	USFS** BARRETT RESOURCES CORP.	FEDERAL 43-35	UNA	CBM		
P112562W	10/30/98	43	71	35	SENE	BARRETT RESOURCES CORP.	FEDERAL 42-35	UNA	CBM	20	422
P112563W	10/30/98	43	71	35	NENE	BARRETT RESOURCES CORP.	FEDERAL 41-25	UNA	CBM	0	0
P112573W	10/30/98	43	71	35	NWNW	BARRETT RESOURCES CORP.	FEDERAL 11-35	UNA	CBM	11	480
P112574W	10/30/98	43	71	35	SWNW	BARRETT RESOURCES CORP.	FEDERAL 12-35	UNA	CBM	27	508
P112575W	10/30/98	43	71	35	SENE	BARRETT RESOURCES CORP.	FEDERAL 21-35	UNA	CBM	30	478
P112576W	10/30/98	43	71	35	SENE	BARRETT RESOURCES CORP.	FEDERAL 22-35	UNA	CBM	22	489
P112577W	10/30/98	43	71	35	NWNE	BARRETT RESOURCES CORP.	FEDERAL 31-35	UNA	CBM	22	428
P112578W	10/30/98	43	71	35	SWNE	BARRETT RESOURCES CORP.	FEDERAL 32-35	UNA	CBM	22	423
P113671W	12/30/98	43	71	35	NENE	BARRETT RESOURCES CORP.	FEDERAL 41-35	UNA	CBM	20	387
P14237W	06/14/72	43	71	35	SWNW	USFS	STUART #T.B. 165		STO	5	275
P128521W	08/17/00	43	71	35	SWSW	USFS** BARRETT RESOURCES CORP.	FEDERAL 14-35-4371	UNA	CBM		
P128522W	08/17/00	43	71	35	NESW	USFS** BARRETT RESOURCES CORP.	FEDERAL 23-35-4371	UNA	CBM		
P128523W	08/17/00	43	71	35	SWSE	USFS** BARRETT RESOURCES CORP.	FEDERAL 34-35-4371	UNA	CBM		
P128524W	08/17/00	43	71	35	NESE	USFS** BARRETT RESOURCES CORP.	BRC FEDERAL 43-35	UNA	CBM		
P111368W	08/07/98	43	71	36	SENE	W.S.B.L.C** YATES PETROLEUM CORP.	RENO CS STATE #1	UNA	STO,MIS,CBM	25	376
P112081W	09/30/98	43	71	36	SENE	W.S.B.L.C** YATES PETROLEUM CORP.	ENL RENO CS STATE #1	UNA	STO,MIS,CBM	25	376
P115174W	04/12/99	43	71	36	NENW	W.S.B.L.C** YATES PETROLEUM CORP.	RENO CS STATE #2	UNA	STO,CBM	100	375
P115175W	04/12/99	43	71	36	NWNW	W.S.B.L.C** YATES PETROLEUM CORP.	RENO CS STATE #3	UNA	STO,CBM	100	397
P115176W	04/12/99	43	71	36	SWSE	YATES PETROLEUM CORP.** W.S.B.L.C	RENO CS STATE #6	UNA	STO,CBM	100	377
P115177W	04/12/99	43	71	36	NENE	YATES PETROLEUM CORP.** W.S.B.L.C	RENO CS STATE #7	UNA	STO,CBM	100	364
P115178W	04/12/99	43	71	36	NWNE	YATES PETROLEUM CORP.** W.S.B.L.C	RENO CS STATE #8	UNA	STO,CBM	100	380
P115179W	04/12/99	43	71	36	SENE	YATES PETROLEUM CORP.** W.S.B.L.C	RENO CS STATE #9	UNA	STO,CBM	100	357
P115180W	04/12/99	43	71	36	NESE	YATES PETROLEUM CORP.** W.S.B.L.C	RENO CS STATE #10	UNA	STO,CBM	100	355
P117263W	04/12/99	43	71	36	NWSW	YATES PETROLEUM CORP.** W.S.B.L.C	RENO CS STATE #12	UNA	STO,CBM	100	389
P117264W	04/12/99	43	71	36	SESW	YATES PETROLEUM CORP.** W.S.B.L.C	RENO CS STATE #14	UNA	STO,CBM	100	394
P117265W	04/12/99	43	71	36	SWSW	YATES PETROLEUM CORP.** W.S.B.L.C	RENO CS STATE #13	UNA	STO,CBM	100	394
P117266W	04/12/99	43	71	36	SESE	YATES PETROLEUM CORP.** W.S.B.L.C	RENO CS STATE #11	UNA	STO,CBM	100	359
P117267W	04/12/99	43	71	36	SWNW	YATES PETROLEUM CORP.** W.S.B.L.C	RENO CS STATE #4	UNA	STO,CBM	100	395
P117268W	04/12/99	43	71	36	NESW	YATES PETROLEUM CORP.** W.S.B.L.C	RENO CS STATE #5	UNA	STO,CBM	100	382

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Permit No.	Priority	Tns	Rng	Sec	qq	Applicant	Facility Name	Status	Uses	Yld Act	T.D.
P44332W	07/20/78	40	70	6	NWSE	USFS	MARG #7		STO	8	722
P8967P	05/01/65	40	71	1	SESE	USFS	MORTON #T B 93		STO	4	565
P37364W	04/19/77	40	71	3	NESW	USFS	ISENBERGER # TB 206		STO	10	585
P59883W	03/22/82	40	71	7	NENW	DONALD B. JACOBS	HOUSE #2		DOM	25	1275
P44333W	07/20/78	40	71	13	NESE	USFS	MARG #8		STO	3	405
P62923W	12/28/82	40	71	15	NWSW	USGS WATER RESOURCES DIV.	USGS BR-10		MON,MIS	0	231
P62924W	12/28/82	40	71	17	NENE	USGS WATER RESOURCES DIV.	USGS BR-11		MON,MIS	0	127
P12753P	12/30/63	40	71	17	NESE	USFS	JACOBS #TB 92		STO	4	UNK
P4524P	12/31/59	40	71	19	NWNE	USFS	HAEFELE #T B 47		STO	5	700
P132640W	02/16/01	40	71	23	NESW	WY DEPT OF TRANSPORTATION	ENL. AMES NO. 1	UNA	STO,MIS		
P18839P	05/31/51	40	72	10	NWNW	INC. FLOYD C. RENO & SON'S	STEVICK WELL #3		STO	10	550
P59882W	03/22/82	40	72	12	NWNE	DONALD B. JACOBS	ILES #1		STO	5	640
P12477P	12/31/30	40	72	13	SESW	DUANE & CHLOE HAEFELE	HAEFELE #1 1930		DOM,STO	10	880
P12478P	12/31/33	40	72	14	NESE	DUANE & CHLOE HAEFELE	HAEFELE #2 1933		DOM,STO	15	640
P12479P	12/31/52	40	72	23	NESW	DUANE & CHLOE HAEFELE	HAEFELE #3 1952	UNA	STO	20	UNK
P25607P	14-Jan-74	41	70	6	NWSE	PAUL & EDITH RUTH WILKINSON	WILKINSON #3		STO	4	805
P33290W	17-May-76	41	70	18	SENW	USFS	BELL #T B 199 (DEEPENED)		STO	10	644
P108419W	16-Dec-97	41	71	1	NWSW	REDSTONE RESOURCES, INC	FEDERAL 13AC-111	UNA	STO,MIS,CBM		
P71738W	14-Jan-86	41	71	1	SWNW	USFS	WILKINSON SPRING TB #55	UNA	STO		
P95333W	30-Jul-81	41	71	2	NENE	FRANCES PUTNAM	JINX #2	UNA	DOM,STO	6	360
P95332W	12-Feb-86	41	71	2	NENE	FRANCES PUTNAM	JINX #3	UNA	DOM,STO	20	480
P129458W	18-Sep-00	41	71	2	NENE	INDEPENDENT PRODUCTION CO., INC.	SEARCHLIGHT #41-2	UNA	STO,CBM		
P129461W	18-Sep-00	41	71	2	NESE	INDEPENDENT PRODUCTION CO., INC.	SEARCHLIGHT #43-2	UNA	STO,CBM		
P129452W	18-Sep-00	41	71	2	NWNE	INDEPENDENT PRODUCTION CO., INC.	SEARCHLIGHT #31-2	UNA	STO,CBM		
P129447W	18-Sep-00	41	71	2	NWSE	INDEPENDENT PRODUCTION CO., INC.	SEARCHLIGHT #33-2	UNA	STO,CBM		
P129460W	18-Sep-00	41	71	2	SENE	INDEPENDENT PRODUCTION CO., INC.	SEARCHLIGHT #42-2	UNA	STO,CBM		
P129455W	18-Sep-00	41	71	2	SESE	INDEPENDENT PRODUCTION CO., INC.	SEARCHLIGHT #44-2	UNA	STO,CBM		
P129454W	18-Sep-00	41	71	2	SWNE	INDEPENDENT PRODUCTION CO., INC.	SEARCHLIGHT #32-2	UNA	STO,CBM		
P129456W	18-Sep-00	41	71	2	SWSE	INDEPENDENT PRODUCTION CO., INC.	SEARCHLIGHT #34-2	UNA	STO,CBM		
P12754P	30-Dec-51	41	71	3	NESW	USFS	MATHESON #TB 42		STO	4	122
P44330W	20-Jul-78	41	71	3	NWSE	USFS	MARG #5		STO	3	163
P23598W	07/25/73	41	71	7	NWSE	PATRICIA L. ISENBERGER	LY #3		STO	10	252
P23603P	07/25/73	41	71	7	NWSW	PATRICIA L. ISENBERGER	SPRING #8		STO	25	8
P108190W	12/04/97	41	71	8	SWNE	JERRY DILTS** KEY PROD. CO. INC.	SAPELO #1	UNA	STO,MIS	80	780
P58121W	05/18/81	41	71	11	NENE	BIG HORN FRACTIONATION	B H FRAC #1		MIS	25	396
P129457W	09/18/00	41	71	11	NENE	INDEPENDENT PRODUCTION CO., INC.	SEARCHLIGHT #41-11	UNA	STO,CBM		
P129449W	09/18/00	41	71	11	NENW	INDEPENDENT PRODUCTION CO., INC.	SEARCHLIGHT #21-11	UNA	STO,CBM		
P129451W	09/18/00	41	71	11	NWNE	INDEPENDENT PRODUCTION CO., INC.	SEARCHLIGHT #31-11	UNA	STO,CBM		
P129453W	09/18/00	41	71	11	NWNW	INDEPENDENT PRODUCTION CO., INC.	SEARCHLIGHT #11-11	UNA	STO,CBM		
P129459W	09/18/00	41	71	11	SENE	INDEPENDENT PRODUCTION CO., INC.	SEARCHLIGHT #42-11	UNA	STO,CBM		
P129450W	09/18/00	41	71	11	SENW	INDEPENDENT PRODUCTION CO., INC.	SEARCHLIGHT #22-11	UNA	STO,CBM		
P129462W	09/18/00	41	71	11	SWNE	INDEPENDENT PRODUCTION CO., INC.	SEARCHLIGHT #32-11	UNA	STO,CBM		
P129448W	09/18/00	41	71	11	SWNW	INDEPENDENT PRODUCTION CO., INC.	SEARCHLIGHT #12-11	UNA	STO,CBM		
P67807W	06/27/84	41	71	13	NWNW	USFS	WILKINSON SPRING #T B 39		STO	0.5	8
P44331W	07/20/78	41	71	14	SESE	USFS	MARG #6		STO	3	605
P123124W	02/07/00	41	71	15	NESW	BARRETT RESOURCES CORP.	MATHESON 23-15-4171	UNA	CBM		

GROUNDWATER RIGHTS FOR WEST ANTELOPE LBA TRACT

Permit No.	Priority	Tns	Rng	Sec	qq	Applicant	Facility Name	Status	Uses	Yld Act	T.D.
P122938W	01/19/00	41	71	18	NWSW	BARRETT RESOURCES CORP.	KILMER 13-18-4171	UNA	CBM		
P125697W	05/16/00	41	71	18	SENE	NORTH FINN, LLC	FEDERAL #42-18	UNA	CBM		
P131960W	01/05/01	41	71	19	NENW	NORTH FINN, LLC	ISENBERGER #21-19	UNA	CBM		
P109953W	05/01/98	41	71	19	NWNE	PATRICIA L. ISENBERGER LITTON	ENL LY #2	UNA	MIS	5	350
P5612P	02/09/69	41	71	19	NWNE	PATRICIA L. ISENBERGER LITTON	LY #2 (DEEPENED)	UNA	STO	1	350
P23604P	07/25/73	41	71	21	SESW	PATRICIA L. ISENBERGER	SPRING #9		STO	25	8
P96882W	08/24/94	41	71	24	NENW	WESCO, INC	WESCO #1	UNA	MIS	18	596
P63112W	02/11/83	41	71	24	SWNE	BRIDLE BIT RANCH	BRIDLE BIT RANCH #1		STO	6	442
P67899W	07/10/84	41	71	27	NESW	USFS	ISENBERGER SPRING #T B 63		STO	0.5	8
P23605P	07/25/73	41	71	27	SWSW	PATRICIA L. ISENBERGER	SPRING #10		STO	25	8
P23601P	07/25/73	41	71	29	SWNW	PATRICIA L. ISENBERGER	LY #6		STO	7	250
P11718W	12/24/71	41	71	31	SESE	ROBERT E. ISENBERGER	ARTESIAN #2		STO	5	508
P23606P	07/25/73	41	71	31	SWSW	PATRICIA L. ISENBERGER	SPRING #11		STO	25	8
P23602P	07/25/73	41	71	33	NWNW	PATRICIA L. ISENBERGER	LY #7		STO	10	600
P9571W	06/30/71	41	71	33	SWSE	USFS	JACOBS #T.B. 161		STO	4	495
P23594W	07/25/73	41	71	34	SWNE	PATRICIA L. ISENBERGER	ARTESIAN #3		STO	10	640
P23596P	07/25/73	41	71	35	NENE	PATRICIA L. ISENBERGER	ARTESIAN #4		DOM,STO	5	UNK
P11652W	08/01/54	41	71	35	SENE	ROBERT E. ISENBERGER	COAL MINE #1		STO	25	30
P23597P	07/25/73	41	71	35	SWSE	PATRICIA L. ISENBERGER	SCHOOL HOUSE #1		DOM,STO	6	550
P16602W	09/01/72	41	71	35	SWNW	W.S.B.L.C.** H.R. MATHESON	STATE-MATHESON #1		IND	500	50
P46168W	12/14/78	41	71	36	NESW	W.S.B.L.C.	ISENBERGER-STATE #1		STO		
P123117W	02/07/00	41	72	11	NWNE	BARRETT RESOURCES CORP.	RENO 31-11-4172	UNA	CBM		
P23599P	07/25/73	41	72	13	NENW	PATRICIA L. ISENBERGER	LY #4	UNA	DOM,STO	10	179
P52637W	06/17/80	41	72	13	NENW	PATRICIA L. ISENBERGER LITTON	LY #10		DOM,STO	15	179
P50639W	11/13/79	41	72	13	NWNE	PATRICIA L. ISENBERGER	LY #9		RES,STO	10	182
P23600P	07/25/73	41	72	13	SWSE	PATRICIA L. ISENBERGER	LY #5		STO	7	300
P50638W	11/13/79	41	72	23	SWNE	PATRICIA L. ISENBERGER	LY #8		STO	15	210
P76179W	12/07/87	41	72	24	NESE	WYOMING STATE HIGHWAY DEPT.	ROBINSON #9		MON,MIS	0	300
P76178W	12/07/87	41	72	24	NESE	WYOMING STATE HIGHWAY DEPT.	ROBINSON #7		MON,MIS	0	100
P76180W	12/07/87	41	72	24	SESE	WYOMING STATE HIGHWAY DEPT.	ROBINSON #10		MON,MIS	0	50
P76181W	12/07/87	41	72	24	SESE	WYOMING STATE HIGHWAY DEPT.	ROBINSON #11		MON,MIS	0	50
P69891W	04/08/85	41	72	24	SWSE	W.S.B.L.C.**PATRICIA L. ISENBERGER	ARTESIAN #1	ADJ	MIS	25	861

Abbreviation Key from the Wyoming SEO Water Right Database

Abbreviations for uses: DEW=Dewatering; DOM=Domestic; DSP=Domestic Supply; FIS=Fish Propagation; FLO=Flood Control; IND=Industrial; IRR=Irrigation; MAN=Manufacturing; MIN=Mining; MIS=Miscellaneous; MON=Monitoring; MUN=Municipal; POW=Power Development; REC=Recreation; RES=Reservoir Supply; STO=Stock; TEM=Temporary Use (normally construction of roads or oil well drilling); UTI=Utility; WET=Wetlands; WIL=Wildlife; CBM=Coal Bed Methane.

Abbreviations for status: ABA=Abandoned; ADJ=Adjudicated; CAN=Canceled; EXP=Expired; GST=Good standing pending receipt of legally required notices; PU=Point of outlet for a reservoir; PUD=Point of diversion for a ditch or pipeline; PUO=Point of outlet for a reservoir; UNA=Unadjudicated.

Record Suffixes are denoted as follows: "A" indicates adjudicated or finalized water rights and unless the right is a territorial appropriation, there will be a match in the reference column from one of the following permit types for the unadjudicated portion of the water right. "C" permits are well statements of claim, filed from 1947 to 1957 for wells completed prior to April 1, 1947. "G" permits are well registrations, filed for wells completed after April 1, 1947. "P" permits are for stock and domestic use wells completed prior to May 24, 1969 and registered with the SEO prior to December 31, 1972. "W" permits are for wells with a priority date for the date of filing with the SEO. "D" signifies a ditch or pipeline permit. "E" signifies an enlargement of a ditch or pipeline permit. "S" signifies a stock reservoir permit. "R" signifies a reservoir permit.

SURFACE WATER RIGHTS FOR NARO NORTH LBA TRACT										
Permit No.	Priority	Tns	Rng	Sec	qq	Applicant	Facility Name	Status	Uses	Source
P9853S	01/14/1986	42	70	20	NENW	USFS	MACKEY #9 223 4	GST	STO	PLAYA DRAW
CR4/302A	03/20/1967	42	70	20	NESE	USFS	MACKEY #F.S. 9-223-2 STOCK RES	PUO	STO	DURBIN DRAW
CR4/252A	03/20/1967	42	70	21	NENW	USFS	MACKEY #F.S. 9-223-3 STOCK RES	PUO	STO	TRUSSLER DRY LAKE BED
P9854S	01/14/1986	42	70	21	SESE	USFS	MACKEY #9 223 5	GST	STO	PARAKEET DRAW
CR2/472A	07/30/1938	42	70	29	SWNE	USFS	THUNDER BASIN #28 RES	PU	STO	CORDER CREEK
CR2/472A	07/30/1938	42	70	29	NESW	USFS	THUNDER BASIN #28 RES	PUO	STO	CORDER CREEK
CR2/472A	07/30/1938	42	70	29	NWSE	USFS	THUNDER BASIN #28 RES	PU	STO	CORDER CREEK
CR6/370A	04/29/1969	42	70	31	NWNE	USFS	WILKINSON #F S 9 264 7 STOCK RES	PUO	STO	CALLAN DRAW
CR3/307A	12/28/1964	42	70	34	NENE	USFS	TECKLA #F.S.9-298-2 STOCK RES	PUO	STO	S FORK PAYNE DR
CR2/471A	02/17/1939	42	70	34	NWNW	USFS	THUNDER BASIN #29 RES	PUO	STO	PAYNE DRAW
CR3/304A	01/31/1964	41	70	8	NESW	USFS	WILKINSON #F S 9 264 4 STOCK RES	ADJ	STO	SOUTH FORK ROGERS DRAW
P2379S	08/29/1958	41	70	8	SESW	PAUL WILKINSON	ROGERS #1	UNA	STO	ROGERS DRAW
CR4/301A	02/27/1967	41	70	9	NESE	USFS	DILTS #F.S. 9-205-8 STOCK RES	PUO	STO	RED DRAW
P7065S	09/20/1971	42	71	23	NESW	USFS	MATHESON #F S 9 228 12	PUO	STO	STUART DRAW
CR9/373A	09/20/1971	42	71	23	NESW	USFS	MATHESON #F S 9 228 12 STOCK RES	PU	STO	STUART DRAW
CR9/373A	09/20/1971	42	71	23	NESW	USFS	MATHESON #F S 9 228 12 STOCK RES	PUO	STO	STUART DRAW
P3915S	08/08/1962	42	71	26	NENE	USFS	WILKINSON #264 2	PUO	STO	WINDMILL DRAW
CR3/308A	08/08/1962	42	71	26	NENE	USFS	WILKINSON #264-2 STOCK RES	PU	STO	WINDMILL DRAW
CR3/308A	08/08/1962	42	71	26	NENE	USFS	WILKINSON #264-2 STOCK RES	PUO	STO	WINDMILL DRAW
P4943R	09/12/1938	42	71	26	NWSW	STEVE NIEMCYK	PORCUPINE RES.	ADJ	STO	PORCUPINE CREEK
P2378S	09/10/1958	42	71	26	SESW	PAUL WILKINSON	HORSEPASTURE #1	UNA	STO	PORCUPINE CREEK

SURFACE WATER RIGHTS FOR NARO SOUTH LBA TRACT										
Permit No.	Priority	Tns	Rng	Sec	qq	Applicant	Facility Name	Status	Uses	Source
P19382D	05/08/1940	41	70	27		FRED DILTS	WATER SPREADING DITCH	PU	STO,IRR	PORCUPINE CREEK
CR1/297A	05/08/1940	41	70	27	SWNE	EST. FRED DILTS	PORCUPINE RES	PU	STO	PORCUPINE CREEK
CR5/136A	06/11/1951	41	70	27	SWNE	JOHN C. DILTS	ENL PORCUPINE RES	PU	IRR	PORCUPINE CREEK
CR8/549A	09/08/1952	41	70	27	SWNE	JOHN C. DILTS	ENL PORCUPINE RES	PU	IRR	PORCUPINE CREEK
CR1/297A	05/08/1940	41	70	27	SENW	EST. FRED DILTS	PORCUPINE RES	PU	STO	PORCUPINE CREEK
CR5/136A	06/11/1951	41	70	27	SENW	JOHN C. DILTS	ENL PORCUPINE RES	PU	IRR	PORCUPINE CREEK
CR8/549A	09/08/1952	41	70	27	SENW	JOHN C. DILTS	ENL PORCUPINE RES	PU	IRR	PORCUPINE CREEK
CR1/297A	05/08/1940	41	70	27	NESW	EST. FRED DILTS	PORCUPINE RES	PU	STO	PORCUPINE CREEK
CR5/136A	06/11/1951	41	70	27	NESW	JOHN C. DILTS	ENL PORCUPINE RES	PU	IRR	PORCUPINE CREEK
CR8/549A	09/08/1952	41	70	27	NESW	JOHN C. DILTS	ENL PORCUPINE RES	PU	IRR	PORCUPINE CREEK
CR1/297A	05/08/1940	41	70	27	SESW	EST. FRED DILTS	PORCUPINE RES	PU	STO	PORCUPINE CREEK
CR5/136A	06/11/1951	41	70	27	SESW	JOHN C. DILTS	ENL PORCUPINE RES	PU	IRR	PORCUPINE CREEK
CR8/549A	09/08/1952	41	70	27	SESW	JOHN C. DILTS	ENL PORCUPINE RES	PU	IRR	PORCUPINE CREEK
CR1/297A	05/08/1940	41	70	27	NWSE	EST. FRED DILTS	PORCUPINE RES	PU	STO	PORCUPINE CREEK
CR5/136A	06/11/1951	41	70	27	NWSE	JOHN C. DILTS	ENL PORCUPINE RES	PU	IRR	PORCUPINE CREEK
CR8/549A	09/08/1952	41	70	27	NWSE	JOHN C. DILTS	ENL PORCUPINE RES	PU	IRR	PORCUPINE CREEK
CR1/297A	05/08/1940	41	70	27	SWSE	EST. FRED DILTS	PORCUPINE RES	PUO	STO	PORCUPINE CREEK
C60/057A	05/08/1940	41	70	27	SWSE	FRED DILTS ESTATE	WATER SPREADING DITCH	ADJ	STO,IRR	PORCUPINE CREEK
C60/057A	05/08/1940	41	70	27	SWSE	FRED DILTS ESTATE	WATER SPREADING DITCH	PUD	STO,IRR	PORCUPINE CREEK
CR5/136A	06/11/1951	41	70	27	SWSE	JOHN C. DILTS	ENL PORCUPINE RES	PUO	IRR	PORCUPINE CREEK
C72/193A	06/11/1951	41	70	27	SWSE	JOHN C. DILTS	WATER-SPREADING DITCH	ADJ	IRR	PORCUPINE CREEK
C72/193A	06/11/1951	41	70	27	SWSE	JOHN C. DILTS	WATER-SPREADING DITCH	PUD	IRR	PORCUPINE CREEK
CR8/549A	09/08/1952	41	70	27	SWSE	JOHN C. DILTS	ENL PORCUPINE RES	PUO	IRR	PORCUPINE CREEK
C60/057A	05/08/1940	41	70	27	SESE	FRED DILTS ESTATE	WATER SPREADING DITCH	ADJ	STO,IRR	PORCUPINE CREEK
C72/193A	06/11/1951	41	70	27	SESE	JOHN C. DILTS	WATER-SPREADING DITCH	ADJ	IRR	PORCUPINE CREEK
CR14/246A	10/04/1983	41	70	31	SWSE	USFS	WETLAND MITIGATION POND	ADJ	WET	ALLUVIAL FLOWS\HAIG DRAW
C60/057A	05/08/1940	41	70	34	NENE	FRED DILTS ESTATE	WATER SPREADING DITCH	ADJ	STO,IRR	PORCUPINE CREEK
C72/193A	06/11/1951	41	70	34	NENE	JOHN C. DILTS	WATER-SPREADING DITCH	ADJ	IRR	PORCUPINE CREEK
C60/057A	05/08/1940	41	70	34	NWNE	FRED DILTS ESTATE	WATER SPREADING DITCH	ADJ	STO,IRR	PORCUPINE CREEK
C72/193A	06/11/1951	41	70	34	NWNE	JOHN C. DILTS	WATER-SPREADING DITCH	ADJ	IRR	PORCUPINE CREEK
C60/057A	05/08/1940	41	70	34	SWNE	FRED DILTS ESTATE	WATER SPREADING DITCH	ADJ	STO,IRR	PORCUPINE CREEK
C72/193A	06/11/1951	41	70	34	SWNE	JOHN C. DILTS	WATER-SPREADING DITCH	ADJ	IRR	PORCUPINE CREEK
C60/057A	05/08/1940	41	70	34	SENE	FRED DILTS ESTATE	WATER SPREADING DITCH	ADJ	STO,IRR	PORCUPINE CREEK
C72/193A	06/11/1951	41	70	34	SENE	JOHN C. DILTS	WATER-SPREADING DITCH	ADJ	IRR	PORCUPINE CREEK
C60/057A	05/08/1940	41	70	34	SENW	FRED DILTS ESTATE	WATER SPREADING DITCH	ADJ	STO,IRR	PORCUPINE CREEK
C72/193A	06/11/1951	41	70	34	SENW	JOHN C. DILTS	WATER-SPREADING DITCH	ADJ	IRR	PORCUPINE CREEK
C60/057A	05/08/1940	41	70	34	NESW	FRED DILTS ESTATE	WATER SPREADING DITCH	ADJ	STO,IRR	PORCUPINE CREEK
C72/193A	06/11/1951	41	70	34	NESW	JOHN C. DILTS	WATER-SPREADING DITCH	ADJ	IRR	PORCUPINE CREEK
C60/057A	05/08/1940	41	70	34	SESW	FRED DILTS ESTATE	WATER SPREADING DITCH	ADJ	STO,IRR	PORCUPINE CREEK
C72/193A	06/11/1951	41	70	34	SESW	JOHN C. DILTS	WATER-SPREADING DITCH	ADJ	IRR	PORCUPINE CREEK
C60/057A	05/08/1940	41	70	34	NESE	FRED DILTS ESTATE	WATER SPREADING DITCH	ADJ	STO,IRR	PORCUPINE CREEK

SURFACE WATER RIGHTS FOR NARO SOUTH LBA TRACT										
Permit No.	Priority	Tns	Rng	Sec	qq	Applicant	Facility Name	Status	Uses	Source
C72/193A	06/11/1951	41	70	34	NESE	JOHN C. DILTS	WATER-SPREADING DITCH	ADJ	IRR	PORCUPINE CREEK
C60/057A	05/08/1940	41	70	34	NWSE	FRED DILTS ESTATE	WATER SPREADING DITCH	ADJ	STO,IRR	PORCUPINE CREEK
C72/193A	06/11/1951	41	70	34	NWSE	JOHN C. DILTS	WATER-SPREADING DITCH	ADJ	IRR	PORCUPINE CREEK
C60/057A	05/08/1940	41	70	34	SWSE	FRED DILTS ESTATE	WATER SPREADING DITCH	ADJ	STO,IRR	PORCUPINE CREEK
C72/193A	06/11/1951	41	70	34	SWSE	JOHN C. DILTS	WATER-SPREADING DITCH	ADJ	IRR	PORCUPINE CREEK
C60/057A	05/08/1940	41	70	34	SESE	FRED DILTS ESTATE	WATER SPREADING DITCH	ADJ	STO,IRR	PORCUPINE CREEK
C72/193A	06/11/1951	41	70	34	SESE	JOHN C. DILTS	WATER-SPREADING DITCH	ADJ	IRR	PORCUPINE CREEK
C60/057A	05/08/1940	41	70	35	SWNW	FRED DILTS ESTATE	WATER SPREADING DITCH	ADJ	STO,IRR	PORCUPINE CREEK
C72/193A	06/11/1951	41	70	35	SWNW	JOHN C. DILTS	WATER-SPREADING DITCH	ADJ	IRR	PORCUPINE CREEK
C60/057A	05/08/1940	41	70	35	SENW	FRED DILTS ESTATE	WATER SPREADING DITCH	ADJ	STO,IRR	PORCUPINE CREEK
C72/193A	06/11/1951	41	70	35	SENW	JOHN C. DILTS	WATER-SPREADING DITCH	ADJ	IRR	PORCUPINE CREEK
C60/057A	05/08/1940	41	70	35	NWSW	FRED DILTS ESTATE	WATER SPREADING DITCH	ADJ	STO,IRR	PORCUPINE CREEK
C72/193A	06/11/1951	41	70	35	NWSW	JOHN C. DILTS	WATER-SPREADING DITCH	ADJ	IRR	PORCUPINE CREEK
C60/057A	05/08/1940	41	70	35	SWSW	FRED DILTS ESTATE	WATER SPREADING DITCH	ADJ	STO,IRR	PORCUPINE CREEK
C72/193A	06/11/1951	41	70	35	SWSW	JOHN C. DILTS	WATER-SPREADING DITCH	ADJ	IRR	PORCUPINE CREEK
C75/026A	08/04/1980	41	70	36	NWNE	WY.B L COMM.	SUNNY #1 SPREADER DAM	PUD	IRR	SUNNY DRAW
C75/026A	08/04/1980	41	70	36	SWNE	WY.B L COMM.	SUNNY #1 SPREADER DAM	ADJ	IRR	SUNNY DRAW
C75/026A	08/04/1980	41	70	36	SENE	WY.B L COMM.	SUNNY #1 SPREADER DAM	ADJ	IRR	SUNNY DRAW
C75/026A	08/04/1980	41	70	36	NESE	WY.B L COMM.	SUNNY #1 SPREADER DAM	ADJ	IRR	SUNNY DRAW
CR3/305A	01/31/1964	41	71	13	NENE	USFS	WILKINSON #F S 9 264 5 STOCK RES	PUO	STO	INNIS DRY L BED

SURFACE WATER RIGHTS FOR LITTLE THUNDER LBA TRACT										
Permit No.	Priority	Tns	Rng	Sec	qq	Applicant	Facility Name	Status	Uses	Source
CR1/387A	03/01/1943	43	71	3	SWNW	E. E. STUART	STUART RES	PU	STO	DRY FORK LITTLE THUNDER CR.
P948R	11/30/1906	43	71	3	SENW	JOHN MORTON SHEEP CO.	THUNDER BASIN NO. 2 RES.	PUO	STO	DRY CREEK
CR1/387A	03/01/1943	43	71	3	SENW	E. E. STUART	STUART RES	PU	STO	DRY FORK LITTLE THUNDER CR.
CR1/387A	03/01/1943	43	71	3	NESW	E. E. STUART	STUART RES	PUO	STO	DRY FORK LITTLE THUNDER CR.
CR1/387A	03/01/1943	43	71	3	SESW	E. E. STUART	STUART RES	PU	STO	DRY FORK LITTLE THUNDER CR.
CR4/254A	02/27/1967	43	71	10	SENE	USFS	STUART #F.S. 9-256-3 STOCK RES	PUO	STO	ERICKSON DRAW
P2343S	08/04/1958	43	71	10	SWSW	PAUL AND RUBY H. STUART	SCHROYER	PUO	STO	SCHROYER DRAW
P5724S	10/10/1966	43	71	11	SESE	HAROLD E. ZIMMER	ZIMMER	PUO	STO	ZIMMER DRAW
CR2/455A	03/31/1938	43	71	22	NWNW	USFS	THUNDER BASIN #10 RES	PUO	STO	LITTLE THUNDER CREEK
CR2/455A	03/31/1938	43	71	22	SWNW	USFS	THUNDER BASIN #10 RES	PU	STO	LITTLE THUNDER CREEK
CR2/455A	03/31/1938	43	71	22	SENW	USFS	THUNDER BASIN #10 RES	PU	STO	LITTLE THUNDER CREEK
CR2/455A	03/31/1938	43	71	22	NESW	USFS	THUNDER BASIN #10 RES	PU	STO	LITTLE THUNDER CREEK
CR2/455A	03/31/1938	43	71	22	NWSW	USFS	THUNDER BASIN #10 RES	PU	STO	LITTLE THUNDER CREEK
CR2/455A	03/31/1938	43	71	22	SWSW	USFS	THUNDER BASIN #10 RES	PU	STO	LITTLE THUNDER CREEK
CR2/455A	03/31/1938	43	71	22	SESW	USFS	THUNDER BASIN #10 RES	PU	STO	LITTLE THUNDER CREEK
P950R	11/30/1906	43	71	24	NWSW	JOHN MORTON SHEEP CO.	THUNDER BASIN NO. 4 RES.	PUO	STO	S. PRONG LITTLE THUNDER CRK.
P950R	11/30/1906	43	71	24	SWSW	JOHN MORTON SHEEP CO.	THUNDER BASIN NO. 4 RES.	PU	STO	S. PRONG LITTLE THUNDER CRK.
P10087S	02/09/1987	43	71	25		USFS	RENO #9 240 13	GST	STO	PETTERS DRAW

Permit No	Priority	Tns	Rng	Sec	qq	Applicant	Facility Name	Status	Uses	Source
CR4/308A	01/31/1964	40	71	1	SESE	USFS	MORTON #F S 9-231-9 STOCK RES	PUO	STO	FISHER DRAW
CR2/477A	01/30/1958	40	71	3	NWNW	USFS	TOM #1 STOCK RES	PUO	STO	TOMS DRAW
P3349S	07/13/1960	40	71	5	SWNW	J. R. LLOYD	MARY #1	PUO	STO	MARY DRAW
P3350S	07/13/1960	40	71	6	SWSW	J. R. LLOYD	SALLY #1	PUO	STO	SALLY DR
P5520S	08/26/1960	40	71	8	NESW	BASS JACOBS & SON	MARKER #1	PUO	STO	MARKER DR
P1384S	02/06/1956	40	71	10	SENW	BASS JACOBS	DONNER #1	PUO	STO	DONNER DRAW
P1384S	02/06/1956	40	71	10	NESW	BASS JACOBS	DONNER #1	PUO	STO	DONNER DRAW
CR14/246A	10/04/1983	41	70	31	SWSE	USFS	WETLAND MITIGATION POND	ADJ	WET	HAIG DRAW, ANTELOPE CRK.
P10357S	02/29/1988	41	71	30	SENW	PATRICIA L. ISENBERGER LITTON	SPRING CREEK SPRING #12	GST	STO	SPRING CREEK

Abbreviation for uses: DEW=Dewatering; DOM=Domestic; DSP=Domestic Supply; FIS=Fish Propagation; FLO=Flood Control; IND=Industrial; IRR=Irrigation; MAN=Manufacturing; MIN=Mining; MIS=Miscellaneous; MON=Monitoring; MUN=Municipal; POW=Powder Development; REC=Recreation; RES=Reservoir Supply; STO=Stock; TEM=Temporary Use (normally construction of roads or oil well drilling); UTI=Utility; WET=Wetlands; WIL=Wildlife; CBM=Coal Bed Methane.

Abbreviations for status: ABA=Abandoned; ADJ=Adjudication; CAN=Canceled; EXP=Expired; GST=Good standing pending receipt of legally required notices; PU=Point of outlet for a resevoir; PUD Point of diversion for a ditch or pipeline; PUO=Point of outlet for a reservoir; UNA=Unadjudicated.

Record Suffixes are denoted as follows: "A" indicates adjudicated or finalized water rights and unless the right is a territorial appropriation, there will be a match in the reference column from one of the following permit types for the unadjudicated portion of the water right. "C" permits are well statements of claim, filed from 1947 to 1957 for wells completed prior to April 1, 1947. "G" permits are well registrations, filed for wells completed after April 1, 1947. "P" permits are for stock and domestic use wells completed prior to May 24, 1969 and registered with the SEO prior to December 31, 1972. "W" permits are for wells with a priority date for the date of filing with the SEO. "D" signifies a ditch or pipeline permit. "E" signifies an enlargement of a ditch or pipeline permit. "S" signifies a stock reservoir permit. "R" signifies a reservoir permit.

MIS=Miscellaneous; MON=Monitoring; MUN=Municipal; POW=Powder Development; REC=Recreation; RES=Reservoir Supply; STO=Stock; TEM=Temporary Use (normally construction of roads or oil well drilling); UTI=Utility; WET=Wetlands; WIL=Wildlife; CBM=Coal Bed Methane.

Abbreviations for status: ABA=Abandoned; ADJ=Adjudication; CAN=Canceled; EXP=Expired; GST=Good standing pending receipt of legally required notices; PU=Point of outlet for a reservoir; PUD Point of diversion for a ditch or pipeline; PUO=Point of outlet for a reservoir; UNA=Unadjudicated.

Record Suffixes are denoted as follows: "A" indicates adjudicated or finalized water rights and unless the right is a territorial appropriation, there will be a match in the reference column from one of the following permit types for the unadjudicated portion of the water right. "C" permits are well statements of claim, filed from 1947 to 1957 for wells completed prior to April 1, 1947. "G" permits are well registrations, filed for wells completed after April 1, 1947. "P" permits are for stock and domestic use wells completed prior to May 24, 1969 and registered with the SEO prior to December 31, 1972. "W" permits are for wells with a priority date for the date of filing with the SEO. "D" signifies a ditch or pipeline permit. "E" signifies an enlargement of a ditch or pipeline permit. "S" signifies a stock reservoir permit. "R" signifies a reservoir permit.

SURFACE WATER RIGHTS FOR WEST ROUNDUP LBA TRACT										
Permit No.	Priority	Tns	Rng	Sec	qq	Applicant	Facility Name	Status	Uses	Source
P3931S	03/18/1963	42	70	7	NWSE	USDA FOREST SERVICE	RENO LIVESTOCK #9-240-2 STOCK RES	PUO	STO	OLSON DRAW
P4904R	07/30/1938	42	70	9	SWNW	USDA FOREST SERVICE	THUNDER BASIN #52 RES	PUO	STO	TRUSSLER CREEK
P4904R	07/30/1938	42	70	9	SENW	USDA FOREST SERVICE	THUNDER BASIN #52 RES	PU	STO	TRUSSLER CREEK
P4904R	07/30/1938	42	70	9	NESW	USDA FOREST SERVICE	THUNDER BASIN #52 RES	PU	STO	TRUSSLER CREEK
P4904R	07/30/1938	42	70	9	NWSW	USDA FOREST SERVICE	THUNDER BASIN #52 RES	PU	STO	TRUSSLER CREEK
P5561S	05/06/1966	42	70	17	NESW	USDA FOREST SERVICE	WILKINSON #F S 9 264 6 STOCK RES	PUO	STO	OLSON DRAW
P4991R	02/17/1939	42	71	12	NENE	USDA FOREST SERVICE	THUNDER BASIN #54 RES	PUO	STO	TANNER DRAW
P4991R	02/17/1939	42	71	12	NWNE	USDA FOREST SERVICE	THUNDER BASIN #54 RES	PU	STO	TANNER DRAW
P7102D	02/13/1906	42	71	12	NWNE	EDITH M. SIMPSON	LITTLE PORCUPINE	PUD	IRR,DOM	LITTLE PORCUPINE CREEK
P7102D	02/13/1906	42	71	12	NWNE	EDITH M. SIMPSON	LITTLE PORCUPINE	ADJ	IRR,DOM	LITTLE PORCUPINE CREEK
P7102D	02/13/1906	42	71	12	SWNE	EDITH M. SIMPSON	LITTLE PORCUPINE	ADJ	IRR,DOM	LITTLE PORCUPINE CREEK
P7102D	02/13/1906	42	71	12	NWSE	EDITH M. SIMPSON	LITTLE PORCUPINE	ADJ	IRR,DOM	LITTLE PO
P7104D	02/13/1906	42	71	12	SENE	EDITH M. SIMPSON	SHEEP DITCH	ADJ	IRR	SHEEP CREEK

APPENDIX G

THREATENED, ENDANGERED, PROPOSED,
AND CANDIDATE SPECIES

USFS REGION 2 SENSITIVE SPECIES AND
MANAGEMENT INDICATOR SPECIES

BLM SENSITIVE SPECIES

Operators of four coal mines in Campbell and Converse Counties, Wyoming have applied to lease five tracts of federal coal as maintenance leases under the Leasing on Application regulations at 43 CFR 3425, as discussed in Chapter 1 of this environmental impact statement (EIS). The five tracts being considered for leasing are the NARO North, NARO South, Little Thunder, West Roundup and West Antelope Lease by Application (LBA) Tracts. The purpose of this Appendix is to provide information about the potential environmental effects that leasing these tracts would have on federally Endangered, Threatened, Proposed, and Candidate Species, and U.S. Forest Service (USFS) Region 2 Sensitive wildlife and vegetative species (terrestrial and aquatic), USFS Thunder Basin National Grassland (TBNG) Forest Plan Management Indicator Species (MIS), and Bureau of Land Management (BLM) designated Sensitive Species.

GENERAL ANALYSIS AREA DESCRIPTION

The General Analysis Area is shown in Figure 3-1 of this EIS. It includes all or part of Townships 40 through 44 North, Ranges 69 through 71 West, and includes portions of southern Campbell County and northern Converse County, Wyoming. Within the General Analysis Area are five active surface coal mines. Four of those mines, Black Thunder, North Rochelle, North Antelope/Rochelle Complex, and Antelope, have applied to lease the federal coal included in five tracts located adjacent to their existing mines. The five tracts and applicant mines are:

- NARO North LBA Tract adjacent to and north of the North Antelope/Rochelle Complex;
- NARO South LBA Tract adjacent to and south of the North Antelope/Rochelle Complex;
- Little Thunder LBA Tract adjacent to and west of the Black Thunder Mine;
- West Roundup LBA Tract adjacent to and southwest of the North Rochelle Mine; and
- West Antelope LBA Tract adjacent to and west of the Antelope Mine.

A study area has been identified for each tract, which includes the tract as applied for and the adjacent lands BLM is considering adding to each tract. The anticipated permit amendment area for each applicant mine is also included in the study area. The anticipated permit amendment study area includes lands adjacent to and outside of an applicant mine's current permit area which the applicant anticipates would be included within an amended mine permit area if they acquire a lease for the maintenance tract they have applied for. The study areas for each tract are shown in Figure 3-1.

The General Analysis Area is located in the eastern portion of the Powder River Basin (PRB), a part of the Northern Great Plains that includes most of northeastern Wyoming. Vegetation is primarily sagebrush and mixed grass

prairie. The climate is semi-arid, with an average annual precipitation at Wright, located approximately six miles east of the Little Thunder LBA Tract (see Figure 1-1 of this EIS) of just over 11 inches (Martner 1986). In the General Analysis Area the regional wind speeds average from nine to 13 miles per hour with local variations in speed and direction due to differences in topography. The General Analysis Area is drained by tributaries to the Cheyenne River, the major surface drainages in this portion of the PRB are shown in Figure 3-5 of this EIS. Elevations range from about 4,500 feet (ft) to 5,000 ft above sea level. Land ownership within the LBA tracts and the General Analysis Area consists of private lands intermingled with federal lands. Federally owned lands included in three of the tracts (NARO North, Little Thunder, and West Antelope) are part of the TBNG and are administered by the USFS. More detailed information about the General Analysis Area is included in Chapter 3 of this EIS.

CONSULTATION HISTORY

The LBA tracts as applied for and the existing federal coal leases and existing approved mine permit boundaries for the adjacent applicant mines are shown in Figures 1-2 through 1-5 of this EIS. Consultation with the U.S. Fish and Wildlife Service (USFWS) has previously occurred for all lands that are within the existing approved mine permit area for each mine.

The location of the existing North Antelope/Rochelle Complex coal leases, the existing approved mine permit area, and the NARO North and NARO South LBA Tracts are shown in Figure 1-2 in this EIS. Consultation with USFWS has previously been conducted for the area included within the existing approved mine permit area. In the most recent mine permit State Decision Document for the Powder River Coal Company's (PRCC's) North Antelope/Rochelle Complex, dated December, 1999, is a letter dated August 19, 1999, from Michael Long, USFWS Cheyenne, Wyoming to Georgia Cash, Wyoming Department of Environmental Quality/Land Quality Division (WDEQ/LQD), Cheyenne, Wyoming documenting approval of the Raptor and Migratory Birds of High Federal Interest (MBHFI) plans for the North Antelope/Rochelle Complex. Also included as Condition No. 2 of the North Antelope/Rochelle Complex State Decision Document, is a requirement for completion of conferencing and consultation with USFWS by the Office of Surface Mining Reclamation and Enforcement (OSM) by February 1, 2000. The incorporation of species-specific protective measures drafted by the Wyoming Field Office of the USFWS and commitment to report/tabulate dead or impaired listed species into the mining permit satisfied the permit condition for completion of conferencing and consultation with USFWS. These items were reviewed with WDEQ/LQD and PRCC in a meeting on January 6, 2000 and documented in a letter dated January 28, 2000, from Michael Long, USFWS to Georgia Cash, WDEQ/LQD.

The location of the existing Black Thunder Mine coal leases, the existing approved mine permit area, and the Little Thunder LBA Tract are shown in Figure 1-3 in

this EIS. Consultation with USFWS has previously been conducted for the area included within the existing approved mine permit area. In the September 1995 mine permit State Decision Document for the Black Thunder Mine is a letter dated November 29, 1995, from Charles P. Davis, USFWS, Cheyenne, Wyoming, to Gregory Reed, OSM, Denver, Colorado, stating concurrence with the Thunder Basin Coal Company (TBCC) permit renewal and amendment project assessment relating to black-footed ferret, bald eagle, and Ute ladies'-tresses. The December 2000 mine plan State Decision Document for the Black Thunder Mine references a USFWS letter dated August 21, 2000, from Michael M. Long, USFWS, Field Supervisor, Cheyenne, Wyoming, to Doug Emme, WDEQ/LQD, Sheridan, Wyoming, which indicated that the agency reviews were completed and the Thundercloud amendment application and commitments were acceptable and that as long as the operation is conducted as proposed all wildlife issues of Federal interest will be adequately addressed.

The location of the existing North Rochelle Mine coal leases, the existing approved mine permit area, and the Little Thunder LBA Tract are shown in Figure 1-4 in this EIS. Consultation with USFWS has previously been conducted for the area included within the existing approved mine permit area. A letter dated October 8, 2002, from Michael M. Long, USFWS, Cheyenne, Wyoming, to Stacy Page, WDEQ/LQD, Sheridan, Wyoming, states USFWS concurrence with Triton Coal Company's (TCC's) plan to protect threatened and endangered (T&E) species listed under the Federal Endangered Species Act.

The location of the existing Antelope Mine coal leases, the existing approved mine permit area, and the West Antelope LBA Tract are shown in Figure 1-5 in this EIS. Consultation with USFWS was previously conducted for the area included within the existing approved mine permit area. In the December 2001 mining plan State Decision Document for the Antelope Mine is a letter dated December 17, 2001, from Michael M. Long, USFWS, Cheyenne, Wyoming, to Larry Kline, OSM, Denver, Colorado, verifying that the USFWS "is satisfied with the species-specific protective measures required to satisfy the consultation requirements of Section 7 of the Endangered Species Act of 1973, as amended (ACT), for the Horse Creek Amendment permit". Furthermore, the USFWS reviewed the MBHFI protection plan in the mine permit and, as stated in the December 2001 State Decision Document, has not given concurrence to the plan, stating the plan does not contain adequate commitment for the amount of mountain plover habitat that will be reclaimed and reestablished and does not contain adequate bond release criteria. Therefore, a condition was attached to Antelope Coal Company's (ACC's) permit stating that when the plan is approved by the USFWS, the approval letter will be inserted into the mine permit document.

THE PROPOSED ACTION

This EIS considers five Proposed Actions, one for each LBA tract listed above in the description of the General Analysis Area. Under the Proposed Action for each tract, a separate competitive lease sale would be held for the federal coal included in each tract as applied for. If there is a successful bidder at that sale, a lease would be issued for the tract of federal coal as applied for. Each tract offered for lease would be subject to standard and special lease stipulations developed for the Wyoming PRB. The stipulations that would be attached to each tract are listed in Appendix D of this EIS.

Under each Proposed Action, it is assumed that each LBA tract would be developed as a maintenance lease to extend the life of the adjacent existing surface coal mine. As a result, under each Proposed Action, existing facilities, roads and employees would be used to mine the coal included in each tract.

There are five No Action Alternatives, one for each tract. Under the No Action Alternative (Alternative 1) for each tract, the BLM would reject the lease application for that tract and not offer it for competitive sale at this time. Selection of Alternative 1 would not affect permitted mining activities on the existing leases at any of the adjacent mines.

In reviewing these lease applications, the BLM identified alternate tract configurations for consideration for leasing. These alternate tract configurations are analyzed as alternatives in this EIS. The alternate tract configurations are described in Chapter 2 of this EIS and shown in Figures 2-1 through 2-4. No alternate tract configurations were identified for the NARO North LBA Tract. Alternative 2 for the NARO South LBA Tract considers adding additional lands west of the LBA tract, while Alternative 3 considers removing some of the lands applied for in the western portion of the LBA tract. Alternative 2 for the Little Thunder LBA Tract considers adding additional lands west of the LBA tract and Alternative 3 considers dividing the Alternative 2 tract into a north and a south tract. Alternatives 2 and 3 for the West Roundup LBA Tract consider increasing the size of the LBA tract. Alternative 2 for the West Antelope LBA Tract considers adding additional land northeast of the LBA tract and Alternative 3 considers decreasing the size of the tract.

FEDERALLY ENDANGERED, THREATENED, PROPOSED, AND CANDIDATE SPECIES BIOLOGY AND HABITAT REQUIREMENTS

The following discussion evaluates the potential environmental effects of the Proposed Actions and Action Alternatives on federally endangered, threatened, proposed, and candidate species.

Endangered: An animal or plant in danger of extinction within the foreseeable future throughout all or a significant portion of its range is classified as endangered.

Threatened: Threatened status applies to an animal or plant species likely to become endangered within the foreseeable future throughout all or a significant portion of its range.

Proposed: A proposed species is any species of animal or plant that is proposed in the Federal Register to be listed under Section 4 of the Endangered Species Act (ESA).

Candidate: Species considered by the USFWS as candidates for possible addition to the lists of T&E wildlife and plants.

The following is a list of species that was provided by USFWS (June 2002), representing all federally listed T&E species, species proposed for listing , and candidate species that may occur in the General Analysis Area.

Bald eagle (*Haliaeetus leucocephalus*): Federally listed as Threatened

Ute ladies'-tresses (*Spiranthes diluvialis*): Federally listed as Threatened

Black-footed ferret (*Mustela nigripes*): Federally listed as Endangered

Mountain plover (*Charadrius montanus*): Federally designated as Proposed Threatened

Black-tailed prairie dog (*Cynomys ludovicianus*): Candidate

Listed Species**Bald eagle (*Haliaeetus leucocephalus*)**

The bald eagle is a federally-listed threatened species (USFWS 1995). Bald eagles occur throughout North America from Alaska to Newfoundland, and from the southern tip of Florida to southern California. In Wyoming, this species builds large nests in the crowns of large mature trees such as cottonwoods or pines. Food availability is probably the single most important determining factor for bald

eagle distribution and abundance. Fish and waterfowl are the primary sources of food where eagles occur along rivers and lakes. Big game and livestock carrion, as well as larger rodents (e.g., prairie dogs) also can be important dietary components where these resources are available (Ehrlich et al. 1988). This species is an uncommon breeding resident in Wyoming utilizing mixed coniferous and mature cottonwood-riparian areas near large lakes or rivers as nesting habitat (Luce et al. 1999).

Bald eagles are closely associated with water, with nest sites commonly less than one mile from a lakeshore or riverbank. Large trees are necessary to support eagle nests, typically cottonwoods or several conifer species. Nest trees are often the largest trees in the stand. Typically, there are alternate nests within or in close proximity to the nest stand. Snags and open-canopied trees near the nest site and foraging areas provide favorable perch sites. Old-growth stands with their structural diversity and open canopies are an important habitat for bald eagles. Bald eagles that have open water or alternate food sources near their nesting territories may stay for the winter, other eagles migrate southward to areas with available prey.

Ute ladies'-tresses (*Spiranthes diluvialis*)

The Ute ladies'-tresses, a member of the orchid family, was listed as threatened on January 17, 1992 due to a variety of factors, including habitat loss and modification, and hydrological modifications of existing and potential habitat areas.

Ute ladies'-tresses is a perennial herb with erect, glandular-pubescent stems 12 to 50 centimeters tall arising from tuberous-thickened roots. This species flowers from late July to September. Plants probably do not flower every year and may remain dormant below ground during drought years.

Rangewide, Ute ladies'-tresses occurs primarily on moist, subirrigated or seasonally flooded soils in valley bottoms, gravel bars, old oxbows or floodplains bordering springs, lakes, rivers or perennial streams at elevations between 1,780 and 6,800 ft (Fertig and Beauvais 1999). Suitable soils vary from sandy or coarse cobbly alluvium to calcareous, histic or fine-textured clays and loams. Populations have been documented from alkaline sedge meadows, riverine floodplains, flooded alkaline meadows adjacent to ponderosa pine, Douglas-fir woodlands, sagebrush steppe, and streamside floodplains. Typical suitable habitat for the orchid is found along perennial or ephemeral streams with subirrigation into late July or August. Until recent coal bed methane (CBM) development in the PRB, ephemeral streams with subirrigation into late July and August did not exist. Some occurrences are also found on agricultural lands managed for winter or early season grazing or hay production. Known sites often have low vegetative cover and may be subjected to periodic disturbances such as flooding or grazing. Populations are often dynamic and "move" within a watershed

as disturbances create new habitat or succession eliminates old habitat (Fertig and Beauvais 1999).

The total known population of this species is approximately 25,000 to 30,000 individuals. Occurrences range in size from one plant to a few hundred individuals. At the time of listing, Ute ladies'-tresses was only known from Colorado, Utah, and extreme eastern Nevada. It is currently known from western Nebraska, southeastern Wyoming, north-central Colorado, northeastern and southern Utah, east-central Idaho, southwestern Montana, and central Washington. In Wyoming, Ute ladies'-tresses is known from four occurrences in the western Great Plains in Converse, Goshen, Laramie, and Niobrara Counties, all discovered between 1993-1997 (Fertig and Beauvais 1999). One of these occurrences was recorded from the Antelope Creek watershed in northwestern Converse County.

Black-footed Ferret (*Mustela nigripes*)

The black-footed ferret is a federally-listed endangered species. The black-footed ferret historically occurred throughout Texas, Oklahoma, New Mexico, Arizona, Utah, Kansas, North and South Dakota, Montana, Wyoming, Nebraska, and Colorado. The black-footed ferret is closely associated with prairie dogs, depending almost entirely upon the prairie dog for its survival. The decline in ferret populations has been attributed to the reduction in the extensive prairie dog colonies that historically existed in the western United States. Ferrets may occur within colonies of white-tailed or black-tailed prairie dogs. The USFWS has determined that, at a minimum, potential habitat for the black-footed ferret must include a single white-tailed prairie dog colony of greater than 200 acres, or a complex of smaller colonies within a 4.3 mile (7 km) radius circle totaling 200 acres (USFWS 1989). Minimum colony size for black-tailed prairie dog is 80 acres (USFWS 1989). The last known wild population was discovered in Meeteetse, Wyoming. Individuals from this population were captured and have been raised in protective captive breeding facilities in an effort to prevent the species' extinction (Clark and Stromberg 1987).

Recent survey efforts in the Shirley Basin have identified a population at this former re-introduction site. This is the only known population in Wyoming.

Proposed Species

Mountain Plover (*Charadrius montanus*)

The mountain plover is proposed for federal listing (USFWS 1999a). The USFWS has 60 days to seek input from three species experts, the public, scientific community, and Federal and State agencies. The USFWS published a 60-day extension to the comment period on April 19, 1999 (USFWS 1999b). In October 2001, the USFWS designated the mountain plover as a proposed threatened species (USFWS 2001).

This species utilizes high, dry, shortgrass prairie with vegetation typically shorter than four inches tall. Within this habitat, areas of blue grama (*Bouteloua gracilis*) and buffalograss (*Buchloe dactyloides*) are most often utilized, as well as areas of mixed-grass associations dominated by needle-and-thread (*Stipa comata*) and blue grama (Dinsmore 1983).

Nests consist of a small scrape on flat ground in open areas. Most nests are placed on slopes of less than five degrees in areas where vegetation is less than three inches tall in April. More than half of identified nests occurred within 12 inches of old cow manure piles and almost 20 percent were found against old manure piles in similar habitats in Colorado. Nests in similar habitats in Montana (Dinsmore 1983) and other areas (Ehrlich et al. 1988) were nearly always associated with the heavily grazed shortgrass vegetation of prairie dog colonies.

Mountain plovers arrive on their breeding grounds in late March with egg-laying beginning in late April. Clutches are hatched by late June and chicks fledge by late July. The fall migration begins in late August and most birds are gone from the breeding grounds by late September.

Candidate Species

Black-tailed Prairie Dog (*Cynomys ludovicianus*)

The black-tailed prairie dog was added to the list of candidate species for federal listing on February 4, 2000 (USFWS 2000a). At that time, the USFWS concluded that listing the black-tailed prairie dog was warranted but precluded by other higher priority actions to amend the lists of threatened and endangered species. No specific date for proposal for listing was given, but the USFWS has committed to reviewing the status of the species one year after publication of the above-mentioned notice (i.e., on February 4, 2001) (USFWS 2000b). As of June 2002, the USFWS was listing the black-tailed prairie dog as a candidate (USFWS June 2002).

The black-tailed prairie dog is a highly social, diurnally active, burrowing mammal. Aggregations of individual burrows, known as colonies, form the basic unit of prairie dog populations. Found throughout the Great Plains in shortgrass and mixed-grass prairie areas (Fitzgerald et al. 1994), the black-tailed prairie dog has declined in population numbers and extent of colonies in recent years due to habitat destruction or disturbance and pest control activities. In Wyoming, this species is primarily found in isolated populations in the eastern half of the state (Clark and Stromberg 1987). Many other wildlife species, such as the black-footed ferret, swift fox, mountain plover, ferruginous hawk and burrowing owl are dependant on the black-tailed prairie dog for some portion of their life cycle (USFWS 2000b).

This species is considered a common resident, utilizing shortgrass and mid-grass habitats in eastern Wyoming (Luce et al. 1999).

NARO NORTH AND SOUTH LBA TRACTS

Listed Species

Ute ladies'-tresses (*Spiranthes diluvialis*)

Habitat and/or Occurrences

Suitable habitat within respective survey areas was traversed during the time of actual flowering of the known population of the Ute ladies'-tresses orchid on Antelope Creek in northern Converse County. Prefield work involved a visit to a known population of the orchid to verify the correct phenological state (flowering) of the orchid. Topographical and wetland delineation maps for the study area were reviewed to identify all significant drainages that may contain the orchid. Suitable habitat factors included less steep stream banks, light soil texture and well drained soils, close lateral or vertical distance to perennial water source during the flowering period, lack of plant competition, lack of general soil alkalinity/salinity, and current or historical management practices that did not promote overgrazing and extensive use of riparian areas.

Areas within the NARO North and NARO South LBA Tracts that are inside the currently approved North Antelope/Rochelle Complex permit area were surveyed by BKS Environmental Associates (Paige Wolken) August 28 and September 2, 1997. No individuals of the Ute ladies'-tresses orchid were located during those surveys. Areas within the LBA tracts that are outside the currently approved North Antelope/Rochelle Complex permit area were surveyed by BKS Environmental Associates (Paige Wolken, Heidi Smith, and Brenda Schladweiler) in August of 1999 and August of 2000. No individuals of the Ute ladies'-tresses orchid were located during those surveys.

Effects of the Proposed Project

Leasing the NARO North and South LBA Tracts under the Proposed Actions or Action Alternatives is not likely to adversely affect Ute ladies'-tresses. No individuals have been located during surveys of potentially suitable habitat on the two tracts in 1997, 1999, and 2000. Because of the ability of this species to persist below ground or above ground without flowering, single season surveys that meet the current USFWS survey guidelines may not detect populations. Undetected populations could be lost to surface disturbing activities. If these two tracts are leased, mining operations could not be initiated until the Mineral Leasing Act of 1920 (MLA) mining plan and the state mining and reclamation

permit are approved. Prior to permit approval, additional surveys and USFWS consultation would be required.

Bald eagle (*Haliaeetus leucocephalus*)

Habitat and/or Occurrences

Bald eagles are relatively common winter residents and migrants in northeastern Wyoming's PRB. Historically, this species has infrequently been seen foraging in the general vicinity of North Antelope/Rochelle Complex and perched in cottonwood trees along Antelope Creek, south of the North Antelope/Rochelle Complex. No unique or concentrated sources of carrion or prey occur in the study area for the NARO North and NARO South LBA Tracts, so foraging bald eagles would not be attracted to the area in great numbers. A few isolated bald eagle nesting attempts have been recorded in the region, but none have been near the NARO North and South LBA Tracts.

The NARO North and South LBA Tracts, the anticipated permit amendment study area and a two- mile perimeter were searched for bald eagles and roosting habitat on February 28, 2001 by Thunderbird Wildlife Consulting, Inc. (TWC), Gillette, Wyoming. During the survey, three adult bald eagles were seen perching in a small cottonwood tree along Horse Creek in the NE $\frac{1}{4}$ of Section 22, T.41N., R.71W., about one mile west of the NARO South anticipated permit amendment area under the Proposed Action. Because of the small stature of the tree and the small number of eagles, this was not classified as a bald eagle roost. Bald eagles were also observed on four occasions during baseline wildlife surveys conducted in 2000 by TWC. On February 23 and March 23, 2000, adult bald eagles were observed in the SE $\frac{1}{4}$ of Section 35, T.42N., R.71W., within the NARO North LBA Tract. Two sub-adult bald eagles were observed on April 18, 2000 perched on a rock in Porcupine Reservoir in Section 27, T.41N., R.70W. One adult was seen on December 11, 2000 perched on a fence post in the NE $\frac{1}{4}$ of Section 11, T.41N., R.71W. Both of these observations were within the anticipated permit amendment area for the North Antelope/Rochelle Complex under the Proposed Action and Action Alternatives.

Effects of the Proposed Project

Leasing and mining the NARO North and South LBA Tracts under the Proposed Action or Action Alternatives is not likely to adversely effect bald eagles. Bald eagle foraging habitat would be lost on the tracts during mining and before final reclamation. The loss of any potential prey habitat would be short-term. Foraging habitat that is lost during mining would be replaced as reclamation continues on already mined out areas. Eagles may alter foraging patterns as they fly around areas of active mining activity. Potential for bald eagles to collide with or be electrocuted by electric power lines on the mine site is minimal due to use of raptor-safe power lines. An increase in the volume and frequency of traffic on the

roads accessing North Antelope/Rochelle Complex may result in an increase in vehicular collisions and roadside carcasses. This could result in an increase of bald eagle foraging along roads in this area. If a lease is issued for these two tracts, mining operations could not be initiated until the MLA mining plan and the state mining and reclamation permit are approved. Prior to permit approval, additional surveys and consultation with USFWS would be required.

Black-footed ferret (*Mustela nigripes*)

Habitat and/or Occurrences

Black-footed ferrets are rare and very unlikely to occur in the vicinity of the NARO North and South LBA Tracts. The black-footed ferret is closely associated with prairie dogs, depending almost entirely upon the prairie dog for its survival. A baseline prairie dog town survey conducted in 2000 found no colonies on the NARO North LBA Tract and three colonies on the NARO South LBA Tract (see prairie dog discussion below). The prairie dog towns located on the NARO South LBA Tract are less than 80 acres in size. An additional three colonies were found within a half-mile of the two LBA tracts. In ferret surveys of the North Antelope/Rochelle Complex and surrounding areas, qualified biologists have not observed any evidence of ferret habitat or activity. For example, no black-footed ferret sign was detected during surveys conducted by TWC (formerly Powder River Eagle Studies) in three black-tailed prairie dog colonies near the mine complex in winter/spring 1999.

Effects of the Proposed Project

Issuing federal coal leases for the NARO North and South LBA Tracts under the Proposed Actions or Action Alternatives is not likely to adversely affect black-footed ferrets. Prairie dog towns of more than 80 acres in area, the typical suitable habitat for this species, are not currently located on either tract. In wildlife surveys conducted for more than the last 20 years by the mines in this area, none of the prairie dog towns in the General Analysis Area have harbored any black-footed ferrets. If leases are issued for these two tracts, mining operations could not be initiated until the MLA mining plan and the state mining and reclamation permit are approved. Prior to permit approval, additional surveys would be required and USFWS consultation would be required.

Proposed Species

Mountain plover (*Charadrius montanus*)

Habitat and/or Occurrences

Mountain plovers have regularly nested at the Antelope Mine, located south of and adjacent to the NARO South LBA Tract, but few have been sighted in the NARO North and South LBA study area. Each year from 1994 through 1996, adult plovers were seen in a black-tailed prairie dog colony in the SE $\frac{1}{4}$ NW $\frac{1}{4}$ of Section 17, T.41N., R.70W., which is on an existing North Antelope/Rochelle Complex federal coal lease. All of those sightings were made in the spring by qualified biologists with Powder River Eagle Studies. Numerous searches of the colony and surrounding area have failed to locate any plover nests and no young have ever been seen. No plovers have been observed in any prairie dog colonies or elsewhere during baseline surveys of the NARO North and South LBA Tracts wildlife study area.

Effects of the Proposed Project

Issuing federal coal leases for the NARO North and South LBA Tracts under the Proposed Actions or Action Alternatives is not likely to jeopardize mountain plovers. The typical suitable habitat for this species is not currently located on either of the tracts, and no plovers have been observed. If leases are issued for these LBA tracts, mining operations could not be initiated until the MLA mining plan and the state mining and reclamation permit are approved. Prior to permit approval, additional surveys and USFWS consultation would be required.

Candidate Species

Black-tailed prairie dog (*Cynomys ludovicianus*)

Habitat and/or Occurrences

Prairie dog towns were surveyed on the NARO North and South LBA wildlife baseline study area and the North Antelope/Rochelle Complex's current permit area in 2000 by TWC. Twenty-seven black-tailed prairie dog colonies totaling 1,148 acres were inventoried on the study area. Six prairie dog towns were inventoried on or within one half-mile of the two LBA tracts. No colonies were observed on the NARO North LBA Tract and one colony (located in the SW $\frac{1}{4}$ of Section 26, T.42N., R.71W.) is located within a half-mile radius of that proposed lease boundary. Three colonies were observed on the NARO South LBA Tract and two others (located in the W $\frac{1}{2}$ of Section 17 and the NE $\frac{1}{4}$ of Section 28, T.41N., R.71W.) are within a half-mile radius of that proposed lease boundary. No additional prairie dog towns were observed on the area that would be added under Alternative 2 for the NARO South LBA Tract.

Effects of the Proposed Project

Issuing a federal coal lease for the NARO North LBA Tract under the Proposed Action or Action Alternatives is not likely to jeopardize the continued existence of

prairie dogs because no prairie dog towns are currently located on the tract. Issuing a federal coal lease for the NARO South LBA Tract under the Proposed Action or Action Alternatives is not likely to jeopardize the continued existence of prairie dogs. There are three small (less than 80 acres) prairie dog colonies located on the NARO South LBA Tract. Those colonies and individuals in those colonies would be likely to be adversely affected if a federal coal lease is issued for the NARO South LBA Tract under the Proposed Action or Action Alternatives, however, there are other colonies in this area which would not be affected by mining operations at the North Antelope/Rochelle Complex or other nearby mines. Habitat where prairie dogs could establish towns would be lost during mining but would be replaced as reclamation occurs on already mined areas. If leases are issued for these LBA tracts, mining operations could not be initiated until the MLA mining plan and state mining and reclamation permit are approved. Prior to permit approval, additional surveys and USFWS consultation would be required.

LITTLE THUNDER LBA TRACT

Listed Species

Ute ladies'-tresses (*Spiranthes diluvialis*)

Habitat and/or Occurrences

A Ute ladies'-tresses orchid survey was completed by Intermountain Resources (Jim Orpet and Russel Tait) on the Little Thunder LBA Tract in August of 2001. The area surveyed was within the LBA tract as applied for, the areas added under Alternative 2, and the anticipated permit amendment study area.

In preparation for Ute ladies'-tresses surveys, Mr. Orpet visited the Rocky Mountain Herbarium in Laramie, Wyoming and reviewed herbaria specimens. The herbarium provided valuable information on sites this species was known to inhabit in Wyoming. Wyoming Wildlife Magazine published an article on this species in August 1995. Several color photographs from that article were used as field references and were carried with the investigators during field surveys.

Based on discussions with persons familiar with flowering dates of this species in Wyoming and the 2001 growing season conditions, field surveys were conducted on August 16–18, 20, 24, and 25. During a first site inventory, the entire study area was surveyed for potentially suitable habitats where the orchid may occur. These surveys were completed on foot, including walking the entire lengths of ephemeral drainages documenting locations of potential habitat and searching for this species. The additional surveys concentrated on thorough searches of the potential habitats identified during the first survey. Survey conditions were generally good except for some areas being heavily grazed by livestock. No Ute ladies'-tresses orchid were found within the study area during these surveys.

Potential habitats based on hydrological criteria were rare and artificially created by CBM production discharge water. The potential for the Ute ladies'-tresses orchid to occur within this study area would be low since the potential habitat created by CBM production discharge water has existed for less than one year. Most of this area was also surveyed in 1996 and prior years, during which time no orchids or other species of concern were identified.

Effects of the Proposed Project

Issuing a federal coal lease for the Little Thunder LBA Tract under the Proposed Action or Action Alternatives is not likely to adversely affect Ute ladies'-tresses. Typical suitable habitat for this species is rare and that which does occur in the study area has just recently been artificially created by CBM production discharge water. Surveys of the existing suitable habitat have not found any Ute ladies'-tresses. Because of the ability of this species to persist below ground or above ground without flowering, single season surveys that meet the current USFWS survey guidelines may not detect populations. If undetected populations are present, they could be lost to surface disturbing activities. If a lease is issued for this tract, mining operations could not be initiated until the MLA mining plan and the state mining and reclamation permit are approved. Prior to permit approval, additional surveys and consultation with USFWS would be required.

Bald eagle (*Haliaeetus leucocephalus*)

Habitat and/or Occurrences

Bald eagles are relatively common winter residents and migrants in northeastern Wyoming's PRB. Historically, this species has infrequently been seen foraging in the general vicinity of Black Thunder Mine. However, no suitable roosting habitat or concentrated prey or carrion sources for bald eagles exist in the Little Thunder study area. No bald eagles were observed in Black Thunder Mine's wildlife survey area in 2001. Qualified biologists with TWC watched for all listed species, including the bald eagle and habitats that could support them, while conducting all other wildlife species surveys. In addition, surveys for all MBHFI, including the bald eagle, were conducted by the same consultant during four days in both spring (May and June) and summer (July 2001).

Effects of the Proposed Project

Issuing a federal coal lease for the Little Thunder LBA Tract under the Proposed Action or Action Alternatives is not likely to adversely affect bald eagles. Bald eagle foraging habitat would be lost on the tract during mining and before final reclamation. The loss of any potential prey habitat would be short-term. Foraging habitat that is lost during mining would be replaced as reclamation continues on already mined out areas. Eagles may alter foraging patterns as they fly around areas of active mining activity. Potential for bald eagles to collide with or be

electrocuted by electric power lines on the mine site would be minimal due to use of raptor-safe power lines. An increase in the volume and frequency of traffic on the roads accessing Black Thunder Mine may result in an increase in vehicular collisions and roadside carcasses. This could result in an increase of bald eagle foraging along roads in this area. If a lease is issued for this tract, mining operations could not be initiated until the MLA mining plan and the state mining and reclamation permit are approved. Prior to permit approval, additional surveys and consultation with USFWS would be required.

Black-footed ferret (*Mustela nigripes*)

Habitat and/or Occurrences

Black-footed ferrets are rare and very unlikely to occur in the vicinity of the Little Thunder LBA Tract. The black-footed ferret is closely associated with prairie dogs, depending almost entirely upon the prairie dog for its survival. Recent surveys have found no prairie dog colonies on the Little Thunder LBA Tract (see prairie dog discussion below). One colony was found within one mile west of the LBA tract, which is within the anticipated permit amendment study area for the Black Thunder Mine, if the Little Thunder LBA Tract is leased. No evidence of ferrets have ever been recorded by qualified biologists during general or specific surveys in the Black Thunder Mine area. TWC watched for all listed species, including the black-footed ferret and habitats that could support them, while conducting all other wildlife species surveys in the area in 2001.

Effects of the Proposed Project

Issuing a federal coal lease for the Little Thunder LBA Tract under the Proposed Action or Action Alternatives is not likely to adversely affect black-footed ferrets. No prairie dog towns are currently located on the tract. In wildlife surveys conducted for more than the last 20 years by the mines in this area, none of the prairie dog towns in the General Analysis Area have harbored any black-footed ferrets. If a lease is issued for the tract, mining operations could not be initiated until the MLA mining plan and the state mining and reclamation permit are approved. Prior to permit approval, additional surveys and USFWS consultation would be required.

Proposed Species

Mountain plover (*Charadrius montanus*)

Habitat and/or Occurrences

Mountain plover preferred habitat consists of level, open and exceedingly grazed sites (Knopf 1996) that are generally lacking in the Little Thunder LBA study area. Even the prairie dog colonies are surrounded by rolling terrain that detracts from

the “openness” of those sites (Powder River Eagle Studies 2000). Historically, there have been a few sightings in the vicinity of the LBA tract and anticipated permit study area, but no plovers were observed during Black Thunder Mine’s wildlife survey in 2001. No surveys specifically targeting these species were conducted in 2001 by TWC, although qualified biologists watched for all listed species and habitats that could support them while conducting all other wildlife species surveys.

Effects of the Proposed Project

Issuing a federal coal lease for the Little Thunder LBA Tract under the Proposed Action or Action Alternatives is not likely to jeopardize mountain plovers. Although there have been a few sightings in the vicinity of the LBA tract, the typical suitable habitat for this species is not currently located on the tract. If a lease is issued for this LBA tract, mining operations could not be initiated until the MLA mining plan and the state mining and reclamation permit are approved. Prior to permit approval, additional surveys and USFWS consultation would be required.

Candidate Species

Black-tailed prairie dog (*Cynomys ludovicianus*)

Habitat and/or Occurrences

No prairie dog colonies exist within the Little Thunder LBA Tract or the area added under Alternative 2, but one colony does exist approximately one mile west of the tract configured under Alternative 2, which is within Black Thunder Mine’s anticipated permit amendment study area. No surveys specifically targeting these species were conducted in 2001 by qualified biologists with TWC, although habitats that could support federally listed species were observed and noted while conducting all other wildlife species surveys.

Effects of the Proposed Project

Issuing a federal coal lease for the Little Thunder LBA Tract under the Proposed Action or Action Alternatives is not likely to jeopardize the continued existence of prairie dogs. No prairie dog towns are currently located on the tract. If a lease is issued for this LBA tract, mining operations could not be initiated until the MLA mining plan and the state mining and reclamation permit are approved. Prior to permit approval, additional surveys and USFWS consultation would be required. Habitat where prairie dogs could establish towns would be lost during mining but would be replaced as reclamation occurs on already mined areas.

WEST ROUNDUP LBA TRACT

Listed Species

Ute ladies'-tresses (*Spiranthes diluvialis*)

Habitat and/or Occurrences

A Ute ladies'-tresses orchid survey was completed by Intermountain Resources (Jim Orpet) on the West Roundup LBA Tract in July and August of 2001 for sites not previously surveyed. The area surveyed included the lands contained within the LBA tract as applied for and the anticipated permit amendment study area.

In preparation for Ute ladies'-tresses surveys, Mr. Orpet visited the Rocky Mountain Herbarium in Laramie, Wyoming and reviewed herbaria specimens. The herbarium provided valuable information on sites this species was known to inhabit in Wyoming. Wyoming Wildlife Magazine published an article on this species in August 1995. Several color photographs from that article were used as field references and were carried with the investigators during field surveys.

Based on discussions with persons familiar with flowering dates of this species in Wyoming and the 2001 growing season conditions, initial field surveys were conducted on July 20. Additional site surveys were completed on August 14, 17, and 24. During the first site inventory, the entire study area was surveyed for potentially suitable habitats where the orchid may occur. These surveys were completed on foot, including walking the entire lengths of ephemeral drainages documenting locations of potential habitat and searching for this species. Potential habitats based on hydrological criteria are rare and artificially created by CBM production discharge water. Several stock reservoirs on ephemeral drainages occur in the study area and all are constructed earthen berms or dams. These ponds generally contain water in early spring, then dry up in the summer, although one pond in the northern part of the study area currently contains water all year due to CBM production discharge water. The additional surveys concentrated on thorough searches of the potential habitats identified during the first survey. Survey conditions were generally good except for some areas being heavily grazed by livestock. No Ute ladies'-tresses orchids were found within the study area during these surveys. The potential for the Ute ladies'-tresses orchid to occur within this study area would be rare since potential habitat created by CBM production discharge water has existed for less than one year.

Effects of the Proposed Project

Issuing a federal coal lease for the West Roundup LBA Tract under the Proposed Action or Action Alternatives is not likely to adversely affect Ute ladies'-tresses. Typical suitable habitat for this species is rare and that which does occur in the

study area has recently been artificially created by CBM production discharge water. Surveys of the existing suitable habitat have not found any Ute ladies'-tresses. Because of the ability of this species to persist below ground or above ground without flowering, single season surveys that meet the current USFWS survey guidelines may not detect populations. If undetected populations are present, they could be lost to surface disturbing activities. If a lease is issued for this tract, mining operations could not be initiated until the MLA mining plan and the state mining and reclamation permit are approved. Prior to permit approval, additional surveys and USFWS consultation would be required.

Bald eagle (*Haliaeetus leucocephalus*)

Habitat and/or Occurrences

Bald eagles are relatively common winter residents and migrants in northeastern Wyoming's PRB. Historically, this species has infrequently been seen foraging in the general vicinity of North Rochelle Mine and the West Roundup LBA Tract. However, no suitable roosting habitat or concentrated prey or carrion sources for bald eagles exist in the West Roundup study area. Qualified biologists with TWC watched for all listed species, including the bald eagle and habitats that could support them, while conducting all other wildlife species surveys. In addition, surveys for all MBHFI, including the bald eagle, were conducted by the same consultant during four days in both spring (May) and summer (June and July). No bald eagles were observed in the North Rochelle Mine's wildlife survey area in 2001.

Effects of the Proposed Project

Issuing a federal coal lease for the West Roundup LBA Tract under the Proposed Action or Action Alternatives is not likely to adversely affect bald eagles. Bald eagle foraging habitat would be lost on the tract during mining and before final reclamation. The loss of any potential prey habitat would be short-term. Foraging habitat that is lost during mining would be replaced as reclamation continues on already mined out areas. Eagles may alter foraging patterns as they fly around areas of active mining activity. Potential for bald eagles to collide with or be electrocuted by electric power lines on the mine site would be minimal due to use of raptor-safe power lines. An increase in the volume and frequency of traffic on the roads accessing North Rochelle Mine may result in an increase in vehicular collisions and roadside carcasses. This could result in an increase of bald eagle foraging along roads in this area. If a lease is issued for this tract, mining operations could not be initiated until the MLA mining plan and the state mining and reclamation permit are approved. Prior to permit approval, additional surveys and consultation with USFWS would be required.

Black-footed ferret (*Mustela nigripes*)

Habitat and/or Occurrences

Black-footed ferrets are rare and very unlikely to occur in the vicinity of the West Roundup LBA Tract. The black-footed ferret is closely associated with prairie dogs, depending almost entirely upon the prairie dog for its survival. Recent surveys indicate no prairie dog colonies are located within the West Roundup LBA Tract (see prairie dog discussion below). One small (less than three acres in area) colony is located within the area added under Alternatives 2 and 3, in the SE¼ of Section 5, T.42N., R.70W. One other colony is located just over a half mile south of the LBA tract, in the NE¼ of Section 18, T.42N., R.70W. No evidence of ferrets have ever been recorded by qualified biologists during general or specific surveys in the West Roundup Mine area. TWC watched for all listed species, including the black-footed ferret and habitats that could support them, while conducting all other wildlife species surveys in the area in 2001.

Effects of the Proposed Project

Issuing a federal coal lease for the West Roundup LBA Tract under the Proposed Action or Action Alternatives is not likely to adversely affect black-footed ferrets. There are no prairie dog towns of adequate size currently located on the tract as proposed or the alternative tract configurations. In wildlife surveys conducted for more than the last 20 years by the mines in this area, none of the prairie dog towns in the General Analysis Area have harbored any black-footed ferrets. If a lease is issued for the tract, mining operations could not be initiated until the MLA mining plan and the state mining and reclamation permit are approved. Prior to permit approval, additional surveys and USFWS consultation would be required.

Proposed Species

Mountain plover (*Charadrius montanus*)

Habitat and/or Occurrences

Mountain plover preferred habitat consists of level, open and exceedingly grazed sites (Knopf 1996) that are generally lacking in the West Roundup LBA study area. There have been no sightings of mountain plover in the vicinity of the LBA tract and anticipated permit amendment study area. No plovers were observed in the North Rochelle Mine wildlife survey area during the 2001 annual wildlife monitoring report period. No surveys specifically targeting these species were conducted in 2001 by TWC, although qualified biologists watched for all listed

species and habitats that could support them while conducting all other wildlife species surveys.

Effects of the Proposed Project

Issuing a federal coal lease for the West Roundup LBA Tract under the Proposed Action or Action Alternatives is not likely to jeopardize mountain plovers. There have been no sightings in the vicinity of the LBA tract, and the typical suitable habitat for this species is not currently located on the tract. If a lease is issued for this LBA tract, mining operations could not be initiated until the MLA mining plan and the state mining and reclamation permit are approved. Prior to permit approval, additional surveys and USFWS consultation would be required.

Candidate Species

Black-tailed prairie dog (*Cynomys ludovicianus*)

Habitat and/or Occurrences

Recent wildlife surveys by TWC indicate that no prairie dog colonies exist within the West Roundup LBA Tract as applied for, although one small (less than three acres) colony is located within the area added under Alternatives 2 and 3, and one other colony is located just over a half mile south of the LBA tract. No surveys specifically targeting these species were conducted in 2001 by qualified biologists with TWC, although habitats that could support federally listed species were observed and noted while conducting all other wildlife species surveys.

Effects of the Proposed Project

Issuing a federal coal lease for the West Roundup LBA Tract under the Proposed Action is not likely to jeopardize the continued existence of prairie dogs because no prairie dog towns are located on the tract as proposed. One small colony (less than three acres in area) is currently located within the area added under Alternatives 2 and 3, in the SE $\frac{1}{4}$ of Section 5, T.42N., R.70W. This colony, which could be adversely affected if that area is leased, is located within the existing mine permit area for the North Rochelle Mine. Habitat where prairie dogs could establish towns would be lost during mining but would be replaced as reclamation occurs on already mined areas. If a lease is issued for this LBA tract, mining operations could not be initiated until the MLA mining plan and the state mining and reclamation permit are approved. Prior to permit approval, additional surveys and USFWS consultation would be required.

WEST ANTELOPE LBA TRACT

Listed Species

Ute ladies'-tresses (*Spiranthes diluvialis*)

Habitat and/or Occurrences

Suitable habitat within the West Antelope LBA study areas was traversed during the time of actual flowering of the known population of the Ute ladies'-tresses orchid on Antelope Creek in Northern Converse County. Prefield work involved a visit to a known population of the orchid to verify the correct phenological state (flowering) of the orchid. The existing orchid population is located near the Ross Road on Antelope Creek approximately 25 miles upstream of Antelope Mine. Topographical and wetland delineation maps for the study area were reviewed to identify all significant drainages that may contain the orchid. Suitable habitat factors included less steep stream banks, light soil texture and well drained soils, close lateral or vertical distance to perennial water source during the flowering period, lack of plant competition, lack of general soil alkalinity/salinity, and current or historical management practices that did not promote overgrazing and extensive use of riparian areas.

Areas of suitable habitat, the majority of which are found along the Antelope Creek drainage, were surveyed by BKS Environmental (Brenda Schladweiler) in August 2001. No individuals of the Ute ladies'-tresses orchid were located during those surveys.

Effects of the Proposed Project

Issuing a federal coal lease for the West Antelope LBA Tract under the Proposed Action or Alternatives 2 or 3 is not likely to adversely affect Ute ladies'-tresses. Typical suitable habitat for this species does not exist on the tract outside of the Antelope Creek valley. ACC would not disturb Antelope Creek and an adjacent buffer zone in the process of mining the West Antelope tract or their existing coal leases. If a lease is issued for this tract, mining operations could not be initiated until the MLA mining plan and the state mining and reclamation permit are approved. Prior to permit approval, additional surveys and consultation with USFWS would be required.

Bald eagle (*Haliaeetus leucocephalus*)

Habitat and/or Occurrences

Bald eagles are relatively common winter residents and migrants in northeastern Wyoming's PRB. Historically, this species has infrequently been seen foraging in the general vicinity of the West Antelope LBA Tract and perched in cottonwood trees along Antelope Creek, which passes through the LBA tract and adjacent Antelope Mine. ACC would not disturb Antelope Creek and an adjacent buffer

zone in the process of mining the West Antelope LBA Tract or their existing coal leases. No bald eagle roosts have been documented in the vicinity of the proposed lease area. The nearest known communal bald eagle roosts are over six miles to the east and southwest of the LBA tract. No unique or concentrated sources of carrion or prey occur in the study area, so foraging bald eagles would not be attracted to the area in great numbers. A few isolated bald eagle nesting attempts have been recorded in the region, but none have been near the West Antelope LBA Tract.

During a February 28, 2001 survey conducted for the North Antelope/Rochelle Complex by TWC, three adult bald eagles were seen perching in a small cottonwood tree along Horse Creek in the NE¼ of Section 22, T.41N., R.71W. Because of the small stature of the tree and the small number of eagles, this was not classified as a bald eagle roost. TWC also reported the following bald eagle observations within the Wildlife Section of Antelope Mine's 2001 WDEQ/LQD Report:

- Two adult eagles were seen feeding on a mule deer carcass on reclaimed lands in Section 14, T.40N., R.71W. in the month of January.
- On February 19, two adult eagles were seen perched in the Antelope Creek riparian corridor in Section 31, T.41N., R.70W. The same day, an immature eagle was seen perched on a power pole along Antelope Creek in Section 32, T.41N., R.70W, an adult bird was seen perched on the ground near a mule deer carcass in Section 12, T.40N., R.71W., and an immature eagle was observed flying over the rough breaks in Section 24, T.40N., R.71W.
- On March 7, two adults and one immature bird were recorded perched on a ridge along the extreme east edge of the mine's two-mile monitoring perimeter.
- On March 17, an immature eagle was seen perched in a cottonwood tree in the Antelope Creek riparian corridor in Section 31, T.41N., R.70W., an adult eagle was observed perched in a cottonwood tree in the Antelope Creek riparian corridor in Section 32, T.41N., R.70W., three adults were seen perched in trees in Section 33, T.41N., R.70W., and an adult bird was seen perched on a hilltop in Section 12, T.40N., R.71W.
- The last bird recorded by TWC in 2001 was observed on April 1, which was an adult bird perched on a power pole in Section 12, T.40N., R.71W.

Effects of the Proposed Project

Issuing a federal coal lease for the West Antelope LBA Tract under the Proposed Action or Alternatives 2 or 3 is not likely to adversely affect bald eagles. Bald eagle foraging habitat would be lost on the tract during mining and before final reclamation. The loss of any potential prey habitat would be short-term. The Antelope Mine and West Antelope LBA Tract areas do not provide any reliable or concentrated food sources for eagles, and the loss of any potential foraging habitat would be short-term. Foraging habitat that is lost during mining would be

replaced as reclamation continues on already mined out areas. Eagles may alter foraging patterns as they fly around areas of active mining activity. Bald eagles could potentially nest or roost in the LBA study area, but neither activity has been documented on the undisturbed tract. ACC would not disturb Antelope Creek and an adjacent buffer zone in the process of mining the West Antelope LBA Tract or their existing coal leases. Cottonwood trees located within the Antelope Creek buffer zone would not be affected and would be available as perching and nesting sites. Cottonwood trees outside of the buffer zone along Antelope Creek would be replaced with plantings along Antelope Creek, Spring Creek, and other reclaimed drainages, eventually restoring perching and nesting sites. Potential for bald eagles to collide with or be electrocuted by electric power lines on the mine site would be minimal due to use of raptor-safe power lines. An increase in the volume and frequency of traffic on the roads accessing Antelope Mine may result in an increase in vehicular collisions and roadside carcasses. This could result in an increase of bald eagle foraging along roads in this area. If a lease is issued for this tract, mining operations could not be initiated until the MLA mining plan and the state mining and reclamation permit are approved. Prior to permit approval, additional surveys and consultation with USFWS would be required.

Black-footed ferret (*Mustela nigripes*)

Habitat and/or Occurrences

Black-footed ferrets are rare and very unlikely to occur in the vicinity of the West Antelope LBA Tract. Prairie dogs are the main food source of black-footed ferrets, and few ferrets have been collected away from prairie dog colonies. Although the proposed lease area and its perimeter harbor some small prairie dog colonies, no evidence of ferrets has been recorded in that vicinity during general or specific ferret surveys conducted over the last 23 years (1978–2001) by the USFS and wildlife consultants (Powder River Eagle Studies and TWC). The USFS conducted surveys on all prairie dog colonies in the TBNG throughout the 1980s. The only evidence of black-footed ferret presence resulting from any survey in the region was a single skull collected during baseline studies for Antelope Mine in 1979 in a prairie dog colony roughly three miles east of the LBA tract. That colony was poisoned in 1982, but has since been recolonized. The lack of black-footed ferret observations or sign in the vicinity of the West Antelope LBA Tract in the last 20 years suggests they are not likely to occur there.

Effects of the Proposed Project

Issuing a federal coal lease for the West Antelope LBA Tract under the Proposed Action or Alternatives 2 or 3 is not likely to adversely affect black-footed ferrets. Ferrets inhabit prairie dog colonies, so mining of lands in the study area could potentially impact these predators. However, in wildlife surveys conducted for more than the last 20 years by the mines in this area, none of the prairie dog towns in the General Analysis Area have harbored any black-footed ferrets. If a

lease is issued for the tract, mining operations could not be initiated until the MLA mining plan and the state mining and reclamation permit are approved. Prior to permit approval and to ensure that no ferrets are adversely affected, appropriate surveys and consultation with USFWS would be required prior to disturbing any prairie dog colonies on the tract.

Proposed Species

Mountain plover (*Charadrius montanus*)

Habitat and/or Occurrences

Annual surveys for mountain plovers have been conducted at the Antelope Mine from 1982 through 2000. Additional intensive studies were conducted from 1985 through 1988 (Parrish 1988, Oelklaus 1989). Antelope Coal Company's staff biologist conducted the annual surveys from 1982 through 1993 and TWC (formerly Powder River Eagle Studies) has conducted all surveys after 1993. Each year, the survey area includes the Antelope Mine permit area and a half-mile perimeter, with special emphasis in areas where birds have been seen in the past (including areas beyond that survey area). The eastern three-quarters of the West Antelope LBA Tract has been surveyed in most years since 1982. Surveys for migrant and nesting mountain plovers occurred from early spring through late summer each year. Personnel have conducted vehicular and pedestrian surveys and searches of all known former use areas and potential new use areas each year. Data collected during surveys included number of birds, age (when possible), location, activity and habitat.

Results of those studies have demonstrated that the mountain plover is a regular migrant and summer resident in the vicinity of Antelope Mine and portions of the LBA tract. Over time, the birds tended to be observed foraging and nesting in roughly the same areas from year to year. In recent years (1994 to 2001), two to three pairs have nested in a small (approximately 88 acres) black-tailed prairie dog colony that straddles the southern boundary of the LBA tract. That colony also appears to be a regular late summer staging area for migrating mountain plovers. Although the entire 88-acre prairie dog colony appears to provide suitable foraging and nesting habitat, mountain plovers have regularly been seen in only about 15 of the 88 total acres of colony; five acres of which overlap the southern edge of the LBA tract. Other sightings of mountain plovers on the proposed lease area were made in a small (approximately 14 acres) prairie dog colony near the north-central boundary of the tract. A single adult was seen foraging within that colony one time during each of the last two spring surveys. Historically, mountain plovers have been observed along the northeastern edge of the LBA tract as proposed, where it meets the southwest corner of the area added under Alternative 2. However, plovers were observed in that area only two of the last 19 years, nesting there only one year. The last sighting of mountain plovers in the Alternative 2

area occurred in 1990. The area has since become largely overgrown with sagebrush and is no longer suitable plover habitat.

One or two pairs of mountain plovers have occasionally nested in a small (approximately 126 acres) prairie dog colony just beyond the east-central edge of the LBA tract. The majority of that prairie dog colony was impacted by mining operations after the 2000 breeding season, but approximately three acres remained intact and active following that disturbance. In May 2001, Antelope Mine and USFWS agreed upon a mitigation plan for the portion of the colony that had been used by mountain plovers over time, and that plan will be finalized in the near future. A comprehensive review of nearly 20 years' of data on mountain plover use in the vicinity of the Antelope Mine also led to the reclassification of some long-term inactive areas as "Former Use Areas." However, ACC will continue to include those areas and the West Antelope LBA Tract study area in annual monitoring for the Antelope Mine. Any former or new use areas within the final configuration of the West Antelope LBA Tract will be included in a USFWS-approved mitigation plan that will be incorporated into Antelope Mine's WDEQ/LQD mine permit.

Effects of the Proposed Project

Issuing a federal coal lease for the West Antelope LBA Tract under the Proposed Action or Alternatives 2 or 3 would impact typical suitable habitat for mountain plover that is currently located on the tract, but would not be likely to jeopardize the species in this area. Mountain plovers regularly nest and stage in a black-tailed prairie dog colony that straddles the southern boundary of the tract. Potential impacts to mountain plovers would include loss of habitat and displacement to suitable habitat nearby. However, depending on the timing of the disturbance, such impacts may be mitigated to some extent by natural circumstances.

The mountain plovers that frequent the LBA tract are almost exclusively found in a small prairie dog colony that straddles the southern boundary of the tract. The birds typically use a 15-acre portion of the colony of which about five acres occur on the LBA tract. It is possible that during the interim between applying for the lease and mining the LBA, the prairie dog colony may naturally expand. If the expansion was to the south, it could increase the quantity of plover habitat beyond the LBA boundary prior to any losses. If prairie dogs do not voluntarily expand to the south prior to mining the LBA tract, those animals that survive may do so after the initial development activities begin. Mountain plovers may also choose to move from this prairie dog colony to a similar colony approximately one mile to the southeast. However, such a move could result in conflicts and competition for resources with the mountain plovers that already inhabit that colony. Alternatively, mountain plovers may move from the prairie dog colony near the south boundary of the LBA tract to a similar area of naturally sparse

vegetation roughly one mile due south of the current colony. Adult and young mountain plovers have infrequently been seen in that area in recent years.

TWC states the following within Antelope Mine's 2001 Annual Wildlife Monitoring Report to the WDEQ/LQD: "Given the species' willingness to return to areas disturbed by mining, the long-term stability of the number of breeding pairs in the area, and the quantity of apparently suitable but unoccupied habitat in the area, it seems that mining operations at Antelope are not adversely impacting mountain plovers".

If a lease is issued for this LBA tract, mining operations could not be initiated until the MLA mining plan and the state mining and reclamation permit are approved. Prior to permit approval, additional surveys and consultation with USFWS would be required. Antelope Mine's currently approved mining and reclamation plan and migratory bird mitigation plan both include measures designed to reduce potential impacts to this species and guide the reclamation of its habitat. Antelope Mine has worked with USFWS to revise and refine the specific measures to be used during protection and reclamation efforts, as well as the acreage to be reclaimed. A new plan was recently developed and is awaiting final approval by the USFWS prior to being incorporated into Antelope Mine's permit document. That plan would be updated and submitted to the USFWS and WDEQ/LQD for approval if the West Antelope LBA Tract is leased and approved for mining.

Candidate Species

Black-tailed prairie dog (*Cynomys ludovicianus*)

Habitat and/or Occurrences

In 2000, TWC mapped the current acreage of prairie dog colonies in the vicinity of the Antelope Mine by walking the perimeters of colonies and delineating them on topographic maps. Approximately 110 acres of black-tailed prairie dog colonies, in four small colonies, are currently present on and within a half mile of the West Antelope LBA Tract as proposed and the area added by Alternative 2. Two colonies are included in, or overlap the LBA tract under the Proposed Action; one in the north-central part and one in the south-central part. Both areas were described in the discussion of mountain plovers above. A third colony covers roughly 2.5 acres in the southwest corner of the area added by Alternative 2. That colony was established in 2000, presumably by survivors of the poisoning efforts that apparently took place in the northern-most colony within the LBA tract in the fall/winter of 1999. The fourth colony consists of the remains of a colony that was disturbed by mining just beyond the east-central boundary of the LBA tract. In

addition to these four colonies in the immediate vicinity of the West Antelope LBA Tract, at least four more small colonies are known to exist within the same complex (4.7-mile radius) in that area.

Effects of the Proposed Project

If a federal coal lease is issued for the West Antelope LBA Tract under the Proposed Action or Alternative 2, there would likely be direct and indirect effects on individuals and colonies of the black-tailed prairie dog because all or portions of three small colonies are currently located on the tract and lands added under Alternative 2: two on the tract as proposed and one on the Alternative 2 area, but would not be likely to jeopardize the continued existence of this species in this area. Much of the largest colony lies outside of the proposed lease area. The majority of the prairie dog colony acreage on the tract would be lost during the mining process. It may be possible to preserve some portions in the largest colony at the southern edge of the tract. Any surviving animals could then serve as a source of prairie dogs for re-colonization of the mine area during and after reclamation.

If a lease is issued for the tract, mining operations could not be initiated until the MLA mining plan and the state mining and reclamation permit are approved. Prior to permit approval, additional surveys would be required. The results of such surveys would be reviewed by USFWS before mining could proceed. Habitat where prairie dogs could establish towns would be lost during mining but would be replaced as reclamation occurs on already mined areas.

REGULATORY REQUIREMENTS AND MITIGATION

The issuance of a Federal coal lease grants the lessee the exclusive rights to mine the coal, subject to the terms and conditions of the lease. Lease ownership is necessary for mining federal coal, but lease ownership does not authorize mining operations. No operations can occur on the leased lands until the approval of both the MLA mining plan and the state mining and reclamation permit under the applicable Wyoming state regulations (Section 1.2). If the NARO North, NARO South, Little Thunder, West Roundup, and West Antelope LBA Tracts are leased, they would be maintenance leases for existing mines with currently approved MLA mining plans and state mining and reclamation permits. In the case of maintenance leases, the existing MLA mining plans and state mining and reclamation plans must be modified to include the newly leased areas before they can be mined.

As part of the application and approval process for MLA mining plans and state mining and reclamation permits, coal lessees are required to conduct additional surveys and other evaluations as needed to ensure compliance with the ESA. The USFWS will again be consulted during the permit application review process.

Permit applications are based on an actual detailed site-specific mining and reclamation proposal and the most current survey information.

The following is a partial list of measures that are required as part of the mining and reclamation permits:

- avoiding bald eagle disturbance;
- restoring bald eagle foraging areas disturbed by mining;
- restoring mountain plover habitat;
- using raptor safe power lines;
- surveying for Ute ladies'-tresses if habitat is present;
- surveying for mountain plover if habitat is present; and
- surveying for black-footed ferrets in prairie dog towns potentially affected by mining.

CUMULATIVE IMPACTS

Existing activities in the PRB that are contributing to cumulative effects to T&E plant and wildlife species include surface coal mining; conventional and CBM oil and gas development; uranium mining; sand, gravel, and scoria mining; ranching; agriculture; road, railroad, and power plant construction; recreational activities; and rural and urban housing development. Mining and construction activities and urban development tend to have more intense impacts on fairly localized areas, while ranching, recreational activities, and oil and gas development tend to be less intensive but spread over larger areas. Oil and gas development and mining activities have requirements for reclamation of disturbed areas as resources are depleted. The net area of energy disturbance in the Wyoming PRB is increasing overall; however, as new areas of disturbance are added, mined-out areas are restored and reclaimed, and oil and gas well sites are reclaimed when depleted oil and gas wells are abandoned.

The total acreage affected by coal mining and oil and gas development would not be disturbed simultaneously, because development would occur over the life of the operations. Some of the disturbed acreage would be reclaimed or would be in the process of being reclaimed when new disturbances are initiated. In the near future, the amount of disturbed T&E plant and wildlife habitats is likely to increase, although reclamation would eventually overtake new development.

Cumulative effects would also occur to T&E plant and wildlife resources as a result of indirect impacts. One factor is the potential import and spread of noxious weeds around roads and facilities. Noxious weeds have the ability to displace native vegetation and hinder reclamation efforts. If weed mitigation and preventative procedures are applied to all construction and reclamation practices, the impact of noxious weeds on T&E plants and wildlife would be minimized.

In reclaimed areas, vegetation cover often differs from undisturbed areas. In the case of surface coal mines, re-established vegetation would be dominated by species mandated in the reclamation seed mixtures (to be approved by WDEQ/LQD). The majority of the approved species are native to the area; however, reclaimed areas may not serve ecosystem functions presently served by undisturbed vegetation communities and habitats, particularly in the short-term, when species composition, shrub cover, and other environmental factors are likely to be different. Establishment of noxious weeds and alteration of vegetation in reclaimed areas has the potential to alter T&E plant and wildlife habitat composition and distribution. As a result, shifts in habitat composition or distribution may affect T&E plant and wildlife species in the PRB.

USFS REGION 2 SENSITIVE AND MANAGEMENT INDICATOR SPECIES

Species that have been identified by the Regional Forester as sensitive species and management indicator species (MIS) must be considered for the three LBA tracts that include USFS lands (NARO North, Little Thunder, and West Roundup).

USFS REGION 2 SENSITIVE SPECIES

The USFS classifies species as “Sensitive” when they meet one or more of the following three criteria: 1) the species is declining in numbers or occurrences, and evidence indicates it could be proposed for federal listing as threatened or endangered if action is not taken to reverse or stop the downward trend; 2) the species’ habitat is declining, and continued loss could result in population declines that lead to federal listing as threatened or endangered if action is not taken to reverse or stop the decline; and 3) the species’ population or habitat is stable but limited. In addition to these criteria, a ranking system is used to identify species for Sensitive status, which is outlined in USFS Manual 2670-2671. Table 1 lists species that have been identified as “Sensitive” for USFS Region 2.

The USFS Douglas Ranger District has reviewed the entire list of animal and plant sensitive species for USFS Region 2 and eliminated those species that occur on the TBNG, but are outside of any effects of the proposal (geographically or biologically), from further review. The species listed in Table 2 will be evaluated for potential effects from the proposed actions and alternatives. These species have been identified as potentially inhabiting the project planning area or potentially affected by the proposed action.

HABITAT AND OCCURRENCES ON AND NEAR THE NARO NORTH, LITTLE THUNDER, AND WEST ROUNDUP LBA TRACTS

Site-specific data on the occurrence of USFS sensitive species on the NARO North, Little Thunder, and West Roundup LBA Tracts were obtained from WDEQ/LQD permit applications and annual reports for the North Antelope/Rochelle Complex, Black Thunder Mine, North Rochelle Mine, and other mines in this area. Wildlife surveys have been conducted on the LBA tracts during baseline and annual monitoring surveys for the existing mines, which include each mine’s current permit area and a two-mile surrounding area. In addition, PRCC conducted wildlife baseline investigations in 2000 on the NARO North LBA Tract. Only limited fisheries and aquatics studies have been conducted for the NARO North, Little Thunder, and West Roundup LBA Tracts. Fish sampling was conducted during baseline studies for the North Antelope and Rochelle Mines in the late 1970s, the North Rochelle Mine in 1980-81, and the Little Thunder LBA Tract in

Table 1. USFS Region 2 Sensitive Species List (provided by USFS June 2002).

Latin Name	Common Name	Status on TBNG
PLANTS		
<i>Pyrrocoma carthamoides</i> var. <i>subsquarqrosus</i>	Absaroka goldenweed	
<i>Malaxis brachypoda</i>	Adder's-mouth	
<i>Parthenium alpinum</i>	Alpine feverfew	
<i>Eriophorum altaicum</i> var. <i>neogaeum</i>	Altai cottongrass	
<i>Adenocaulon bicolor</i>	American trail plant	
<i>Corallorhiza odontorhiza</i>	Autumn coralroot	
<i>Salix serissima</i>	Autumn willow	
<i>Austragalus proximus</i>	Aztec milk-vetch	
<i>Gilia penstemonoides</i>	Beardtongue gilia	
<i>Sanguinaria canadensis</i>	Bloodroot	
<i>Eriogonum brandegei</i>	Brandegee wild-buckwheat	
<i>Penstemon caryi</i>	Cary beardtongue	
<i>Cypripedium fasciculatum</i>	Clustered lady's-slipper	
<i>Aletes humilis</i>	Colorado aletes	
<i>Gaura neomexicana coloradoensis</i>	Colorado butterfly plant	
<i>Ptilagrostis mongholica porteri</i>	Colorado false needle grass	
<i>Frasera coloradensis</i>	Colorado gentian	
<i>Machaeranthera coloradoensis</i>	Colorado tansy-aster	
<i>Scirpus cyperinus</i>	Cottongrass bulrush	
<i>Townsendia condensate</i> var. <i>anomela</i>	Cushion townsend-daisy	
<i>Eriogonum visherii</i>	Dakota wild-buckwheat	
<i>Phacelia scopulina</i> var. <i>submutica</i>	Debeque scorpion-weed	
<i>Penstemon degeneri</i>	Degener's penstemon	
<i>Asclepias unicalis</i>	Dwarf milkweed	
<i>Equisetum scirpoides</i>	Dwarf scouring-rush	
<i>Carex alopecoidea</i>	Fox-tail sedge	
<i>Lesquerella fremontii</i>	Fremont's bladderpod	
<i>Potentilla effusa</i> var. <i>rupicola</i>	Front Range cinquefoil	
<i>Epipactis gigantea</i>	Giant helleborine	
<i>Ipomopsis globularis</i>	Globe gilia	
<i>Carex intumescens</i>	Greater bladder sedge	
<i>Viola selkirkii</i>	Great-spurred violet	
<i>Primula egaliksensis</i>	Greenland primrose	
<i>Austragalus anisus</i>	Gunnison milk-vetch	
<i>Festuca hallii</i>	Hall's fescue	
<i>Sullivantia hapemanii</i> var. <i>purpusii</i>	Hapeman's coolwort (Colorado)	
<i>Sullivantia hapemanii</i> var. <i>hapemanii</i>	Hapeman's coolwort (Wyoming)	
<i>Penstemon harringtonii</i>	Harrington's beardtongue	
<i>Salix lanata calcicola</i>	Hulten wooly willow	
<i>Ipomopsis spicata robruthii</i>	Kirkpatrick ipomopsis	
<i>Aquilegia laramiensis</i>	Laramie columbine	
<i>Sphaeromeria simplex</i>	Laramie false sagebrush	
<i>Platanthera orbiculata</i>	Large round-leaf orchid	

Table 1. USFS Region 2 Sensitive Species List (provided by USFS June 2002)
(Continued).

Latin Name	Common Name	Status on TBNG
<i>Carex livida</i>	Livid sedge	
<i>Carex pedunculata</i>	Long-stalk sedge	
<i>Muhlenbergia glomerata</i>	March muhly	
<i>Astragalus molybdenus</i>	Molybdenum milk-vetch	
<i>Salix myrtillifolia</i> var. <i>myrtillifolia</i>	Myrtle-leaf willow	
<i>Parrya nudicaulis</i>	Naked-stem wallflower	
<i>Botrychium lineare</i>	Narrow-leaved moonwort	
<i>Arnica lonchophylla</i>	Northern arnica	
<i>Rubus arcticus acaulis</i>	Northern blackberry	
<i>Ipomopsis polyantha</i> var. <i>polyantha</i>	Pagosa skyrockets	
<i>Lesquerella pruinosa</i>	Pagosa Springs bladderpod	
<i>Botrychium campestre</i>	Pale moonwort	
<i>Agoseris lackschewitzii</i>	Pink agoseris	
<i>Botrychium campestre</i>	Prairie moonwort	
<i>Arctostaphylos rebra</i>	Red manzanita	
<i>Botrychium echo</i>	Reflected moonwort	
<i>Astragalus ripleyi</i>	Ripley's milk-vetch	
<i>Neoparrya lithophila</i>	Rock-loving aletes	
<i>Scirpus rollandii</i>	Rolland's bulrush	
<i>Drosera rotundifolia</i>	Round-leaf sundew	
<i>Amerorchis rotundifolia</i>	Round-leaved orchid	
<i>Chenopodium cycloides</i>	Sandhill goosefoot	
<i>Armeria maritime</i> var. <i>siberica</i>	Sea pink	
<i>Shoshonea pulvinata</i>	Shoshonea	
<i>Draba smithii</i>	Smith's whitlow-grass	
<i>Braya glabella</i>	Smooth rockcress	
<i>Aster mollis</i>	Soft aster	
<i>Adiantum capillus-veneris</i>	Southern maidenhair fern	
<i>Ambrosia linearis</i>	Streaked ragweed	
<i>Lycopodium complanatum</i>	Trailing clubmoss	
<i>Lycopodium dendroideum</i>	Treelike clubmoss	
<i>Botrychium ascendens</i>	Upward-lobe moonwort	
<i>Mimulus gemmiparus</i>	Weber's monkey-flower	
<i>Ipomopsis aggregata</i>	Weber's scarlet-gilia	
<i>Descurainia torulosa</i>	Wind River tansy-mustard	
<i>Erigeron lanatus</i>	Wooly fleabane	
FISH		
<i>Hybopsis aestivalis tetranemus</i>	Chub, Arkansas River speckled	
<i>Platygobio gracilis</i>	Chub, flathead	K
<i>Hybopsis meeki</i>	Chub, sicklefin	
<i>Phoxinus erythrogaster</i>	Dace, southern red belly	
<i>Etheostoma cragini</i>	Darter, Arkansas	
<i>Fundulus diaphanus</i>	Killfish, banded	
<i>Notropis girardi</i>	Shiner, Arkansas River	
<i>Cyleptus elongatus</i>	Sucker, blue	
<i>Fundulus sciadicus</i>	Topminnow, plains	K

Table 1. USFS Region 2 Sensitive Species List (provided by USFS June 2002)
(Continued).

Latin Name	Common Name	Status on TBNG
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<i>Oncorhynchus</i> (=Salmo) <i>clarki pleuriticus</i>	Trout, Colorado River cutthroat	
<i>Oncorhynchus</i> (=Salmo) <i>clarki virginalis</i>	Trout, Rio Grande cutthroat	
<i>Oncorhynchus</i> (=Salmo) <i>clarki bouveri</i>	Trout, Yellowstone cutthroat	
INVERTEBRATES		
<i>Speyeria idalia</i>	Butterfly, regal fritillary	
<i>Phyciodes batesii</i>	Butterfly, tawny crescent	S
<i>Acronicta albarufa</i>	Moth, albarufan dagger	
<i>Ethmia monachella</i>	Moth, lost ethmiid	
<i>Decodes stevensi</i>	Moth, Stevens' tortricid	
<i>Discus shimeki cockerellii</i>	Snail, Cockerell's striate disc	
<i>Oreohelix strigosa cooperi</i>	Snail, Cooper's Rocky Mountain	
<i>Acroloxus coloradensis</i>	Snail, Rocky Mountain capshell	
REPTILES AND AMPHIBIANS		
<i>Rana pipiens</i>	Frog, northern leopard	K
<i>Rana pretiosa</i>	Frog, spotted	
<i>Rana sylvatica</i>	Frog, wood	
<i>Phrynosoma cornutum</i>	Lizard, Texas horned	
<i>Ambystoma tigrinum</i>	Salamander, tiger	K
<i>Storeria occipitomeoculatae pahasapae</i>	Snake, Black Hills redbellied	
<i>Arizona elegans blanchardi</i>	Snake, Kansas glossy	
<i>Tropidoclonion lineatum</i>	Snake, lined	
<i>Lampropeltis triangulum multistrata</i>	Snake, pale milk	S
<i>Diadophis punctatus arnyi</i>	Snake, prairie ringneck	
<i>Leptotyphlops dulcis</i>	Snake, Texas blind	
<i>Rhinocheilus lecontei tessellatus</i>	Snake, Texas longnosed	
<i>Bufo boreas boreas</i>	Toad, boreal western	
<i>Kinosternon flavescens flavescens</i>	Turtle, yellow mud	
MAMMALS		
<i>Euderma maculatum</i>	Bat, spotted	
<i>Plecotus townsendii</i>	Bat, Townsend's big-eared	K
<i>Martes pennanti</i>	Fisher	
<i>Vulpes velox</i>	Fox, swift	K
<i>Thomomys fuscus</i>	Gopher, Wyoming pocket	
<i>Spermophilus tridecemlineatus alleni</i>	Ground squirrel, Allen's thirteen-lined	
<i>Felis lynx canadensis</i>	Lynx, North American	
<i>Marmota flaviventris notioros</i>	Marmot, Wet Mountains yellow-bellied	
<i>Martes americana</i>	Marten	
<i>Zapus hudsonicus preblei</i>	Mouse, Prebles' meadow jumping	
<i>Myotis thysanodes pahasapensis</i>	Myotis, fringe-tailed	S
<i>Cynomys ludovicianus</i>	Prairie dog, black-tailed	K
<i>Bassariscus astutus</i>	Ringtail	
<i>Sorex nanus</i>	Shrew, dwarf	
<i>Microsorex hoyi montanus</i>	Shrew, pygmy	
<i>Conepatus mesoleucus figginsi</i>	Skunk, Colorado hognosed	

Table 1. USFS Region 2 Sensitive Species List (provided by USFS June 2002)
(Continued).

Latin Name	Common Name	Status on TBNG
<i>Microtus richardsoni</i>	Vole, water	
<i>Mustela rixosa</i>	Weasel, least	

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<i>Gulo gulo luscus</i>	Wolverine, North American	
BIRDS		
<i>Botaurus lentiginosus</i>	Bittern, American	U
<i>Grus canadensis</i>	Crane, greater sandhill	
<i>Coccyzus americanus</i>	Cuckoo, western yellow-billed	K
<i>Numenius americanus</i>	Curlew, long-billed	K
<i>Histrionicus histrionicus</i>	Duck, harlequin	
<i>Contopus borealis</i>	Flycatcher, olive-sided flycatcher	
<i>Epidonax trailii extimus</i>	Flycatcher, southwestern willow	
<i>Accipiter gentilis apache</i>	Goshawk, Apache northern	
<i>Accipiter gentilis</i>	Goshawk, northern	K
<i>Tympanachus phasianellus columbianus</i>	Grouse, Columbian sharp-tailed	
<i>Buteo regalis</i>	Hawk, ferruginous	K
<i>Plegadis chihi</i>	Ibis, white-faced	K
<i>Regulus satrapa</i>	Kinglet, golden-crowned	
<i>Gavia immer</i>	Loon, common	K
<i>Progne subis</i>	Martin, purple	
<i>Falco columbarius</i>	Merlin	K
<i>Sitta pygmaea</i>	Nuthatch, pygmy	
<i>Pandion haliaetus</i>	Osprey	U
<i>Aegolius funereus</i>	Owl, boreal	
<i>Otus flammeolus</i>	Owl, Flammulated	
<i>Athene cunicularia</i>	Owl, western burrowing	K
<i>Tympanachus pallidicinctus</i>	Prairie chicken, lesser	
<i>Charadrius montanus</i>	Plover, mountain	K
<i>Charadrius alexandrinus nivosus</i>	Plover, western snowy	
<i>Tympanachus cupido</i>	Prairie chicken, greater	
<i>Bartramia longicauda</i>	Sandpiper, upland	K
<i>Lanius ludovicianus</i>	Shrike, loggerhead	K
<i>Ammodramus bairdii</i>	Sparrow, Baird's	K
<i>Passerella iliaca</i>	Sparrow, fox	K
<i>Cygnus buccinator</i>	Swan, trumpeter	
<i>Cypseloides niger</i>	Swift, black	
<i>Chlidonias niger</i>	Tern, black	K
<i>Picoides tridactylus</i>	Woodpecker, three-toed	
<i>Picoides arcticus</i>	Woodpecker, black-backed	
<i>Melanerpes lewis</i>	Woodpecker, Lewis'	K
Status Codes:		
K = Known occurrence in vicinity. Date of last observation indicates that species still occurs in area.		
N = No recent observations; surveys recently completed; may be historic records; potential habitat possible.		
S = Suspected occurrence. May be historic records but no recent observations. Suitable habitat likely.		
U = Unknown occurrence, more surveys may be needed, may be historic records, potential habitat possible.		

Table 2. USFS Region 2 Listed Sensitive Species That May Occur in the TBNG or be Impacted by Leasing the NARO North, Little Thunder, and West Roundup LBA Tracts (provided by USFS Douglas Ranger District, September 2002).

Name	Status in TBNG	Habitat and Occurrence in TBNG
AMPHIBIANS AND REPTILES		
Northern leopard frog <i>Rana pipens</i>	K	Shallow, permanent, or semi-permanent standing water with at least some emergent vegetation (Wagner 1997). Deeper lakes or ponds with well-oxygenated water that does not freeze at bottom required for over wintering (Wagner 1997). Found throughout Wyoming (Baxter and Stone 1980, Luce et al. 1999).
Tiger salamander <i>Ambystoma tigrinum</i>	K	Sagebrush plains, forests, and meadows near water including riparian areas, streams, wetlands, ponds. Relatively common throughout Wyoming (Baxter and Stone 1980, Luce et al. 1999), documented during annual wildlife surveys for the Antelope Mine, Black Thunder Mine, and North Rochelle Mine.
FISH		
Flathead chub <i>Hybopsis gracilis</i>	S	Documented in Antelope Creek and other tributary drainages during late 1970's water resource surveys.
Plains topminnow <i>Fundulus sciadicus</i>	U	Species known from northeast Colorado and eastern Wyoming.
Banded killifish <i>Fundulus diaphanus</i>	U	Species known from northeast Nebraska.
MAMMALS		
Black tailed prairie dog <i>Cynomys ludovicianus</i>	K	Basin-prairie shrub, grasslands. Relatively abundant in Campbell County. The TBNG harbors one of the seven major colony complexes remaining in North America.
Swift fox <i>Vulpes velox</i>	K	Flat to gently rolling, short or mixed grass prairies, generally lacking in shrubs or woody vegetation (Cotterill 1997). Swift foxes use multiple den sites year-round for shelter, protection from predators, and rearing young.
BIRDS		
Burrowing owl <i>Athene cunicularia</i>	K	Grasslands, basin-prairie shrub. Requires burrows, primarily of badgers and prairie dogs, for nesting and roosting (Haug et al. 1993). Summer resident of open rangeland habitats throughout Wyoming, including the TBNG (Luce et al. 1999). Most burrowing owl nests in the TBNG are found in prairie dog colonies.
Ferruginous hawk <i>Buteo regalis</i>	K	Basin-prairie shrub, grasslands, rock outcrops. Construct platform stick nest in trees, on cliff ledges, or on ground. Summer TBNG resident.
Loggerhead shrike <i>Lanius ludovicianus</i>	K	Relatively open, heterogeneous habitats with perches for hunting and thorns, sharp twigs, or barbed wire for impaling prey (Yosef 1996). Common summer resident throughout Wyoming (Luce et al. 1999).

Table 2. USFS Region 2 Listed Sensitive Species That May Occur in the TBNG or be Impacted by Leasing the NARO North, Little Thunder, and West Roundup LBA Tracts (provided by USFS Douglas Ranger District, September 2002) (Continued).

Name	Status in TBNG	Habitat and Occurrence in TBNG
Long-billed curlew <i>Numenius americanus</i>	K	Grasslands, plains foothills, wet meadows, prefers to nest in areas with large open expanses of grassland, with relatively low vegetation, bare ground, and few shrubs (Hill 1998). Relatively uncommon summer resident of grasslands and sagebrush-grasslands in Wyoming (Luce et al. 1999).
Upland sandpiper <i>Bartramia longicauda</i>	K	Prairies and meadows. Uncommon summer resident of the eastern plains of Wyoming, including the TBNG (Luce et al. 1999).

Status Codes:

K = Known occurrence in vicinity. Date of last observation indicates that species still occurs in area.

S = Suspected occurrence. May be historic records but no recent observations. Suitable habitat likely.

U = Unknown occurrence, more surveys may be needed, may be historic records, potential habitat possible.

2002. The West Antelope LBA Tract does not include and TBNG lands administered by USFS, but more extensive fisheries and aquatics studies have been conducted along Antelope Creek and its tributaries for the Antelope Mine. The following discussion summarizes the results of these studies. Commonwealth Associates, Inc. conducted baseline aquatic studies for ACC in late September 1978 and mid-June 1979. The surveys included four sites on Antelope Creek (one upstream of the mine, one downstream, and two within the mine area) and one site on Horse Creek, a tributary of Antelope Creek, near its confluence with Antelope Creek. Of the three fish species listed in Table 2, the flathead chub (*Platygobio gracilis*), plains topminnow (*Fundulus sciadicus*), and the banded killifish (*Fundulus diaphanus*), only the flathead chub was recorded in Antelope Creek during these baseline surveys (Commonwealth Associates, Inc. 1980). This species was described as “relatively common”, but it constituted less than five percent of the stream catch relative abundance during either survey period. It was not collected at the station upstream from the mine, where water was nearly absent during both sampling periods. No fish were found in Horse Creek but Commonwealth Associates Inc. speculated that many of the fishes that inhabit Antelope Creek probably could also be found in Horse Creek during periods of stream flow. In 1998, minnow traps were placed in two pools in Horse Creek as part of baseline studies for the Horse Creek LBA Tract. The only species captured in the traps was the green sunfish (*Lepomis cyanellus*).

The flathead chub was also collected in Antelope Creek during studies by Wesche et al. (1978). Those studies occurred from 1975 through 1977 and included the stretch of Antelope Creek from its mouth upstream to about the middle of the

Antelope Mine permit area (about the uppermost extent of where this species was detected during the Antelope Mine baseline studies). None of the three species were collected in Porcupine Reservoir, a 40 to 50 acre impoundment near the mouth of Porcupine Creek, a small tributary to Antelope Creek, during studies conducted by Ecology Consultants, Inc. in 1977.

According to the baseline report for Antelope Mine, Baxter and Simon (1970) reported the presence of plains topminnows in Cheyenne River headwater streams, and suggest they were probably introduced (Antelope Creek is a headwater stream of the Cheyenne River). The baseline report does not name the specific headwater streams where Baxter and Simon found this species.

NARO North LBA Tract

Stretches of two tributaries to Porcupine Creek (Boss Draw and Corder Creek) cross USFS land in the NARO North LBA Tract, and the Porcupine Creek valley passes between USFS land in Sections 26 and 35, T.42N., R.71W. Porcupine Creek is a tributary of Antelope Creek, which is located approximately seven miles south of the NARO North LBA Tract. Porcupine Creek is an ephemeral to intermittent stream, which includes isolated deeper pools that tend to go dry during drought periods. Boss Draw and Corder Creek are small ephemeral drainages, which do not support fisheries under natural conditions. The addition of produced water from CBM wells in the area could increase aquatic habitat for fish species in this area if sufficient water is produced to create a perennial flow in Antelope Creek and any of its tributaries. TWC does not have complete aquatics baseline reports from the North Antelope and Rochelle Mines' permit document, although portions they do have indicate no records of USFS sensitive fish species.

Wetland habitats suitable for the northern leopard frog and tiger salamander are very limited in the vicinity of the NARO North LBA Tract. Livestock grazing and annual desiccation further limit the suitability of wetlands for the leopard frog. However, both species have been documented in the area. Leopard frogs were documented during original baseline surveys for the North Antelope and Rochelle Mines in the late 1970s. In April 1996, one leopard frog was seen in a pool along an ephemeral drainage just southeast of the North Antelope/Rochelle Complex permit area. Tiger salamander larvae were observed in a pool along Porcupine Creek during 2001.

No prairie dog colonies are located on the NARO North LBA Tract. One colony is located in SW $\frac{1}{4}$ of Section 26, T.42N., R.71W., approximately one half-mile from USFS lands included in the tract.

Habitats in the vicinity of the NARO North LBA tract are marginal (relatively dense sagebrush stands) for the swift fox. Sightings are rare in southern Campbell County. The species has only been documented once by TWC biologists during

22 years of wildlife studies at coal mines in the PRB. On the night of March 27, 2002, one swift fox was observed trotting beside the relocated Reno county road in SW¼ SE¼ of Section 15, T.42N., R.70W.

Burrowing owls have nested in the area but no nests have been documented on the NARO North LBA tract. Although no prairie dog colonies exist on the tract, owls could potentially nest in badger burrows.

There are three active ferruginous hawk nests located on USFS lands on the tract, and others are located within two miles. There are not abundant nesting sites for the loggerhead shrike on the NARO North LBA Tract, but they have been documented to nest on and adjacent to the tract. Upland sandpipers are relatively uncommon in the North Antelope/Rochelle Complex area but suitable habitat is abundant. Long-billed curlews have only been documented a few times in the area and suitable habitat is quite limited.

Little Thunder LBA Tract

A portion of the Little Thunder Creek drainage between Little Thunder Reservoir and Reno Reservoir crosses USFS land in Section 24, T.43N., R.71W. Little Thunder Creek is an ephemeral tributary to Black Thunder Creek, which is a tributary to the South Fork of the Cheyenne River. Little Thunder Creek does not support fisheries under natural conditions, however, CBM development could increase habitat for fish species if sufficient water is produced to create a perennial flow in Little Thunder Creek or its tributaries. No USFS sensitive fish species have been documented in the vicinity of the Little Thunder LBA Tract.

Wetland habitats suitable for the northern leopard frog and tiger salamander are limited in the vicinity of the Little Thunder LBA Tract. Livestock grazing and annual desiccation further limit the suitability of wetlands for the leopard frog. However, both species have been documented in the area. Leopard frogs were apparently relatively abundant along Little Thunder Creek during original baseline surveys for the Black Thunder Mine in 1974. The species has only been recorded once since that time. Both adult and larval tiger salamanders were observed southeast of the Little Thunder LBA Tract in 2001 and 2002. Larvae were also found along North Prong Little Thunder Creek about two miles northwest of the LBA tract in 2002.

No prairie dog colonies are located on the Little Thunder LBA Tract. The nearest colonies are more than one mile away.

Habitats in the vicinity of the Little Thunder LBA Tract are marginal (relatively dense sagebrush stands) for the swift fox. Sightings are rare in southern Campbell County. The species has only been documented once by TWC biologists during 22 years of wildlife studies at coal mines in the PRB. On the night of

March 27, 2002, one swift fox was observed approximately five miles southeast of the proposed lease area.

Burrowing owls have nested in the area but no nests have been documented on the Little Thunder LBA Tract. Although no prairie dog colonies exist on the tract, owls could potentially nest in badger burrows.

Five active ferruginous hawk nests are located on or in close proximity to USFS lands within the Little Thunder LBA Tract. The loggerhead shrike has been documented in the area but nesting habitat on the LBA tract is very limited. Upland sandpipers are relatively uncommon in the Black Thunder Mine area but suitable habitat is abundant. Long-billed curlews have only been documented a few times in the area and suitable habitat is quite limited.

West Roundup LBA Tract

A portion of the Trussler Creek drainage crosses USFS land in Sections 8 and 9, T.42N., R.70W., and a small portion of Olson Draw, a tributary to Trussler Creek crosses USFS land in Section 7, T.42N., R.70W. Trussler Creek is a tributary of Little Thunder Creek. Little Thunder Creek is a tributary of Black Thunder Creek, which is a tributary of the South Fork of the Cheyenne River. Olson Draw and Trussler Creek are ephemeral streams, which do not support fisheries under natural conditions, however, CBM development could increase habitat for fish species if sufficient water is produced to create a perennial flow in Little Thunder Creek or its tributaries. No USFS sensitive fish species have been documented in the vicinity of the West Roundup LBA Tract.

Wetland habitats suitable for the northern leopard frog and tiger salamander are very limited in the vicinity of the West Roundup LBA Tract. Livestock grazing and annual desiccation further limit the suitability of wetlands for the leopard frog. That species has not been documented in the North Rochelle Mine area. Many tiger salamander larvae were seen in several dugouts along Trussler Creek in the SE $\frac{1}{4}$ of Section 5, T.42N., R.70W. during July 2001. During a light rain storm on the night of August 9, 2001, at least 10 adult salamanders were seen crossing the Reno road (paved county road) adjacent to the North Rochelle Mine railroad spur. In May 2002, two desiccated salamanders were found at a burrowing owl nest north of the Reno road in Section 5, T.42N., R.70W.

No prairie dog colonies are located on USFS lands included in the West Roundup LBA Tract. One small colony (less than three acres) is located just north of the USFS Special Use Permit area for the North Rochelle Mine in the SE $\frac{1}{4}$ of Section 5, T.42N., R.70W.

Habitats in the vicinity of the West Roundup LBA Tract are marginal (relatively dense sagebrush stands) for the swift fox. Sightings are rare in southern Campbell County. The species has only been documented once by TWC biologists

during 22 years of wildlife studies at coal mines in the PRB. On the night of March 27, 2002, one swift fox was observed approximately two miles southeast of the proposed lease area.

Burrowing owls have nested in the area but no nests have been documented on the West Roundup LBA Tract. Although no prairie dog colonies exist on the tract, owls could potentially nest in badger burrows. There are two active ferruginous hawk nests located on the LBA tract and a third is within a half mile of the tract. The loggerhead shrike has been documented in the area but nesting habitat on the LBA tract is very limited. Upland sandpipers are relatively uncommon in the North Rochelle Mine area but suitable habitat is abundant. Long-billed curlews have only been documented a few times in the area and suitable habitat is quite limited.

DIRECT AND INDIRECT EFFECTS ON SENSITIVE SPECIES

The following discussion is a preliminary evaluation of the potential direct and indirect environmental effects on USFS Region 2 Sensitive Species identified as potentially inhabiting the USFS lands on the NARO North, Little Thunder, and West Roundup LBA Tracts. A more detailed Biological Assessment and Biological Evaluation Report, and Appraisal of Management Indicator Species is in preparation for these LBA tracts, and will be available upon request prior to a USFS decision to consent or not consent to leasing the USFS lands included in the three tracts. In that report, USFS will make a determination regarding the significance of any potential adverse impacts to USFS Region 2 Sensitive Species if the three LBA tracts that include USFS lands are leased.

NARO North LBA Tract

Leasing and mining the NARO North LBA Tract is not expected to impact any of the Region 2 sensitive fish species. The USFS lands included in this tract that would be disturbed include short stretches of Boss Draw and Corder Creek, which are ephemeral tributaries to Porcupine Creek, an ephemeral to intermittent tributary to Antelope Creek. Boss Draw and Corder Creek do not support fisheries under natural conditions. Produced water from CBM wells could temporarily increase aquatic habitat for fish in this area. Antelope Creek and an adjacent buffer zone would not be disturbed as a result of this leasing action or any of the leasing actions included in this EIS. Surface runoff sediment from the mined lands, which could affect water quality in Antelope Creek, would be deposited in ponds or other sediment control devices located inside the North Antelope/Rochelle Complex permit area.

Leasing and mining are not expected to impact either the black-tailed prairie dog or swift fox. There are no black-tailed prairie dog colonies located on the NARO North LBA Tract, and swift fox do not appear to inhabit the lease area.

Mining and associated activities have the potential to destroy nests and impact the reproductive success of ferruginous hawks and other raptors nesting in the area. However, PRCC has been diligent about avoiding and mitigating such impacts in the past through a variety of means. PRCC has monitored nesting raptor populations, maintained and implemented current USFWS approved Raptor Mitigation Plans, adjusted operations to provide temporal and spatial buffers around raptor nests, and ensured that new power transmission lines at the mine conform to the Avian Powerline Interaction Commission guidelines (EEI/RRF 1996). Provided that those practices are continued, direct impacts on ferruginous hawks are unlikely. Indirect impacts, such as the temporary loss of foraging habitat during active mining, are not expected to negatively affect the survival or reproductive success of any hawks.

Disturbance of habitats during mining could impact individual burrowing owls, loggerhead shrikes, and upland sandpipers, but is not likely to cause a trend to federal listing or loss of viability. PRCC can avoid direct impacts to burrowing owls by continuing to monitor nesting raptor populations, maintaining and implementing current USFWS approved Raptor Mitigation Plans, and taking precautions to provide adequate temporal and spatial buffers around nests. Assuming active shrike nests are not removed during the breeding season, direct impacts on that species should be minimal. Suitable sandpiper habitat exists on the LBA tract that could be eliminated by mining but direct impacts to individuals are unlikely. Given the paucity of past observations and the marginal habitats available in the area, impacts to the long-billed curlew are unlikely.

Little Thunder LBA Tract

Leasing and mining the Little Thunder LBA Tract is not expected to impact any of the Region 2 sensitive fish species. The USFS lands included in this tract that would be disturbed includes a portion of the Little Thunder Creek drainage, which is an ephemeral tributary of Black Thunder Creek, a tributary of the South Fork of the Cheyenne River. Little Thunder Creek does not support fisheries under natural conditions. Produced water from CBM wells could temporarily increase aquatic habitat for fish in this area. Surface runoff sediment from the mined lands, which could affect water quality downstream in Black Thunder Creek, would be deposited in ponds or other sediment control devices located inside the Black Thunder Mine permit area.

Leasing and mining are not expected to impact either the black-tailed prairie dog or swift fox. There are no black-tailed prairie dog colonies located on the Little Thunder LBA Tract, and swift fox do not appear to inhabit the lease area.

Mining and associated activities have the potential to destroy nests and impact the reproductive success of ferruginous hawks and other raptors nesting in the area. However, TBCC has been diligent about avoiding and mitigating such impacts in the past through a variety of means. TBCC has monitored nesting raptor

populations, maintained and implemented current USFWS approved Raptor Mitigation Plans, adjusted operations to provide temporal and spatial buffers around raptor nests, and ensured that new power transmission lines at the mine conform to the Avian Powerline Interaction Commission guidelines (EEI/RRF 1996). Provided that those practices are continued, direct impacts on ferruginous hawks are unlikely. Indirect impacts, such as the temporary loss of foraging habitat during active mining, are not expected to negatively affect the survival or reproductive success of any hawks.

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West Roundup LBA Tract

Leasing and mining the West Roundup LBA Tract is not expected to impact any of the Region 2 sensitive fish species. The USFS lands included in this tract that would be disturbed includes portions of the Trussler Creek drainage. Trussler Creek is an ephemeral tributary of Little Thunder Creek. Little Thunder Creek is an ephemeral tributary of Black Thunder Creek, a tributary to the South Fork of the Cheyenne River. Trussler Creek does not support fisheries under natural conditions. Produced water from CBM wells could temporarily increase aquatic habitat for fish in this area. Surface runoff sediment from the mined lands, which could affect water quality downstream in Black Thunder Creek, would be deposited in ponds or other sediment control devices located inside the North Rochelle Mine permit area.

Leasing and mining are not expected to impact either the black-tailed prairie dog or swift fox. There are no black-tailed prairie dog colonies located on the West Roundup LBA Tract, and swift fox do not appear to inhabit the lease area.

Mining and associated activities have the potential to destroy nests and impact the reproductive success of ferruginous hawks and other raptors nesting in the area. However, TCC has been diligent about avoiding and mitigating such impacts in the past through a variety of means. TCC has monitored nesting raptor populations, maintained and implemented current USFWS approved Raptor Mitigation Plans, adjusted operations to provide temporal and spatial buffers around raptor nests, and ensured that new power transmission lines at the mine

conform to the Avian Powerline Interaction Commission guidelines (EEI/RRF 1996). Provided that those practices are continued, direct impacts on ferruginous hawks are unlikely. Indirect impacts, such as the temporary loss of foraging habitat during active mining, are not expected to negatively affect the survival or reproductive success of any hawks.

Disturbance of habitats during mining could impact individual burrowing owls, loggerhead shrikes, and upland sandpipers, but is not likely to cause a trend to federal listing or loss of viability. TCC can avoid direct impacts to burrowing owls by continuing to monitor nesting raptor populations, maintaining and implementing current USFWS approved Raptor Mitigation Plans, and taking precautions to provide adequate temporal and spatial buffers around nests. Assuming active shrike nests are not removed during the breeding season, direct impacts on that species should be minimal. Suitable sandpiper habitat exists on the LBA tract that could be eliminated by mining but direct impacts to individuals are unlikely. Given the paucity of past observations and the marginal habitats available in the area, impacts to the long-billed curlew are unlikely.

CUMULATIVE EFFECTS REGARDING SENSITIVE SPECIES

Through early 2002, the lands included in the NARO North, Little Thunder, and West Roundup LBA Tracts have been used for agricultural livestock grazing and hunting. In addition to the proposed project, future activities are likely to include: coal bed methane gas exploration and development; hunting (possibly); livestock grazing; and eventual surface coal mining and reclamation with native plant species.

No critical habitat for any USFS Sensitive Species has been delineated in the LBA tracts. Except for surface coal mining, habitat disturbance associated with the future activities likely to occur in the area will be minimal in extent and duration. Any losses that do occur will eventually be mitigated by reclamation with native seed mixes, which may improve habitat quality by reducing the presence of non-native plants (e.g., crested wheatgrass) in the LBA tracts. Leasing the NARO North, Little Thunder, and West Roundup LBA Tracts will not conflict with the current Forest Plan, or any future objectives to manage the area and provide habitat for Sensitive Species.

MITIGATION

Mitigation measures designed to reduce impacts to wildlife that are required by the Surface Mining Control and Reclamation Act and state law are included in Table 4-16 of this EIS. They include:

- C using raptor-safe power lines;
- C designing fences to permit wildlife passage;
- C creating artificial raptor nest sites;
 - relocating raptor nests and taking other actions to maintain active nesting pairs;
- C restoring premining topography to the maximum extent possible;
- C planting a diverse mixture of grasses, forbs, and shrubs in configurations beneficial to wildlife; and
- C building and maintaining sediment control ponds or other sediment control devices during mining.

MONITORING

Wildlife monitoring has been and will be conducted annually by the North Antelope/Rochelle Complex, Black Thunder Mine, and North Rochelle Mine as part of the requirements of their existing mining and reclamation permits. These permits will be amended to include the NARO North, Little Thunder, and West Roundup LBA Tracts, respectively, if the tracts are leased as proposed under the Proposed Action or Action Alternatives.

USFS MANAGEMENT INDICATOR SPECIES

As part of the development of the Land and Resource Management Plan for the TBNG (USFS 2002a), the USFS identified Management Indicator Species (MIS) using seven criteria, which are listed in Appendix B of the Final EIS for the Northern Great Plains Management Plans Revision (USFS 2001). MIS are “plant or animal species selected because their population changes are believed to indicate the effects of management activities on other species of selected major biological communities or on water quality”. Currently, no plants, fish, or invertebrates are listed as MIS for the TBNG.

Table 3-128 of the Final EIS for the Northern Great Plains Management Plans Revision for the TBNG (USFS 2001) lists three MIS species that were selected by the USFS for the TBNG. These three species are sage grouse, black-tailed prairie dog, and plains sharp-tailed grouse.

Appropriate year-round habitat for the plains sharp-tailed grouse is not available in the vicinity of the NARO North, Little Thunder, or West Roundup LBA Tracts. Sharp-tailed grouse have occasionally been observed in the General Analysis Area, but not on any of the LBA tracts.

Sage grouse monitoring has occurred within the area since 1967. The overall indication is a decreasing population trend. Sage grouse generally do not respond positively to human activities and disturbances. The decline in sage grouse across its range has been attributed, in part, to loss in habitat and increased human disturbances during critical periods of its life cycle. These periods include breeding, nesting, and in some cases during stressful periods due to winter conditions.

There are currently no active sage grouse leks on the NARO North, Little Thunder, or West Roundup LBA Tracts. The nearest lek to the Little Thunder and West Roundup tracts is the Black Thunder lek (NE $\frac{1}{4}$ NW $\frac{1}{4}$ of Section 31, T.31N., R.70W.). That lek has not been attended by grouse since 1993. The four known sage grouse leks that comprise the Rochelle lek complex are located near the NARO North LBA Tract. Two of those leks are active (Payne and Kort) and two have not been attended since at least 1999 (Wilson and Rochelle). The Payne and Kort leks are located in NE $\frac{1}{4}$ NW $\frac{1}{4}$ of Section 26, T.42N., R.70W. and SE $\frac{1}{4}$ SW $\frac{1}{4}$ of Section 31, T.42N., R.69W., respectively. Surveys in 2002 yielded peak counts of 18 and five males on the Payne and Kort leks, respectively.

Because of its proximity to two active leks, development of the NARO North LBA Tract has the most potential to directly affect sage grouse. Potential impacts include: the destruction of active nests during topsoil removal, mortalities caused by additional vehicle traffic, and displacement of grouse from their core home range. Collectively, those factors could diminish the survival and reproductive success of grouse, resulting in a decline of the Rochelle sage grouse population.

If precautions are taken to avoid direct mortalities and disturbances to nests and leks during the breeding season, grouse will have the opportunity to disperse away from mine activities.

The range of sagebrush density and height on all three LBA tracts represents potential year-round habitat for sage grouse. Consequently, development of those tracts could potentially affect grouse through habitat disturbance and degradation. Mining could potentially eliminate all suitable habitat within the lease areas. Although sagebrush is seeded on reclaimed lands, the low recruitment and slow growth rate of sagebrush will render those areas unsuitable for grouse for at least several decades. The construction of new powerlines could diminish the value of otherwise suitable habitats by providing additional perching opportunities for golden eagles (*Aquila chrysaetos*) and thus increasing the predation risk to grouse in those areas.

The black-tailed prairie dog is a “candidate” for possible federal listing. According to the Northern Great Plains Management Plan Revision Final EIS (USFS 2001), long-term population trends for black-tailed prairie dogs on the national grasslands are down. Primary threats include habitat loss and deterioration as a result of cultivation, urban sprawl and fragmentation. However, as indicated in the previous discussion of USFS Region 2 Sensitive Species, the TBNG harbors one of the seven major black-tailed prairie dog colony complexes remaining in North America.

The occurrence of black-tailed prairie dogs on the NARO North, Little Thunder, and West Roundup LBA Tracts was discussed in the previous section on USFS Region 2 Sensitive Species.

BLM SENSITIVE SPECIES EVALUATION

INTRODUCTION

BLM Wyoming has prepared a list of sensitive species to focus species management efforts towards maintaining habitats under a multiple use mandate. The authority for this policy and guidance comes from the ESA, as amended; Title II of the Sikes Act, as amended; the FLPMA; and the Department Manual 235.1.1A., General Program Delegation, Director, BLM.

The goals of the sensitive species policy are to:

- Maintain vulnerable species and habitat components in functional BLM ecosystems.
- Ensure sensitive species are considered in land management decisions.
- Prevent a need for species listing under the Endangered Species Act.
- Prioritize needed conservation work with an emphasis on habitat.

PROJECT DESCRIPTION

Under the Proposed Action, BLM will hold separate leases for the federal coal lands in the NARO North and NARO South LBA Tracts as applied for by PRCC, the Little Thunder LBA Tract as applied for by Ark Land Company (ALC), the West Roundup LBA Tract as applied for by TCC, and the West Antelope LBA Tract as applied for by ACC (see Figures 2-1 through 2-4 and the land descriptions in Section 2.1). There are actually five Proposed Actions, one for each of the LBA tracts. For each tract, the Proposed Action assumes that the applicant for a tract would be the successful bidder on that tract and that each tract would be mined as a maintenance lease for an existing mine.

SPECIES OCCURRENCE AND HABITAT DESCRIPTIONS

Sensitive species were listed for the BLM Buffalo Field Office within its range. Numerous sensitive species do or could occur within the five LBA tracts. Specialized habitat requirements (i.e., caves, cliffs, calcareous rock outcrops) make occupation for other sensitive species unlikely. Table 3 lists BLM sensitive species and summarizes their habitat requirements.

Table 3. BLM Sensitive Species, Habitat Requirements, and Occurrence for the Buffalo Field Office.

Common Name (scientific name)	Habitat
Amphibians	
Northern leopard frog (<i>Rana pipiens</i>)	Beaver ponds, permanent water in plains and foothills
Spotted frog (<i>Rana pretiosa</i>)	Ponds, sloughs, small streams
Birds	
Baird's sparrow (<i>Ammodramus bairdii</i>)	Grasslands, weedy fields
Brewer's sparrow (<i>Spizella breweri</i>)	Basin-prairie shrub
Burrowing owl (<i>Athene cunicularia</i>)	Grasslands, basin-prairie shrub
Ferruginous hawk (<i>Buteo regalis</i>)	Basin-prairie shrub, grasslands, rock outcrops
Greater sage-grouse (<i>Centrocercus urophasianus</i>)	Basin-prairie shrub, mountain-foothill shrub
Loggerhead shrike (<i>Lanius ludovicianus</i>)	Basin-prairie shrub, mountain-foothill shrub
Long-billed curlew (<i>Numenius americanus</i>)	Grasslands, plains, foothills, wet meadows
Northern goshawk (<i>Accipiter gentilis</i>)	Conifer and deciduous forests
Peregrine falcon (<i>Falco peregrinus</i>)	Cliffs
Sage sparrow (<i>Amphispiza billneata</i>)	Basin-prairie shrub, mountain-foothill shrub
Sage thrasher (<i>Oreoscoptes montanus</i>)	Basin-prairie shrub, mountain-foothill shrub
Trumpeter swan (<i>Cygnus buccinator</i>)	Lakes, ponds, rivers
White-faced ibis (<i>Plegadis chihi</i>)	Marshes, wet meadows
Yellow-billed cuckoo (<i>Coccyzus americanus</i>)	Open woodlands, streamside willow and alder groves
Mammals	
Dwarf Shrew (<i>Sorex nanus</i>)	Mountain foothill shrub, grasslands
Fringed myotis (<i>Myotis thysanodes</i>)	Conifer forests, woodland chaparral, caves and mines
Long-eared myotis (<i>Myotis evotis</i>)	Conifer and deciduous forest, caves and mines

Table 3. BLM Sensitive Species, Habitat Requirements, and Occurrence for the Buffalo Field Office (Continued).

Common Name (scientific name)	Habitat
Spotted bat (<i>Euderma maculatum</i>)	Cliffs over perennial water, basin-prairie shrub
Swift fox (<i>Vulpes velox</i>)	Grasslands
Townsend's big-eared bat (<i>Corynorhinus townsendii</i>)	Forests, basin-prairie shrub, caves and mines
Plants	
Cary beardtongue (<i>Penstemon caryi</i>)	Calcareous rock outcrops and rocky soil in sage, juniper, Douglas-fir and limber pine communities; 5,200 to 8,500 ft
Porter's sagebrush (<i>Artemisia porteri</i>)	Sparsely vegetated badlands of ashy or tufaceous mudstone and clay slopes; 5,300 to 6,500 ft
William's wafer parsnip (<i>Cymopterus williamsii</i>)	Open ridgetops and upper slopes with exposed limestone outcrops or rockslides; 6,000 to 8,300 ft

CREDENTIALS OF SURVEY PERSONNEL

BKS Environmental, Inc. of Gillette, Wyoming

Brenda K. Schladweiler

Ms. Schladweiler is the Senior Plant Ecologist and Reclamation Specialist for BKS Environmental, Inc. Ms. Schladweiler obtained a Master of Science degree in Soil Science and is currently pursuing a Doctorate Degree in Soil Science from the University of Wyoming. Ms. Schladweiler has skills in baseline soils and vegetation assessments in Wyoming and other western states. She has conducted soil assessments for NPDES discharge and land disposal of CBM production water, compiled reclamation plans for various coal, uranium, and bentonite projects and has coordinated management and monitoring for various mining and oil and gas reclamation projects.

Paige Wolken

Ms. Wolken obtained a Master of Science degree in Plant and Soil Sciences from the University of Wyoming. Ms. Wolken has accumulated eight years of field experience in identifying and mapping of sensitive (T&E) species, the collection and analysis of vegetation data for reclamation monitoring, and has conducted wetland delineation for state and private project permitting.

Heidi Smith

Ms. Smith is pursuing a Master of Science degree in Agronomy and Plant Pathology from the University of Wyoming. Ms. Smith has performed baseline studies and monitoring of reclaimed areas on open pit coal mines in the PRB for BKS since 1999.

Intermountain Resources of Laramie, Wyoming

Jim Orpet

Mr. Orpet obtained a Master of Science degree in Range Management from the University of Wyoming and has accumulated 23 years of field experience in vegetation and plant surveys. This experience includes preparation of plant species lists for over 100 projects throughout Wyoming. Mr. Orpet was qualified in 1987 by the WDEQ/LQD to conduct T&E and other plant and animal surveys on AML projects within the state. Qualification at that time was based on review and approval of Mr. Orpet's credentials by the WGFD and the USFWS. Mr. Orpet has also completed numerous wetland surveys that have been approved by the COE.

Russel Tait

Mr. Tait obtained a Bachelor of Science degree in Wildlife Management from the University of Wyoming and has accumulated 10 years of field experience in vegetation and plant surveys in Wyoming. Mr. Tait has assisted Mr. Orpet in conducting Ute ladies'-tresses orchid surveys for over five years on coal mines and other resource development projects in Wyoming.

Thunderbird Wildlife Consulting, Inc. of Gillette, Wyoming

Gwyn McKee

Ms. McKee obtained a Master of Science degree in Wildlife Ecology from the University of Missouri-Columbia. She has accumulated more than 15 years of professional experience, with the last eight in Wyoming. Ms. McKee has skills that include planning and conducting surveys for a variety of terrestrial and aquatic species, summarizing data, and preparing technical reports for private, state, and federal agencies. Ms. McKee is considered qualified by all state and federal agencies to conduct T&E and other wildlife surveys within the region. Those qualifications include surveys for mountain plovers and their habitat, and certification by the USFWS to conduct black-footed ferret surveys.

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APPENDIX H

CBM WELLS CAPABLE OF PRODUCTION ON OR IN SECTIONS
ADJACENT TO THE NARO NORTH, NARO SOUTH,
LITTLE THUNDER, WEST ROUNDUP, AND
WEST ANTELOPE LBA TRACTS

Api No.	Company	Well Name	Tns	Rng	Sec	qq	Status
542928	REDSTONE RESOURCES INC	ISSENBERGER 21-19	41	71	19	NE NW	SI
547038	PHILLIPS PETROLEUM CO	ANTELOPE CREEK 32-27-41-71	41	71	27	SW NE	PS
535161	INDEPENDENT PRODUCTION CO	BRADLEY CBM 16-1-2	42	70	16	SE NE	SI
539506	YATES PETROLEUM CORP	SCHOOL CREEK CS ST 1	42	70	36	SE NW	SI
546529	CONTINENTAL INDUSTRIES LC	STATE 44-36	42	71	36	SE SE	PG
546530	CONTINENTAL INDUSTRIES LC	STATE 43-36	42	71	36	NE SE	PG
546531	CONTINENTAL INDUSTRIES LC	STATE 42-36	42	71	36	SE NE	PG
546532	CONTINENTAL INDUSTRIES LC	STATE 41-36	42	71	36	NE NE	PG
546533	CONTINENTAL INDUSTRIES LC	STATE 34-36	42	71	36	SW SE	PG
546534	CONTINENTAL INDUSTRIES LC	STATE 33-36	42	71	36	NW SE	PG
546535	CONTINENTAL INDUSTRIES LC	STATE 32-36	42	71	36	SW NE	PG
546536	CONTINENTAL INDUSTRIES LC	STATE 31-36	42	71	36	NW NE	PG
546537	CONTINENTAL INDUSTRIES LC	STATE 24-36	42	71	36	SE SW	PG
546538	CONTINENTAL INDUSTRIES LC	STATE 23-36	42	71	36	NE SW	PG
546539	CONTINENTAL INDUSTRIES LC	STATE 22-36	42	71	36	SE NW	PG
546540	CONTINENTAL INDUSTRIES LC	STATE 21-36	42	71	36	NE NW	PG
546541	CONTINENTAL INDUSTRIES LC	STATE 14-36	42	71	36	SW SW	PG
546542	CONTINENTAL INDUSTRIES LC	STATE 13-36	42	71	36	NW SW	PG
546543	CONTINENTAL INDUSTRIES LC	STATE 12-36	42	71	36	SW NW	PG
546544	CONTINENTAL INDUSTRIES LC	STATE 11-36	42	71	36	NW NW	PG
537364	RIM OPERATING INC	CBM H 44-06	43	70	6	SE SE	FL
537365	RIM OPERATING INC	CBM H 42-06	43	70	6	SE NE	FL
537366	RIM OPERATING INC	CBM H 33-06	43	70	6	NW SE	FL
537367	RIM OPERATING INC	CBM H 31-06	43	70	6	NW NE	FL
537368	RIM OPERATING INC	CBM H 22-06	43	70	6	SE NW	FL
537369	RIM OPERATING INC	CBM H 24-06	43	70	6	SE SW	FL
537370	RIM OPERATING INC	CBM H 13-06	43	70	6	NW SW	FL
537371	RIM OPERATING INC	CBM H 11-06	43	70	6	NW NW	FL
537877	RIM OPERATING INC	CBM H 31-07	43	70	7	NW NE	FL
537879	RIM OPERATING INC	CBM H 24-07	43	70	7	SE SW	FL
537880	RIM OPERATING INC	CBM H 13-07	43	70	7	NW SW	FL
537362	RIM OPERATING INC	CBM H 22-07	43	70	7	SE NW	FL
537363	RIM OPERATING INC	CBM H 11-07	43	70	7	NW NW	FL
537361	RIM OPERATING INC	CBM H 42-07	43	70	7	SE NE	SI
542583	RIM OPERATING INC	CBM 13-18 H	43	70	18	NW SW	FL
537881	RIM OPERATING INC	CBM H 11-18	43	70	18	NW NW	FL

Api No.	Company	Well Name	Tns	Rng	Sec	qq	Status
542023	RIM OPERATING INC	CBM 33-01R	43	71	1	NW SE	FL
537856	RIM OPERATING INC	CBM D 31-01	43	71	1	NW NE	FL
537857	RIM OPERATING INC	CBM D 11-01	43	71	1	NW NW	FL
537911	RIM OPERATING INC	CBM D 42-01	43	71	1	SE NE	FL
537912	RIM OPERATING INC	CBM D 22-01	43	71	1	SE NW	FL
537379	RIM OPERATING INC	CBM D 44-01	43	71	1	SE SE	FL
537381	RIM OPERATING INC	CBM D 24-01	43	71	1	SE SW	FL
537382	RIM OPERATING INC	CBM D 13-01	43	71	1	NW SW	FL
544739	WILLIAMS PRODUCTION RMT CO	REVLAND FED TRUST 43-2-4371	43	71	2	NE SE	SI
544740	WILLIAMS PRODUCTION RMT CO	REVLAND FED TRUST 41-2-4371	43	71	2	NE NE	SI
544741	WILLIAMS PRODUCTION RMT CO	REVLAND FED TRUST 34-2-4371	43	71	2	SW SE	SI
544742	WILLIAMS PRODUCTION RMT CO	REVLAND FED TRUST 32-2-4371	43	71	2	SW NE	SI
537858	RIM OPERATING INC	CBM D 42-11	43	71	11	SE NE	FL
537859	RIM OPERATING INC	CBM D 31-11	43	71	11	NW NE	FL
535155	WILLIAMS PRODUCTION RMT CO	ZIMMER 43-11	43	71	11	NE SE	PS
535156	WILLIAMS PRODUCTION RMT CO	ZIMMER 34-11	43	71	11	SW SE	PS
537347	RIM OPERATING INC	CBM D 11-12	43	71	12	NW NW	FL
537349	RIM OPERATING INC	CBM D 13-12	43	71	12	NW SW	FL
537350	RIM OPERATING INC	CBM D 22-12	43	71	12	SE NW	FL
537351	RIM OPERATING INC	CBM D 24-12	43	71	12	SE SW	FL
537352	RIM OPERATING INC	CBM D 31-12	43	71	12	NW NE	FL
537353	RIM OPERATING INC	CBM D 33-12	43	71	12	NW SE	FL
537354	RIM OPERATING INC	CBM D 42-12	43	71	12	SE NE	FL
537355	RIM OPERATING INC	CBM D 44-12	43	71	12	SE SE	FL
537860	RIM OPERATING INC	CBM D 31-13	43	71	13	NW NE	FL
537876	RIM OPERATING INC	CBM D 42-13	43	71	13	SE NE	FL
539645	WILLIAMS PRODUCTION RMT CO	HOPKINS TRUST 44-13-4371	43	71	13	SE SE	PS
539646	WILLIAMS PRODUCTION RMT CO	ARCH 33-13-4371	43	71	13	NW SE	PS
535152	WILLIAMS PRODUCTION RMT CO	ARCH 22-13	43	71	13	SE NW	PS
535153	WILLIAMS PRODUCTION RMT CO	ARCH 24-13	43	71	13	SE SW	PS
535154	WILLIAMS PRODUCTION RMT CO	ARCH 13-13	43	71	13	NW SW	PS
533164	WILLIAMS PRODUCTION RMT CO	YOUNG 11-13	43	71	13	NW NW	PS
539641	WILLIAMS PRODUCTION RMT CO	REVLAND TRUST 12-14-4371	43	71	14	SW NW	PS
539642	WILLIAMS PRODUCTION RMT CO	REVLAND TRUST 23-14-4371	43	71	14	NE SW	PS
539643	WILLIAMS PRODUCTION RMT CO	REVLAND TRUST 21-14-4371	43	71	14	NE NW	PS
539644	WILLIAMS PRODUCTION RMT CO	REVLAND TRUST 14-14-4371	43	71	14	SW SW	PS

Api No.	Company	Well Name	Tns	Rng	Sec	qq	Status
535157	WILLIAMS PRODUCTION RMT CO	ARCH 42-14	43	71	14	SE NE	PS
535158	WILLIAMS PRODUCTION RMT CO	ARCH 44-14	43	71	14	SE SE	PS
531964	WILLIAMS PRODUCTION RMT CO	FEDERAL 14-23	43	71	23	SW SW	PS
531966	WILLIAMS PRODUCTION RMT CO	FEDERAL 34-23	43	71	23	SW SE	PS
540746	WILLIAMS PRODUCTION RMT CO	FEDERAL 14-24	43	71	24	SW SW	PS
536473	WILLIAMS PRODUCTION RMT CO	ARCH 22-24	43	71	24	SE NW	PS
536474	WILLIAMS PRODUCTION RMT CO	ARCH 31-24	43	71	24	NW NE	PS
533367	WILLIAMS PRODUCTION RMT CO	FEDERAL 12-25	43	71	25	SW NW	PS
532603	WILLIAMS PRODUCTION RMT CO	FEDERAL 22-25	43	71	25	SE NW	PS
532604	WILLIAMS PRODUCTION RMT CO	FEDERAL 11-25	43	71	25	NW NW	PS
532503	WILLIAMS PRODUCTION RMT CO	ARCH 34-25-4371	43	71	25	SW SE	PS
532505	WILLIAMS PRODUCTION RMT CO	ARCH 14-25-4371	43	71	25	SW SW	PS
532506	WILLIAMS PRODUCTION RMT CO	ARCH 23-25-4371	43	71	25	NE SW	PS
544917	WILLIAMS PRODUCTION RMT CO	ARCH 43-25-4371	43	71	25	NE SE	PS
533456	WILLIAMS PRODUCTION RMT CO	FEDERAL 32-26	43	71	26	SW NE	PS
533362	WILLIAMS PRODUCTION RMT CO	FEDERAL 43-26	43	71	26	NE SE	PS
533364	WILLIAMS PRODUCTION RMT CO	FEDERAL 34-26	43	71	26	SW SE	PS
532598	WILLIAMS PRODUCTION RMT CO	FEDERAL 44-26	43	71	26	SE SE	PS
532599	WILLIAMS PRODUCTION RMT CO	FEDERAL 42-26	43	71	26	SE NE	PS
532600	WILLIAMS PRODUCTION RMT CO	FEDERAL 33-26	43	71	26	NW SE	PS
532511	WILLIAMS PRODUCTION RMT CO	ARCH 12-26	43	71	26	SW NW	PS
532513	WILLIAMS PRODUCTION RMT CO	ARCH 14-26	43	71	26	SW SW	PS
532515	WILLIAMS PRODUCTION RMT CO	ARCH 23-26	43	71	26	NE SW	PS
532517	WILLIAMS PRODUCTION RMT CO	ARCH 22-26	43	71	26	SE NW	PS
532630	WILLIAMS PRODUCTION RMT CO	ARCH 32-27	43	71	27	SW NE	PS
533363	WILLIAMS PRODUCTION RMT CO	FEDERAL 41-35	43	71	35	NE NE	PS
533368	WILLIAMS PRODUCTION RMT CO	FEDERAL 32-35	43	71	35	SW NE	PS
532593	WILLIAMS PRODUCTION RMT CO	FEDERAL 31-35	43	71	35	NW NE	PS
532594	WILLIAMS PRODUCTION RMT CO	FEDERAL 22-35	43	71	35	SE NW	PS
532595	WILLIAMS PRODUCTION RMT CO	FEDERAL 21-35	43	71	35	NE NW	PS
532596	WILLIAMS PRODUCTION RMT CO	FEDERAL 12-35	43	71	35	SW NW	PS
532597	WILLIAMS PRODUCTION RMT CO	FEDERAL 11-35	43	71	35	NW NW	PS
532605	WILLIAMS PRODUCTION RMT CO	FEDERAL 43-35	43	71	35	NE SE	PS
532606	WILLIAMS PRODUCTION RMT CO	FEDERAL 42-35	43	71	35	SE NE	PS
535087	YATES PETROLEUM CORP	RENO CS STATE 5	43	71	36	NE SW	FL
534540	YATES PETROLEUM CORP	RENO CS STATE 14	43	71	36	SE SW	FL

Appendix H

Api No.	Company	Well Name	Tns	Rng	Sec	qq	Status
534541	YATES PETROLEUM CORP	RENO CS STATE 13	43	71	36	SW SW	FL
534542	YATES PETROLEUM CORP	RENO CS STATE 12	43	71	36	NW SW	FL
534543	YATES PETROLEUM CORP	RENO CS STATE 11	43	71	36	SE SE	FL
534544	YATES PETROLEUM CORP	RENO CS STATE 10	43	71	36	NE SE	FL
534545	YATES PETROLEUM CORP	RENO CS STATE 9	43	71	36	SE NE	FL
534546	YATES PETROLEUM CORP	RENO CS STATE 8	43	71	36	NW NE	FL
534547	YATES PETROLEUM CORP	RENO CS STATE 7	43	71	36	NE NE	FL
534548	YATES PETROLEUM CORP	RENO CS STATE 6	43	71	36	SW SE	FL
534549	YATES PETROLEUM CORP	RENO CS STATE 4	43	71	36	SW NW	FL
534550	YATES PETROLEUM CORP	RENO CS STATE 3	43	71	36	NW NW	FL
534551	YATES PETROLEUM CORP	RENO CS STATE 2	43	71	36	NE NW	FL
533309	YATES PETROLEUM CORP	RENO CS STATE 1	43	71	36	SE NW	FL
540187	RIM OPERATING INC	CBM C 22-25	44	71	25	SE NW	FL
540189	RIM OPERATING INC	CBM C 24-25	44	71	25	SE SW	FL
539748	RIM OPERATING INC	CBM C 13-25	44	71	25	NW SW	FL
539750	RIM OPERATING INC	CBM C 11-25	44	71	25	NW NW	FL
537870	RIM OPERATING INC	CBM C 44-25	44	71	25	SE SE	FL
537915	RIM OPERATING INC	CBM C 31-25	44	71	25	NW NE	FL
537916	RIM OPERATING INC	CBM C 33-25	44	71	25	NW SE	FL
537869	RIM OPERATING INC	CBM C 42-25	44	71	25	SE NE	FL
540275	RIM OPERATING INC	CBM C 11-26	44	71	26	NW NW	FL
540276	RIM OPERATING INC	CBM C 13-26	44	71	26	NW SW	FL
540277	RIM OPERATING INC	CBM C 22-26	44	71	26	SE NW	FL
540278	RIM OPERATING INC	CBM C 24-26	44	71	26	SE SW	FL
540279	RIM OPERATING INC	CBM C 33-26	44	71	26	NW SE	FL
540280	RIM OPERATING INC	CBM C 44-26	44	71	26	SE SE	FL
537871	RIM OPERATING INC	CBM C 42-26	44	71	26	SE NE	FL
537917	RIM OPERATING INC	CBM C 31-26	44	71	26	NW NE	FL
534526	WILLIAMS PRODUCTION RMT CO	CHITTENDEN 14-27	44	71	27	SW SW	FL
543423	COLEMAN OIL & GAS INC	FERGUSON 12-27	44	71	27	SW NW	PS
543424	COLEMAN OIL & GAS INC	FERGUSON 21-27	44	71	27	NE NW	PS
542192	WILLIAMS PRODUCTION RMT CO	FERGUSON 43-27-4471	44	71	27	NE SE	PS
542193	WILLIAMS PRODUCTION RMT CO	FERGUSON 34-27-4471	44	71	27	SW SE	PS
534527	WILLIAMS PRODUCTION RMT CO	CHITTENDEN 23-27	44	71	27	NE SW	PS
544712	WILLIAMS PRODUCTION RMT CO	STUART FEDERAL 43-34-4471	44	71	34	NE SE	PS
544713	WILLIAMS PRODUCTION RMT CO	STUART FEDERAL 34-34-4471	44	71	34	SW SE	PS

Api No.	Company	Well Name	Tns	Rng	Sec	qq	Status
544714	WILLIAMS PRODUCTION RMT CO	STUART FEDERAL 23-34-4471	44	71	34	NE SW	PS
544715	WILLIAMS PRODUCTION RMT CO	STUART FEDERAL 21-34-4471	44	71	34	NE NW	PS
544716	WILLIAMS PRODUCTION RMT CO	STUART FEDERAL 14-34-4471	44	71	34	SW SW	PS
544717	WILLIAMS PRODUCTION RMT CO	STUART FEDERAL 12-34-4471	44	71	34	SW NW	PS
537983	RIM OPERATING INC	CBM C 31-35	44	71	35	NW NE	FL
537984	RIM OPERATING INC	CBM C 42-35	44	71	35	SE NE	FL
548448	RIM OPERATING INC	CBM C 22-35	44	71	35	SE NW	SI
548447	RIM OPERATING INC	CBM C 11-35	44	71	35	NW NW	SI
537872	RIM OPERATING INC	CBM C 44-36	44	71	36	SE SE	FL
537873	RIM OPERATING INC	CBM C 42-36	44	71	36	SE NE	FL
537874	RIM OPERATING INC	CBM C 24-36	44	71	36	SE SW	FL
537875	RIM OPERATING INC	CBM C 22-36	44	71	36	SE NW	FL
537919	RIM OPERATING INC	CBM C 11-36	44	71	36	NW NW	FL
537920	RIM OPERATING INC	CBM C 13-36	44	71	36	NW SW	FL
537921	RIM OPERATING INC	CBM C 31-36	44	71	36	NW NE	FL
537922	RIM OPERATING INC	CBM C 33-36	44	71	36	NW SE	FL

Status Codes: PG = Producing Gas, FL = Flowing, PS = Pumping Submersible, SI = Shut In